Scientific Production Enterprise

“NASOSTECHCOMPLECT”

MK-2 Type Coupling

MAINTENCE GUIDENCE

НТК 02.000У.001.00.00 РЭ

2021

TABLE OF CONTENTS

GENERAL SPESIFICATION

1.1 Connective coupling MK 2 type (coupling) is intended for torque transfer from drive to pumps, compressors and other rotating mechanisms with compensation of radial, angular and axial deflection of shafts connection.

1.2 УХЛ2О4 is climatic manufacturing of couplings according to ГОСТ 15150. Couplings allow using in explosive areas В-1а and В-1г classes according to “Principles of Electric Devices Structure” with IIA-T3 explosive mixture category and group according ГОСТ 12.1.011.

1.3 According to reliability indexes nomenclature by ГОСТ 27.003 coupling is:

- specified purpose item according to purpose specificity
- 1-type item according to probable state number (working capacity), i.e. it can be in workable state or non-workable state
- continuous long application item according to application modes;
- item, which failure and transfer to limiting state doesn’t lead to disastrous effects, according to failure consequences
- repairable item according to workable state regeneration after failure during maintenance process;
- serviced item according to technical service potentials during maintenance.

1.4 Nomenclature structure of ***MK 2 – XXX*** coupling consists of:

MK	compensative coupling;
2	double-row (two rows of springing element packages);
XXX	power index = N × 1000 / n,

N is transmission power, kW;
n is coupling rotational speed, rev/min.

TECHNICAL SPESIFICATION

Table 1

Factor name	Coupling size-series							
	MK 2-17	**MK 2-34**	**MK 2-67**	**MK 2-105**	**MK 2-270**	**MK 2-420**	**MK2–670**	**MK2–1050**
Transmitted torque, N×m								
- rated	160	315	630	1 000	2 500	4 000	6 300	10 000
- maximum short-term	395	787	1 575	2 500	6 250	10 000	15 750	25 000
Allowable rotational speed, (rev/min)	20 000	16000	13500	13500	11000	9000	7500	6800
Allowable radial deflection of shaft axes*, mm								
- when putting into operation	0,05							
- in continuous operation**	0,35	0,45	0,60	0,35	0,40	0,75	0,80	0,60
Allowable inter-misalignment of half-coupling ends, for maximum diameter*, mm								
- when putting into operation	0,1							
- in continuous operation**	0,6	0,8	1,0	0,65	0,8	1,4	1,6	1,8
Allowable axial deflection of shafts, mm	± 1,8	± 2,4	± 3,0	± 1,8	± 2,6	± 3,0	± 3,4	± 3,4
Coupling overall dimension, mm:								
- diameter, nor more than	100	125	150	150	180	220	255	305
- length *	230	250	300	300	350	450	500	550
Mass, kg*	9	11	18	18	30	52	75	103

* Parameters given for couplings with minimal shaft end distance.

** For shaft axial deflection nor more than 75% of maximum allowable value.

Detailed information about relation of allowable axial and angular deflections of shafts are given in the diagram (appendix B, figure B.1).

Actual parameters of every coupling (allowable radial deflection of shaft axes and allowable inter-misalignment of half-coupling ends) are given in particular coupling certificate.

2.2 Reliability indexes

Coupling reliability in terms of operation conditions, given in the table 1, has the following indexes:

- average error-free running time - nor less than 50 000 hrs. ;
- average total service life - nor less than 9 years.

MEMO: *Criterion of failure is appearance and development of fatigue cracks in springing elements*

DESIGN AND OPERATING PRINCIPLE

3.1 Design description

3.1.1 Coupling design is torsion resistible all-metal unit, which can compensate misalignment and axial deflection of connectable shafts by special compensative elements elastic deformations.

3.1.2 Coupling (figure 1) consists of motor hub **1**, mechanism hub **2**, spacer unit **3**, screws **4**, washers **5** and spacer ring **6**.

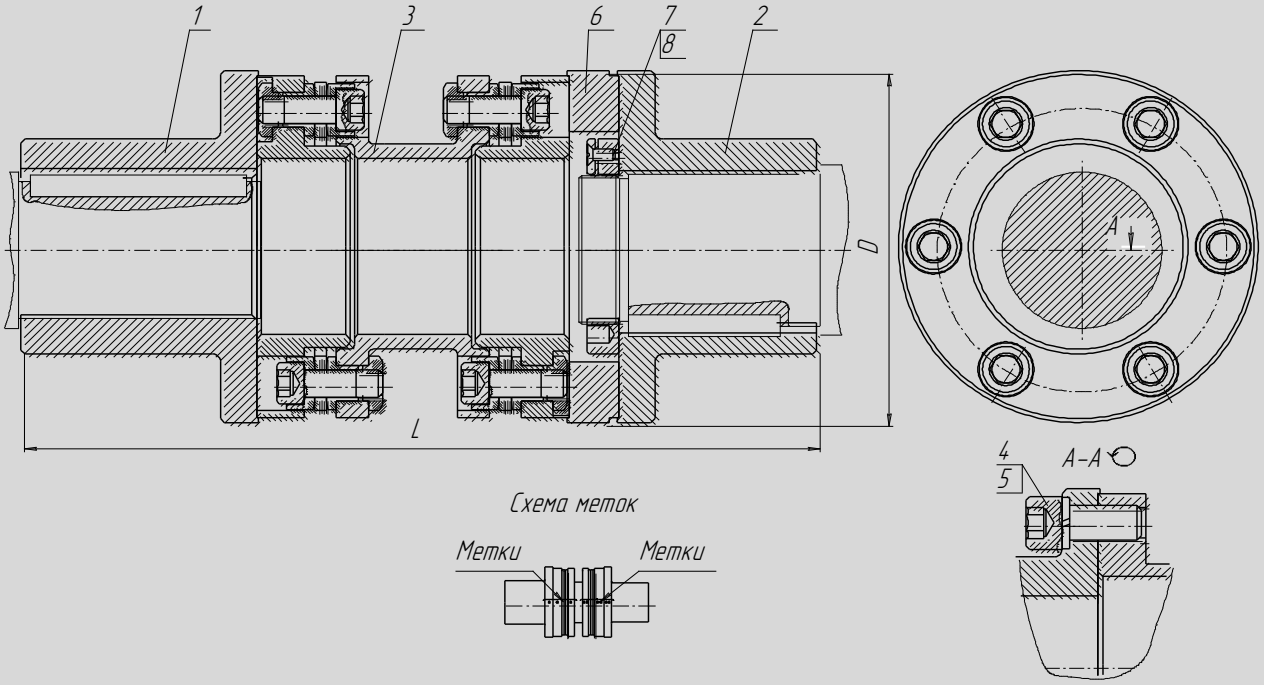

Figure 1

3.1.3 Hub **1** is fixed at cylindrical motor shaft end by fit H7/k6 using feather key **17** and screw **18** (figure 4).

3.1.4 Hub **2** is fixed at cylindrical (conical) mechanism shaft end by feather key and if provided by nut **7** (figure 1).

3.1.5 Spacer unit is connected with every hub by bolts **4** and washers **5**.

3.1.6 Part position after coupling assembly and balancing is determined by marks (punching) along the external part boundary.

3.1.7 Spacer unit (figure 2) consists of two springing element units **9** and parts: spacer casing **10**, two separators **11** and nuts **12**.

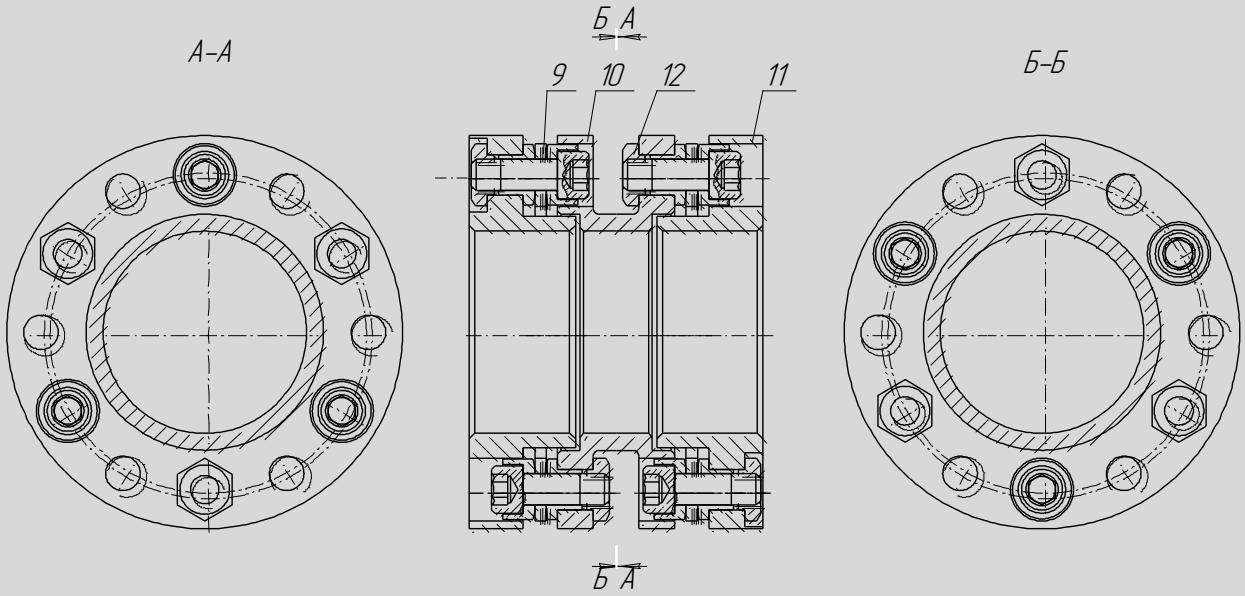

Figure 2

3.1.8 Each springing element unit design (figure 3) consists of springing element package (set) **13**, screws **14**, bushes **15** and overload rings **16**. The unit is interchangeable and is supplied as an auxiliary for coupling repair.

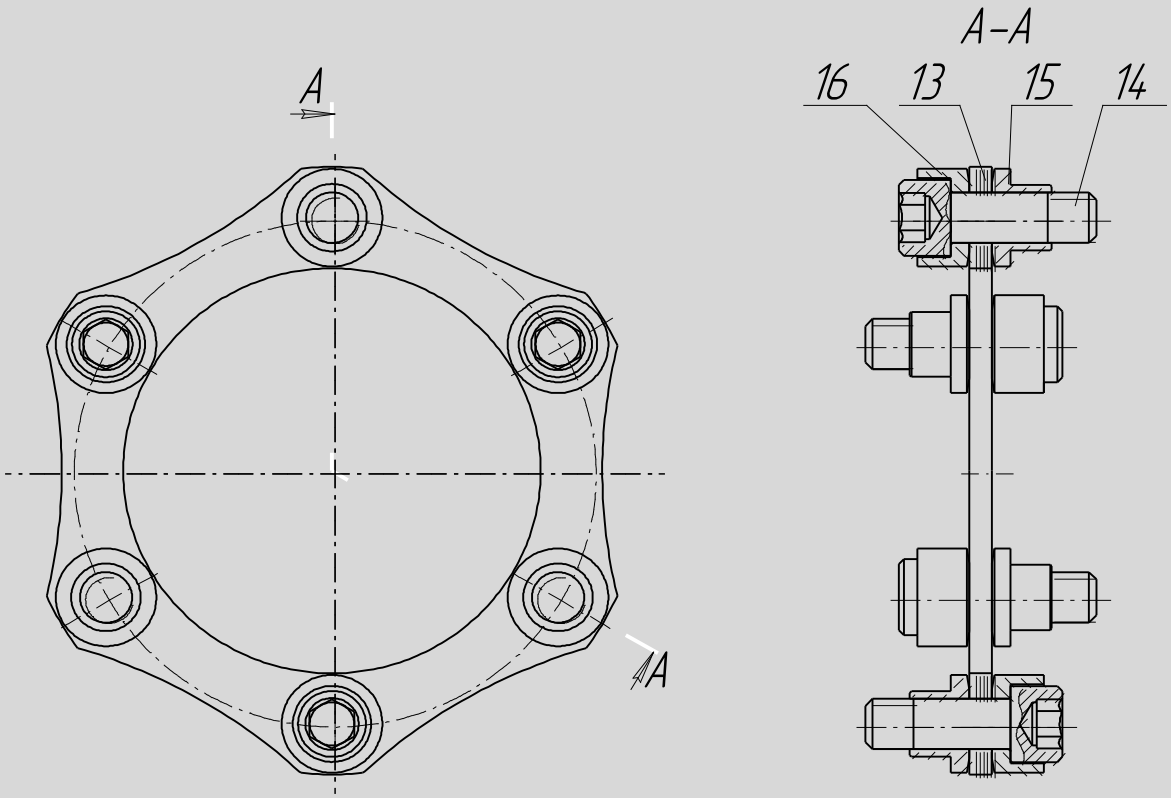

Figure 3

3.2 Operation principle

3.2.1 Torque transfer between half-couplings and spacer is realized by end surfaces friction forces, which are provided by screw **4** stretching (figure 1).

3.2.2 Torque transfer by springing element is realized by its section tension and compression forces between screws **14**, which are connected to spacer casing **10** and separators **11** (figure 2).

3.2.3 Spacer casing alignment 3 in half-couplings 1 and 2 (figure 1) is provided by fit of centering spigot.

3.2.4 Coupling compensation of shaft relative position deflection is realized by complex deformation of springing element unit in both packages.

3.2.5 In case of emergency failure of springing element package torque can be transferred by screws **14** (figure 3) with overload rings **16**. Overload rings are spark-protection element.

SUPPLY ASSEMBLY

4.1 Standard supply assembly of MK-2 type coupling consists of:

- Coupling
- Packing pan (box)
- Given maintenance guidance – 1 copy to 1 address
- Registration certificate- 1 copy for each coupling

4.2 The following can be supplied on demand:

- Ready-assembled springing element unit
- Device for spacer unit mounting
- Device for shaft alignment
- Hub remover

INSTALLATION OF COUPLING AND COUPLING REMOVAL

IMPORTANT
It is necessary to follow the mounting drawing (figure 1) and the given guidance when carrying out any works with coupling.

MEMO: *Don't dismount the middle part of the coupling. It is necessary to turn to the coupling producer when springing element package 13 should be changed.*

5.1 Preparation to mounting

5.1.1 Resume and inspect the coupling.

5.1.2 Turn screws **4** with washers **5** out of spacer **3** (figure 1) and disconnect half-couplings **1** and **2** off spacer **3**.

5.1.3 If the coupling was supplied with allowance "for boring by position", you should bore hub and machine key grooves. Half-couplings basing should be carried out in surfaces А and Б (appendix А) when finishing. Basing accuracy is 0.03 mm.

IMPORTANT
Coupling reliability and lifetime and dynamic loads on unit shaft supports depend on hub boring accuracy.

5.2 MOUNTING

5.2.1 Fix hub **2** at mechanism shaft and hub **1** at motor shaft (figure 4), keeping size **Б** between end surfaces of the hub **1** and the ring **6** (or hub **2** if the ring **6** is absent) equal to actual length of the coupling middle part by appropriate location and fixing of the hub **1** at motor shaft in the following order.

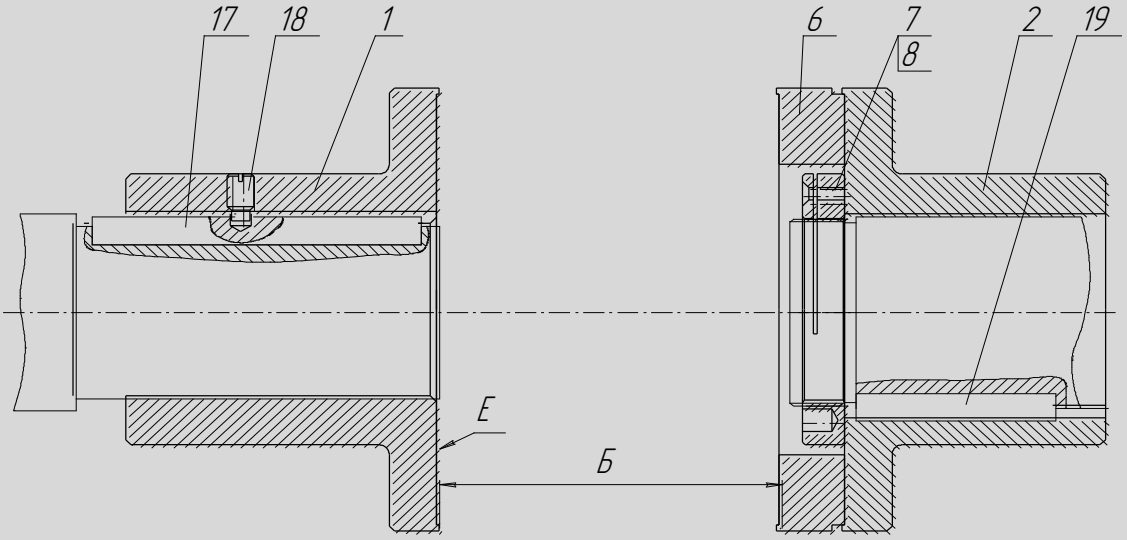

Figure 4

5.2.1.1 Check axial acceleration of motor rotors and driving machine and put them to operative location.

5.2.1.1.1 For motor with sliding bearings

Carry out idle start and for steady rotation check working axial position by issued structure of motor. Circular groove (mark) at shaft should index with device indicator. Stop motor and, moving rotor in axial direction, renew its position to that one, when rotation occurs, connecting circular groove at shaft with device indicator.

Exceeding of motor shaft axial start in sliding bearings above allowable axial deflection of the coupling is not obstacle for its using, because elastic forces of coupling limit relative axial deflections of connectable shafts to allowable values.

5.2.1.1.2 For motor with hydraulic face

Remove pump rotor to suction side up to the stop (closing of hydraulic face axial clearance)

5.2.1.2 Set key **19** to groove and press hub **2** at driving machine shaft. If necessary previously heat it up to 80…90°C. Screw nut **7** (if it is provided). Connect the ring **6** to hub **2**, by connecting marks.

5.2.1.3 Set key **17** to motor shaft groove, press hub **1**, if necessary previously heat it up to 80…90°C. When hub **1** mounting, it is necessary to keep size **Б** between flanges of hub **1** and ring **6** equal to middle part of the

coupling to within ±0.5 mm. Actual value of size **Б** for each pump is marked on spacer housing and given in the coupling registration certificate.

IMPORTANT
Size Б should be kept by moving at hub 1 motor shaft.

For units with heat (or another) axial motion of shafts, higher than 50% of allowable axial deflection of the coupling, it is recommended to provide size **Б** for typical operation by preliminary axial tightness of the coupling (it is sufficient only in case of rigid axial fixation of both connectable shafts).

For units with two conic ends of shafts. Fitting of size **Б** is provided by grinding of spacer ring **6** by actual size after both couplings mounting. Besides it is necessary to provide parallelism of front surfaces of ring **6** to within 0.03 mm.

5.2.2 Carry out alignment according to the requirements, given in the unit documents.

Allowable deflections of shaft axes for alignment are given in the table 2.

Table 2

Deflection direction	Value, mm
Radial	0,05
Front (relative beating of hub ends, measured for maximum diameter)	0,1

IMPORTANT

For units with radial shaft move, over than 0.05 mm, it is necessary to provide alignment with required accuracy for typical operation by introducing given preliminary radial alignment.

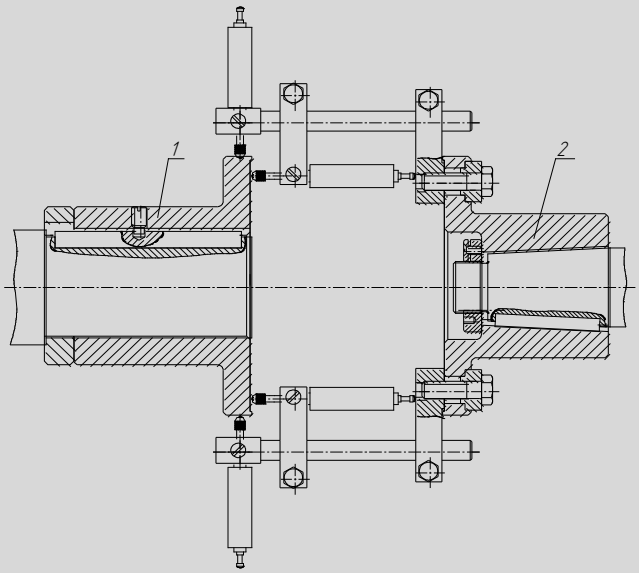

Figure 5

5.2.5 Mount spacer unit between half-couplings in the following order.

5.2.5.1 Turn issued devices for spacer dismounting into threaded holes of separators **11** (figure 6) and reap spacer unit at 2…2,5mm when screwing both rods of device **20**.

5.2.5.2 While keeping spacer unit **3** in reaped state by both rods of device **20**, put it to the opening between half-couplings and when connecting any side flanges by marks (punching), fasten this flange couple by screws **4** with washers **5**.

5.2.5.3 When turning connectable shafts, connect the second flange couple by marks (figure 1) and when turning device rods, connect flanges by grindings, fasten both flanges by screws **4** with washers **5**.

5.3 Reap screws **4** in both flange connections. Values of screw **4** tightening moments are given in the table 3.

Table 3 **N×m**

Coupling standard-size series							
MK2-17	**MK2-34**	**MK2–67**	**MK2–105**	**MK2–270**	**MK2-420**	**MK2–670**	**MK2–1050**
30^{+5} ($3{,}0^{+0{,}5}$)	40^{+5} ($4{,}0^{+0{,}5}$)	75^{+5} ($7{,}5^{+0{,}5}$)	75^{+5} ($7{,}5^{+0{,}5}$)	200_{-20} ($20{,}0_{-2{,}0}$)	350^{+30} ($35{,}0^{+3{,}0}$)	650^{+50} ($65{,}0^{+5{,}0}$)	650^{+50} ($65{,}0^{+5{,}0}$)

IMPORTANT

Coupling dismounting should be carried out with switched off network driving motor and closed suction and charging gate valves.

After turning screws 4, springing element 13 packages (figure 3) shouldn't have deformation features for shaft operative location.

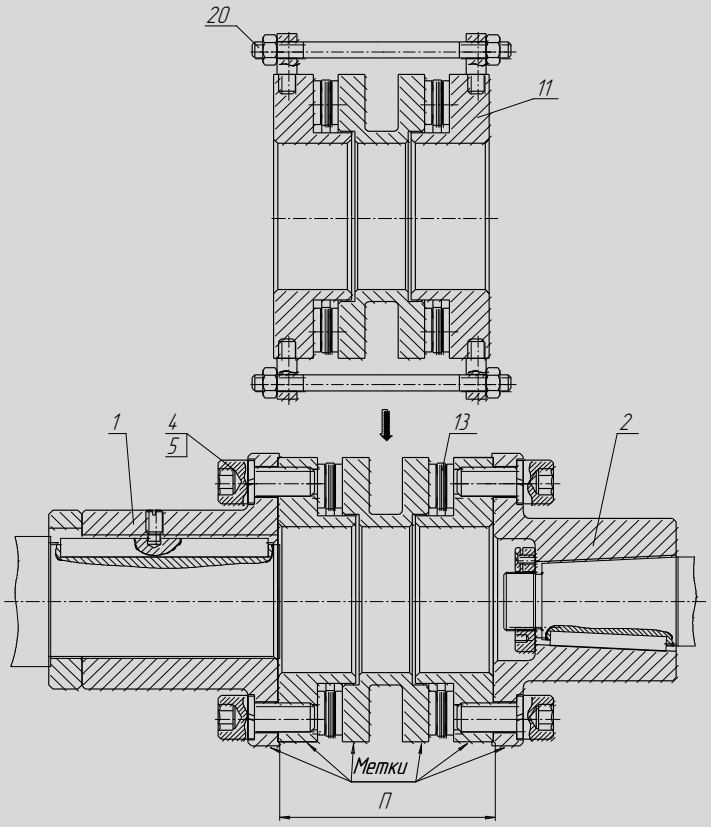

Figure 6

5.4 COUPLING DISMOUNTING

5.4.1 Carry out unit spacer dismounting in the following order.

5.4.1.1 Fix mounting devices **20** in threaded holes of separator **11** (figure 7).

5.4.1.2 Partly turn screws **4** out of both half-couplings and reap spacer unit at 2…2,5mm when screwing both rods of device **20**.

5.4.1.3 Finally turn screws **4** with washers **5** by keeping spacer unit by device **20** rods and take spacer unit out of opening.

5.4.1.4 Take device **20** away from spacer unit.

IMPORTANT

Spacer dismounting should be carried out with switched off network driving motor and closed suction and charging gate valves.

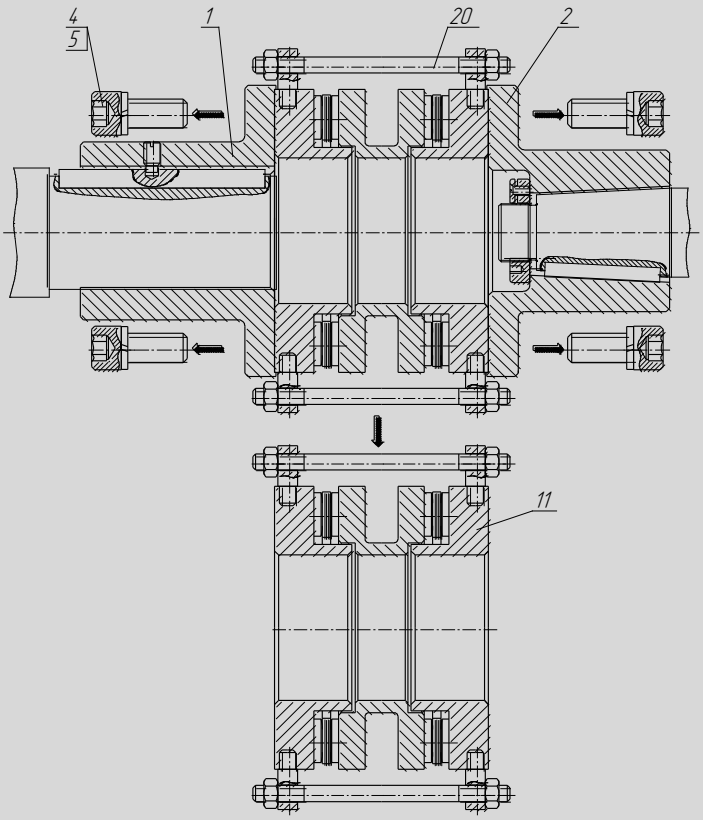

Figure 7

5.4.2 Dismount hubs **1**, **2** (figure 8) in the following order

5.4.2.1 Unscrew and take away nut **7**.

5.4.2.2 Fix remover **21** at the hub **2**, press hub to shaft end.

5.4.2.3 Turn screw **18** out of motor hub **1**. Fix remover **21** at hub **1**, press hub from shaft end.

IMPORTANT

Coupling dismounting should be carried out with switched off network driving motor and closed suction and charging gate valves. Don’t press half-couplings from shafts by hammer impacts or in any similar way.

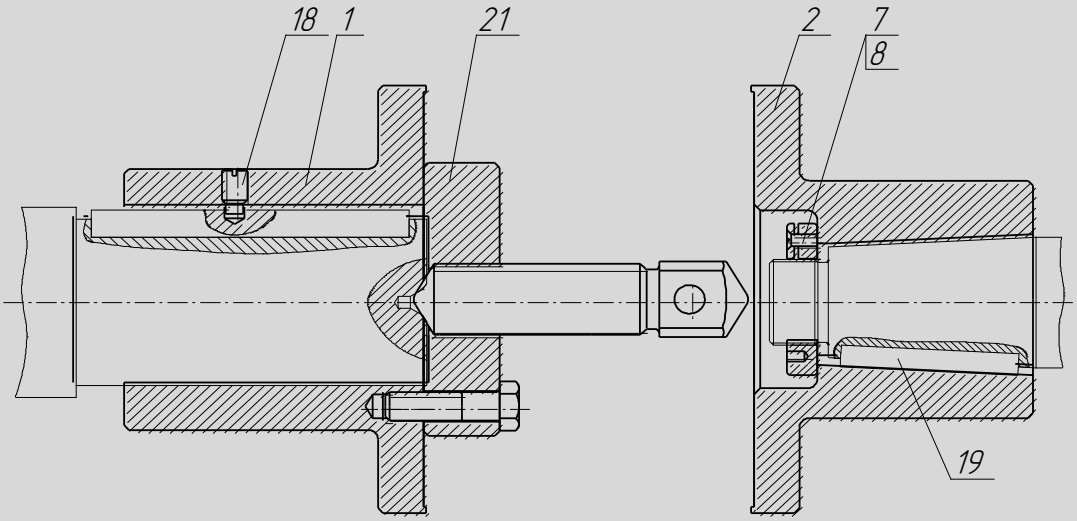

Figure 8

SAFETY INSTRUCTIONS

6.1 The coupling design meets the requirements of general safety measures ГОСТ 12.2.003 and ГОСТ 12.2.004.
6.2 The coupling should be protected by lagging.
6.3 Check up, servicing and repair of the coupling should be provided for stopped unit and off line motor.

MAINTENANCE

7.1 In case of unit break-out, current and other repairs it is important to:

- check and renew to means, given in the table 2, unit shaft alignment, as high radial and angular shaft deflections cause the most dangerous cyclical tensions in springing elements and are the main reason of coupling reliability reduction and loss of life;
- check screw **4** tightening**;**
- check state of peripheral springing elements in packages **13**.

7.2 Appearance of micro cracks and plastic deformation of springing elements in packages **13** (figure 3) is a result of continuous unit operation with disturbed shaft alignment.

MEMO: For coupling efficiency renewal it is necessary to renew unit shaft alignment to norms, given in the table 2, and replace springing element packages 13, which include elements with features of plastic deformation and failure.

7.3 Replacement of springing element packages **13** (figure 3) should be provided according to the coupling producer technology.

TRANSPORTATION AND STORAGE

8.1 Coupling transporting by any mode of transport is allowed if keeping the rules of freight transporting for a given mode of transport. Transporting conditions should conform to group 5 by ГОСТ 15150 (housing in macroclimatic areas with temperate and cold climate) with regard to climatic factors influence.

8.2 Storage conditions should conform to group 2 by ГОСТ 15150 (closed not-heated storehouse in macroclimatic areas with temperate and cold climate).

MANUFACTURERS' WARRANTY

9.1 Supplier guarantees the coupling conformity to technical documents when consumer keeps storage, mounting and maintenance rules, established by the given guidance.

9.2 Guarantee life – 12 months from the coupling setting to work day. Guarantee time calculation – in accordance to ГОСТ 22352.

APPENDIX A

The scheme of hub basing for machining of setting bore and key groove

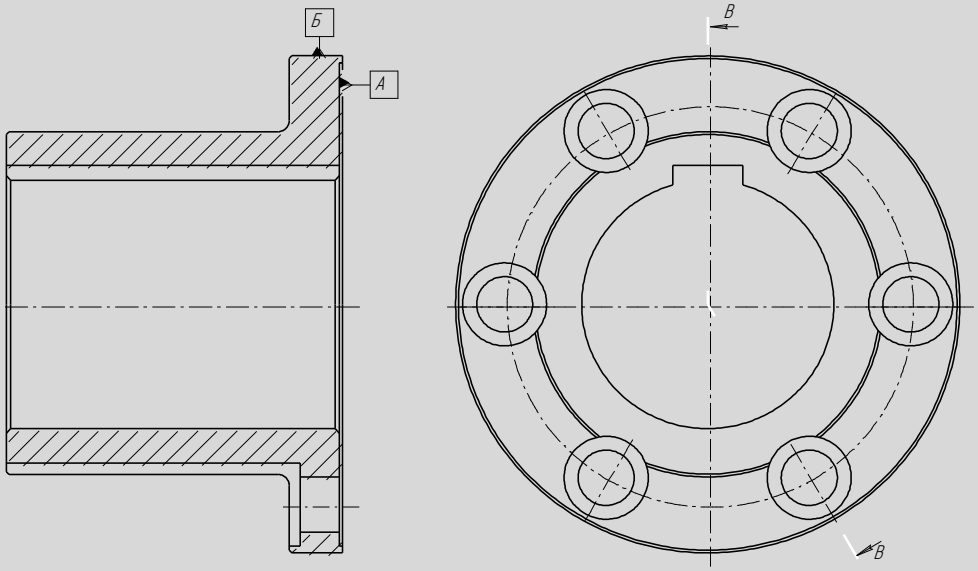

Figure A.1

APPENDIX B

Diagram of shaft tolerance displacements for MK-2 type couplings

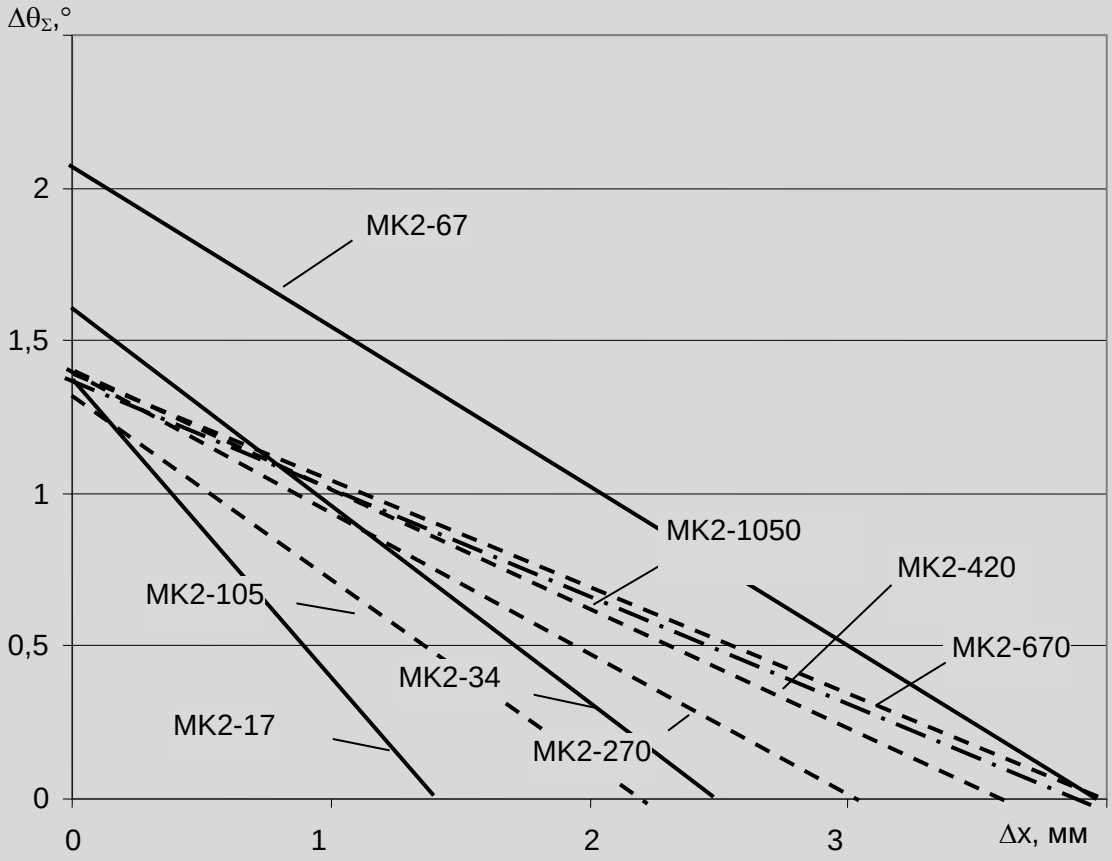

Figure B.1

$\Delta\theta_\Sigma$ – actual spacer angular deflection, degree;
ΔX – axial deflection of shafts, mm.

$$\Delta\theta_\Sigma = \arctan\left(\frac{\Delta Y}{L}\right) + \Delta\theta$$

where *L* – interval between springing element packages, mm;
ΔY - radial deflection of shaft axes, mm;
$\Delta\theta$ - angular deflection of shaft axes, degree.

$$\Delta\theta = \arctan\left(\frac{\Delta Z}{D}\right)$$

where ΔZ - hub end beating, measured for diameter D (mm), mm.

Coupling working point (ΔX; $\Delta\theta_\Sigma$) should lie in the field, limited by coordinate axes and appropriate curve.