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NOVOTEST

Operation Manual



Cross Cut Adhesion Tester NOVOTEST AN-2409

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Caution!

Please read this manual carefully before using the Cross Cut Adhesion Tester NOVOTEST AN-2409.

This operating manual (hereinafter OM) includes general information in order to give the operating personnel understanding of functioning and operating rules of the Cross Cut Adhesion Tester NOVOTEST AN-2409 (hereinafter referred to as “the device”). The document contains technical characteristics, description of the design and principle of operation, as well as information necessary for the correct use of the device. Before starting work, it is necessary to read this manual, as the device operation must be carried out by persons who are familiar with the operation principle and the device design.

Correct and effective use of the hardness tester requires obligatory availability:

- Testing methods;
- Conditions for testing, according to testing methods;
- Trained, and familiar with this OM user.

The enterprise-manufacturer reserves the right to make non-critical changes, without making worse technical characteristics of the device. These changes may not be mentioned in the text of current document.

The standard delivery kit of the device includes the operational documentation as a part of this OM.

The present OM applies to all modifications of the device.

1 DESCRIPTION AND OPERATION OF THE DEVICE AND ITS COMPONENTS

1.1 The purpose of the device

Cross Cut Adhesion Tester NOVOTEST AN-2409 with multi-edge blade is designed for cuts (parallel or lattice) adhesion testing method, and for thickness range of paint coatings up to 200 μ s, according to ISO 2409, ISO 16276-2, ASTM B 3359. Device can be used on both flat and curved surfaces.

1.2 Technical characteristics of the device

Structurally Cross Cut Adhesion Tester NOVOTEST AN-2409 is consist of plastic handle and metal head for fastening multi-edge blade, which is made of tool steel. Each blade has six main and two restrictive edges. User can sharpen blunted edges.

Notes: The ISO/JIS standard recommends that the cutting tool is replaced when the top of the blades has flattened to 0.1 mm.

The main characteristics of the device are presented in Table 1.1.

Table 1.1 - The main characteristics of the device

Overall dimensions of the device, mm	145x50x40
Weight, not more than, kg	0,25
Dimension of the blade, mm	28x36x4,8
Number of cuts	6
Pitch between cutting edges, mm	1; 2; 3
Angle of cutting edge	30°

1.3 Standard delivery set

- Cross Cut Adhesion Tester NOVOTEST AN-2409 1 pc.
- Multiblade two-sided blade with 1 mm between edges per customer request
- Multiblade two-sided blade with 2 mm between edges per customer request
- Multiblade two-sided blade with 3 mm between edges per customer request
- Hex key per customer request
- Packing 1 pc.
- Operation manual 1 pc.

Available options:

- Eye glass per customer request
- Brush per customer request
- Adhesive tape per customer request

* At the request of the customer, the delivery set can be expanded with additional equipment or parts.

1.4 Parts

Structurally Cross Cut Adhesion Tester NOVOTEST AN-2409 is made as a handle with a head, on which changeable blades are placed (Figure 1.2). Blade is fastened by bolt to the cutter head. Standard delivery set includes three multi-edge two-sided blades with 1, 2 and 3 mm between edges. Every blade has two equal sides with identic edges. Thus, when the cutting edges of one side of the blade become worn, user can use the second set of the cutting edges on the opposite side of the blade. For this just rotate blade through 180°.



1 – handle; 2 – information about the device (manufacture's plate); 3 – bolt; 4 – blade.

Figure 1.2 – Cross Cut Adhesion Tester NOVOTEST AN-2409

1.5 Design and functioning

The principal of device operating is making smooth cuts on tested coating. Cuts are made by special changeable blades (there are three standard types) with 6 cutting edges and two restrictive edges. Distance between cutting edges is 1, 2 or 3 mm – it depends on blade type. Blade is selected in accordance with characteristics of tested coating. After making cuts, the place of cutting is to be cleaned and adhesion is then assessed visually by comparing the grid of squares against Standards (ISO 2409 or ASTM D 3359).

The device can be used for both (parallel or lattice cuts) adhesion-testing methods.

1.6 Means of measurement, tools and accessories

The correct work of the device is checked by coating testing. The cutter must score through the coating down to the substrate and distance between cuts should comply with blade type (1 mm, 2 mm, 3 mm).

In case of defect found, the device must be fixed on the manufacturer site.

1.7 Marking and sealing

There is a label with device type, trademark of the manufacturer, serial number, year of output on the device.

1.8 Packing

The device and accessories are delivered in a package, excluding their damage during transportation.

2 INTENDED USE

2.1 Operational limitations

Operation of the device should be carried out under the influence of factors and taking into account the parameters of the monitored objects in accordance with the specified technical characteristics. The device must be used within its technical characteristics.

Only qualified personnel, familiar with the operation manual are allowed to use this device.

2.2 Preparing the device for use

1. Carry out visual external inspection of the device; make sure that there are no mechanical damages;
2. Prepare the sample for testing in accordance with the Standards;
3. Carry out coating testing at least on three different areas of the tested sample. Coating thickness deviation across the whole tested sample should be not more than 10% ;
4. Select the correct blade according to Table 2.1;

Table 2.1 – Blade selection

Coating Thickness		Cutter blade - Number of cuts		
(μm)	(mils)	ASTM - Metal substrates	ISO/JIS - Hard substrates (metal)	ISO/JIS - Soft substrates (wood, plaster)
0 to 50	0 to 2	1 mm - 11 cuts		
50 to 125	2 to 5	2 mm - 6 cuts		
> 125	> 5	x		
0 to 60			1 mm - 6 cuts	2 mm - 6 cuts
61 to 120			2 mm - 6 cuts	2 mm - 6 cuts
121 to 250			3 mm - 6 cuts	3 mm - 6 cuts

5. Use the hex key to undo bolt on the cutter head and install the required cutting edge. Then screw back and tighten the blade secure bolt.

2.3 Using the device. Lattice cuts testing method.

1. Put the device on the tested sample, press down to the coating and move it about 20 mm, making cuts through the coating up to the substrate. Moving speed should be about 20-40 mm/s. In the same way make cuts in the orthogonal direction (Figure 2.1) in order to get lattice pattern on the coating for testing.

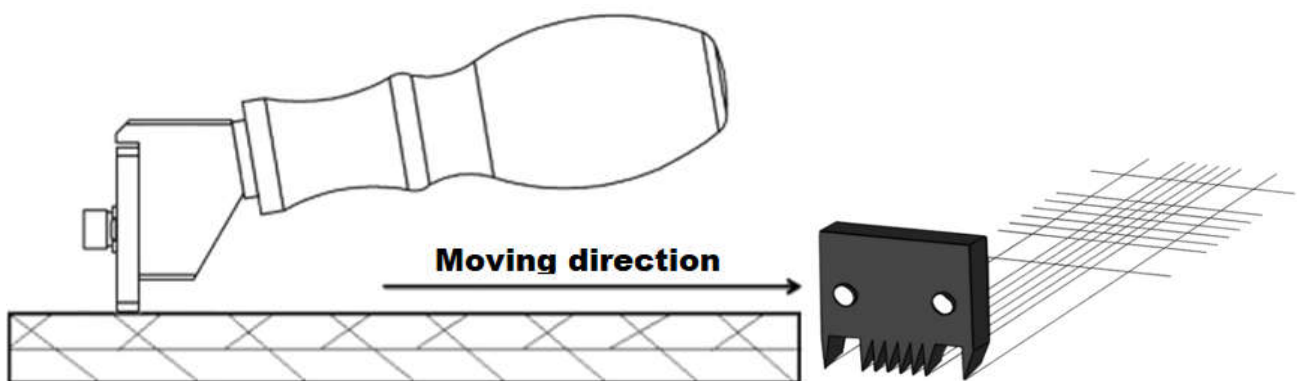
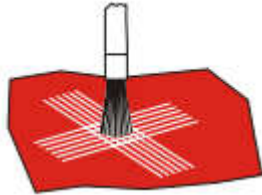
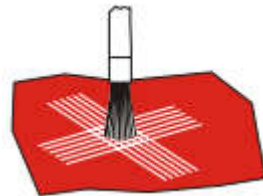
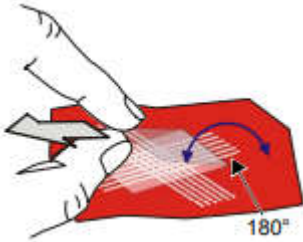
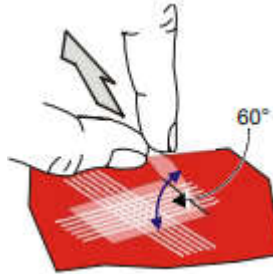


Figure 2.1 – Making cuts on the coating

2. Step-by step recommendation as for caring out correct adhesion testing of the coatings according to Standards (ASTM D 3359, ISO 2409).

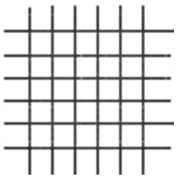
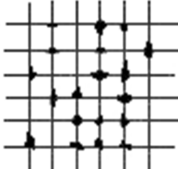
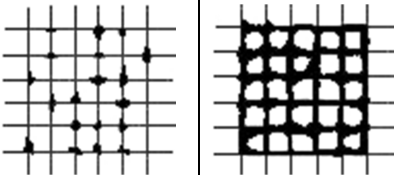
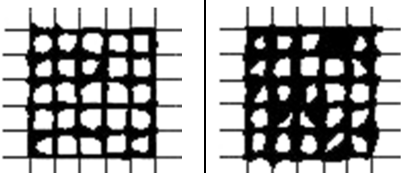
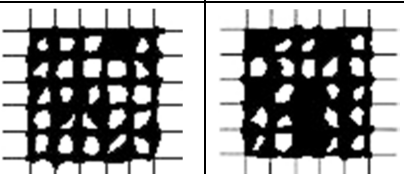
	ASTM	ISO/JIS
1	Place the cutting tool on the sample, press down gently and pull the tool towards you in one steady movement to make a series of parallel cuts approximately 20 mm long. Apply sufficient pressure to ensure that you cut right through the coating to the surface of the substrate 	Place the cutting tool on the sample, press down gently and pull the tool towards you in one steady movement to make a series of parallel cuts approximately 20 mm long. Apply sufficient pressure to ensure that you cut through the coating to the substrate. Note: If the substrate is wood or similar, make cuts at 45° to the direction of the grain. 
2	Place the cutting tool on the sample at 90° to the first cut and repeat step (1) to create a lattice pattern on the coating 	Place the cutting tool on the sample at 90° to the first cut and repeat step (1) to create a lattice pattern on the coating. 
3	Brush lightly to remove detached flakes or ribbons of coating. 	Brush lightly several times (at least 5) forwards and several times (at least 5) backwards along the diagonals of the lattice to remove debris. 
4	Inspect to ensure the cuts have penetrated all the way through the coating.	
5	-	If the substrate is soft, jump to step (10). If the substrate is hard or wood, proceed to the next step (6)
6	Select the correct adhesive tape. Remove and discard two complete turns of adhesive tape. Remove an additional length of tape at a steady rate and cut a piece approximately 75 mm from this length.	Select the correct adhesive tape. Remove and discard two complete turns of adhesive tape. Remove an additional length of tape at a steady rate and cut a piece approximately 75 mm from this length.

7	Centre the cut piece of tape over the lattice and smooth into place using a finger. Tape position should be parallel to one of the cuts. Rub the tape firmly in the cutting area and at least 20 mm more using the eraser on the end of a pencil to ensure good adhesion between the tape and the coating. 	Centre the cut piece of tape over the lattice and smooth into place using a finger. Tape position should be parallel to one of the cuts. Rub the tape firmly in the cutting area and at least 20 mm more using a finger nail or finger tip to ensure good adhesion between the tape and the coating. 
8	Within 90 seconds (± 30 seconds) of applying the tape, remove the tape by pulling in a single smooth action at an angle of 180° to the coating surface. 	Within 5 minutes of applying the tape, remove the tape by pulling in a single smooth action taking approximately 0.5 to 1 seconds at an angle of 60° to the coating surface. 
9	-	To maintain a permanent record of the test, retain the tape by applying it to a transparent film
10	Assess the coating adhesion by viewing the lattice of cuts using an illuminated magnifier. Compare the lattice of cuts with the ISO/JIS and ASTM standards shown in “ISO/JIS and ASTM standards” (Table 2.2).	Assess the coating adhesion by viewing the lattice of cuts in good light. If agreed, use an eye glass to aid viewing. Compare the lattice of cuts with the ISO/JIS and ASTM standards shown in “ISO/JIS and ASTM standards” (Table 2.2).
11	Repeat the test at least at two other coating areas. Distance between lattice pattern should be at least 20 mm.	

Notes: If coating has more than one layer (for example, automobile coating), it is recommended to use adhesive tape at least twice: in parallel to both cut lines.

Notes: For one-layer coating (for example galvanic – E-coating) using adhesive tape for one time is sufficient. Nevertheless, it is not appropriate for coating, which is produced as a result of sintering.

Table 2.2 – Estimation of the adhesion or resistance to separation of coatings from substrates. according to Standards (ASTM D 3359, ISO 2409).

Lattice pattern	Description	Scoring system	
		ASTM	ISO/JIS
	The edges of the cuts are completely smooth; none of the squares of the lattice is detached.	5B	0
	Detachment of flakes of the coating at the intersections of the cuts. A cross cut area not significantly greater than 5% is affected.	4B	1
	The coating has flaked along the edges and/or at the intersections of the cuts. A cross cut area significantly greater than 5%, but not significantly greater than 15% is affected.	3B	2
	The coating has flaked along the edges of the cuts partly or wholly in large ribbons, and/or it has flaked partly or wholly on different parts of the squares. A cross cut area significantly greater than 15%, but not significantly greater than 35%, is affected.	2B	3
	The coating has flaked along the edges of the cuts in large ribbons and/or some squares have detached partly or wholly. A cross cut area significantly greater than 35%, but not significantly greater than 65%, is affected.	1B	4
	Any degree of flaking that cannot be classified even by classification 4 (1B).	0B	5

Testing result is adhesion score according to Standards, which user got most times on all tested areas of two samples. Meanwhile, deviation should not be more than one point.

In case of deviation in more than one point, tests are to be repeated with the same quantity of samples and average score of four tests becomes an adhesion result. If two scores have equal repeatability worst adhesion score becomes a result.

3 TECHNICAL MAINTENANCE OF THE PRODUCT AND ITS COMPONENTS

3.1 Security measures

After putting into operation it is recommended to inspect the device periodically in order to control:

- operability;
- compliance with the operating conditions;
- absence of external damages to component device parts.

To work with the device are allowed those who have been instructed as for safety operating.

3.2 Technical inspection

The recommended inspection interval is at least once a year.

The inspection procedure (verification; hereinafter - inspection) applies to Cross Cut Adhesion Tester NOVOTEST AN-2409 and establishes methods and means of their primary and periodic inspection.

3.2.1 Operations and inspection means

During the inspection, it is necessary to carry out operations and to apply means of inspection specified in Table 3.1.

Table 3.1 – Operations and inspections means

Operation	Is mandatory after	
	manufacturing and repair	operation and storage
Inspection of technical documents	yes	yes
Visual inspection	yes	yes
Estimation of geometry characteristics: – angle of cutting edges of working blades; – thickness of cutting edges of working blades; – distance between cutting edges	yes	yes
Presentation of the inspection results	yes	yes

3.2.2 Visual inspection

While visual inspecting user should check:

- parts and accessories according to standard set list;
- every blade must have six working (cutting) edges;
- no scratchers, scorings and mechanical damages on cutting edges, which can make influence on test results;
- there is a label with device type, trademark of the manufacturer, serial number, year of output on the cutter head.

3.2.3 Estimation of geometry characteristics

Geometry characteristics of blades and cutting edges are estimated out when blades are took apart from the cutter head.

Angle cutting edges of working blades is measured by means of flat test angles 29° и 31°.

At least three cutting edges should be checked.

Value of cutting edge angle should be in range 29° и 31°

Thickness of cutting edges of working blades is determined by means of two-dimensional device.

Every cutting edge must be checked. Thickness of cutting edge should be no more than 0.1 mm.

Distance between cutting edges is determined by means of two-dimensional device

Distance is measured on the edge between the equal points of neighboring teeth

Measurements must be carried out at least three times on different tooth-to-tooth pairs.

Distance between cutting edges (tooth-to-tooth distance) must be: $1,0 \pm 0,1$ mm; $2,0 \pm 0,1$ mm; $3,0 \pm 0,1$ mm (or comply with values in Operation manual).

3.3 Warranty

The following warranty information is valid for all NOVOTEST products.

The manufacturer guarantees the conformity of the device to the requirements of the technical conditions under the user's compliance with the conditions of transportation, storage and operation, and timely maintenance at the manufacturer's premises at least once a year.

3.3.1 Basic Warranty

The new NOVOTEST device, purchased from the manufacturer or an authorized dealer, is covered by basic warranty of 3 (1+2) year, upon compulsory condition of routine maintenance at least once a year.

If any part of the device fails due to a defect in the material or production process, it will be repaired or replaced free of charge by the manufacturer or by any authorized NOVOTEST dealer, regardless of whether the ownership of the device has passed to another person during the warranty period.

The warranty for the device begins to operate from the date of purchase of the device, as a rule, on the day of shipment of the device to the customer. In the case that the device is purchased by an intermediary company, the beginning of the warranty period is the time of transfer of the device to the intermediary.

3.3.2 Extended warranty

A special program for extending the basic warranty period from 3 to 5 years is available. To participate in the program, buyer must pay a certificate when purchasing equipment. Extended warranty terms are specified in the certificate.

3.3.3 Warranty for repaired or replaced parts

All NOVOTEST brand spare parts installed during the warranty repair process are covered by the NOVOTEST guarantee (until the end of the warranty period).

Spare parts replaced during warranty service under warranty are not returned to the owner of the device.

3.3.4 Wear parts

Parts that are subject to wear during the operation of the device fall into two main categories. The first includes those parts that require replacement or adjustment at the interval prescribed by the maintenance schedule of the device, and to the second wear elements, the frequency of replacement or adjustment of which depends on the operating conditions of the device.

3.3.4.1 Parts replaced with routine maintenance

The parts listed below have a limited service life and need to be replaced or adjusted at intervals prescribed by the maintenance schedule of the device. The basic warranty extends to these parts until the moment when their first replacement or adjustment is required. The warranty period for each part can not exceed the restrictions (on the time of operation of the device or operating time) specified in the conditions of the basic guarantee.

- built-in rechargeable batteries;
- gaskets, if they are removed in connection with the concomitant adjustment;
- oil and working fluids.

3.3.4.2 Wear parts

The parts listed below either have a limited service life, or may require replacement (adjustment) because of the damage. However, these parts are covered by the basic NOVOTEST warranty for 12 months or until the first scheduled maintenance of the device (whichever comes first):

- probes and their components;
- connecting cables;
- details and mechanisms exposed to mechanical influences during operation.

Note: Details, which are wearing by friction (such as knives, cutters, movable probe parts, ultrasonic piezoelectric probes, details with support platforms and so on.), are not covered by the basic guarantee NOVOTEST if these parts fail due to normal wear during the device usage. However, if during the warranty period these parts fail due to an initial defect in the material or workmanship, they will be repaired or replaced according to the basic warranty.

3.3.5 Duties of the owner

The “Operation Manual” contain information on the proper operation and maintenance of the device.

Proper operation and maintenance of the device will help the user avoid expensive repairs caused by incorrect operation, neglect or improper maintenance. In addition, following our recommendations increases the life of the device. Therefore, the owner of the device should:

- If a defect or fault is detected, as soon as possible to contact the manufacturer or an authorized NOVOTEST dealer for warranty repairs. This will help to minimize the repair required by the device.
- Carry out maintenance for your appliance in accordance with the operating.

Note: Neglect of timely maintenance of the device in accordance with the prescribed schedule deprives purchaser of the rights to warranty repair or replacement of defective parts.

- When servicing the appliance, use only original spare parts and NOVOTEST service fluids (which are marked accordingly).
- Make notes on the maintenance performed on the instrument, save all invoices and receipts. If necessary, they will serve as proof that the maintenance was carried out in a timely manner, using the recommended spare parts and operating fluids. This will help user with warranty claims for defects that may occur as a result of non-compliance with the maintenance schedule of the instrument or the use of unauthorized parts or materials.
- Regularly clean the instrument housing and probes of the device in accordance with the recommendations of NOVOTEST.
- Keep operating and storage conditions in accordance with the recommendations of NOVOTEST.

3.3.6 Warranty Limitations

NOVOTEST is not responsible if the need for repair or replacement of parts was caused by one of the following factors:

- Damage caused by negligent / improper operation of the appliance, a natural disaster, water ingress into the appliance, the probe, accessories and parts of the appliance (in the absence of a production fault) by an accident or using the appliance for other purposes;
- Operational wear of parts;
- Failure to comply with NOVOTEST recommendations for maintenance of the device within the specified time;
- Violation of the operating conditions of the device, recommended by NOVOTEST;

- Changes in the design of the device or its components, interference with the operation of the instrument systems, etc., without agreement with the manufacturer;
- Use of batteries and other components of improper quality;
- Voltage drop in the mains;
- Deny to timely correct any damage identified during routine maintenance;
- Factors beyond the scope of NOVOTEST control, for example: air pollution, hurricanes, chipping, scratches and the use of unsuitable cleaners;
- Use of repair technologies not approved by NOVOTEST;
- Use of non-original NOVOTEST spare parts and fluids.

Repair operations covered by the NOVOTEST warranty must be performed only by an authorized NOVOTEST service center.

3.3.7 Other cases not covered by the warranty

The basic NOVOTEST warranty, extended NOVOTEST warranty excludes the liability of NOVOTEST for any unforeseen or consequential damage incurred as a result of a defect covered by the above warranties. Such damage is (but is not limited to the following list):

- compensation for inconvenience, phone calls, costs of placing and transferring the device, loss of profits or damage to property;
- all warranties become invalid if the device is officially recognized as not subject to repair.

3.3.8 Guarantees and consumer legislation

The basic NOVOTEST warranty, the extended NOVOTEST guarantee do not infringe upon your legal rights granted to the user by the purchase and sale contract, which is drawn up upon the purchase of the device from the manufacturer or an authorized NOVOTEST dealer; as well as applicable local legislation defining the rules for the sale and servicing of consumer goods.

3.4 Maintenance of the device

This maintenance information is valid for all NOVOTEST products.

Maintenance of the device is performed during the entire service life and is divided into:

- preventive;
- planned.

Preventive maintenance is carried out not less often than once in three months and includes external inspection, clearing and greasing.

Planned maintenance is carried out by the manufacturer at least once a year and is a mandatory requirement for maintaining the guarantee from the manufacturer.

It is very important to carry out its maintenance in a timely manner throughout the life of the device. At the same time, it is necessary to follow the schedule presented in tab. 3.2 (focusing on the development of the device or the months of its operation, whichever comes first).

The specific list of operations performed during each maintenance depends on the model of the device, as well as on the year of its production and the amount of operating time. An authorized NOVOTEST service center will provide the user with information on the work to be performed when servicing the device.

Records on the routine maintenance of the device are made in the passport for the device. Information about maintenance is very important, they may be needed to implement your rights to warranty repair of the device. Therefore, always check that at the end of the maintenance period your authorized NOVOTEST service center has stamped it in the appropriate place under the record of the procedures performed.

Table 3.2 - Maintenance schedule for NOVOTEST

Device	Maintenance schedule NOVOTEST
All models except those listed below	Annual maintenance is performed after one year or 2,000 operating hours (whichever occurs first)
Portable hardness testers (Leeb, UCI, Combined)	Annual maintenance is performed after one year or 2,000 operating hours (whichever occurs first)

4 MAINTENANCE

The device by type of performance and taking into account operating conditions refers to products that are repaired at special enterprises or at the manufacturer.

To set the device for warranty service in the service center (SC), it is necessary to present correctly completed passport for the device. SC makes a mark in the passport about setting the device for warranty service and sends a photocopy to the manufacturer.

Sending the device for warranty (post-warranty) repair or verification should be done with the passport of the device. In the accompanying documents it is necessary to indicate the mailing details, telephone and fax of the sender, as well as the way and the address of the return delivery.

Warranty repair is carried out in the presence of a completed passport.

5 STORAGE

Store the device at an ambient temperature of +5 ° C to +40 ° C and relative humidity up to 80% at a temperature of 25 ° C.

In the case of short-term storage and during interruptions between applications, the device must be stored in a suitable packaging container. In the storage place there should be no vapors of corrosive substances (acids, alkalis) and direct sunlight. The device must not be subjected to sudden shocks, falls or strong vibrations.

Devices should be stacked on shelves or stacked in transport packaging.

6 TRANSPORTATION

Packed instruments can be transported by any mode of transport provided the following conditions are met:

- transportation is carried out in factory packaging;
- there is no direct exposure to moisture;
- the temperature does not exceed -50 ° C to +50 ° C;
- humidity does not exceed 95% at temperatures up to 35 ° C;
- vibration in the range from 10 to 500 Hz with amplitude up to 0.35 mm and acceleration up to 49 m/s²;
- impacts with a peak acceleration value of up to 98 m/s²;
- the devices placed in the transport are fixed to avoid falling and collision.

7 RESYCLING

The product does not contain in its design any dangerous or poisonous substances that can harm human health or the environment and do not pose a threat to life, health of people and the environment at the end of their service life. In this regard, the recycling of the product can be made according to the rules for the disposal of general industrial waste. Recycling is carried out separately by groups of materials: plastic elements, metal fasteners.



NOTES

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NOTES

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.