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TRANSMISSION SHAFTS

MADE FROM STEEL 45 X H2MΦ A-ш

SPECIFICATIONS

172.45.1TY-1

ISSUE- 18

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MANUAL		
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These specifications pertain to transmission shafts, made from steel 45 X H2MФA-Ш, in the drawings of which reference is made about the present specifications.

1. TECHNICAL REQUIREMENTS

1.1. The shafts should correspond to the requirements of drawings and the present specifications. Running-in of shank and intermediate sections should be done on shafts, in the drawings of which, requirements of running-in are given.

1.2. Chemical compound, mechanical properties macrostructure of metal of grade 45xH2 MФA-Ш for manufacturing the shafts should correspond to the requirements of TY 14-1-1725-76, GOST 4543-71 and the present specifications.

1.3. Over heating during upsetting of heads is not allowed.

1.4. Quality of heat treatment of shafts.

1.4.1. Hardness for the surface of shafts and hardness along the sections should correspond to the requirements of drawing.

1.4.2. Mechanical properties of steel for shafts after heat treatment should correspond to Table 1.

Table 1

Ultimate strength, $\sigma_в$ MPa (kgf/mm²)	Yield point ($\sigma_{0.2}$) MPa (kgf/mm²)	Elongation (δ), %	Reduction area (ψ), %	Impact strength. KCV/150/2/10 (x10-5 D ж/м2)
	not less than.			
1372 (140)	1225 (125)	7	32	3,2

1.4.3. On the surface of shafts, after heat treatment, zone of full decarburization is not allowed. Depth of partial decarburizing should not exceed 0.3 mm.

1.4.4. Deviation of shafts from straightness for the entire length of rod, after heat treatment, should not exceed ;

0.2 mm - for shafts with a length upto 250 mm.

0.4 mm - for shafts above 250 mm.

1.5. Quality of surface of shafts after grinding.

1.5.1. Travel of shank of shafts to the head should be smooth. Sudden reduction of intermediate sections as well as presence of gradation are not allowed.

1.5.2. Presence of burns is not allowed on the surface of shafts after grinding.

1.5.3. After grinding, presence of decarbuzied layer is not permitted on the surface of shafts. Allowance for grinding should ensure complete removal of decarburized layer.

1.5.4. On the rod of shafts and intermediate sections there should not be crazes, cracks, nicks, marks and longitudinal and lateral surface defects.

1.5.5. Crazes, cracks, nicks and marks are rectified by dressing by a depth not exceeding:-

0.2 mm - for shank

0.07 mm - for intermediate sections.

The dressed areas should have smooth passage to the surface of shaft.

After the rectification of defects, shafts should be subjected to repeated inspection. Defects are not allowed.

1.5.6. Instead of dressing the defects of surface, repeated grinding of the entire shank and intermediate sections, within the limits of tolerance for dimensions, specified in the drawing, is permitted.

1.6. Requirements for running-in of shank and intermediate sections :

1.6.1. Running-in of shank and intermediate sections should be carried out with rotating rollers on the side of any ring in one pass.

1.6.2. Longitudinal feed, during running-in, shall be switched off only after releasing the pressure on rollers.

1.6.3. Value of overlapping during partial running-in after rectification of defects should not be less than 20 mm.

1.6.4. During the process of running-in, oiling of contact areas of rollers with the shaft should be done with oil. Grade of oil is fixed as per the technological process.

1.6.5. Tolerance for squareness of rollers to the surface being run-in shall not exceed 0.15 mm (to be ensured by the design of fixture for running-in).

1.6.6. Difference of outer diameters of rollers, set to the fixture, shall not exceed 2 mm.

1.6.7. Operating surface of rollers, during running-in, should be in the same plane misalignment may not exceed 0.5 mm.

1.6.8. Rollers with (ϕ160-10) mm. diameter with rounding-off radii of working surface (R5±1) mm, heat treated for hardness HRC э 61, should be used for running-in.

On the working surface of rollers there should not be crazes, cracks, burns, dints, dents, chipping off of metal and traces of deformation of edge.

For eliminating the said defects, rollers may be reground within the limits of tolerance for the diameter. Dressing is not allowed. A certificate should be drawn-up for each roller. Using of rollers without the certificate, testifying about its acceptance, is not allowed.

1.6.9. Wear of working surface of rollers is permitted till the formation of the zone with a width not exceeding 1 mm. The worn-out rollers should be subjected to compulsory replacement or regrinding.

1.6.10. Force on the roller during running-in should be 4000-4500 H (400-450 kgf) when their longitudinal feed does not exceed 0.5 mm/revolution.

1.7. Quality of surface of shafts after running-in :

1.7.1. Presence of non-run-in sections, nicks, contraction and buckling are not allowed on the rod and intermediate sections.

1.7.2. The shafts, on the surfaces of which defects, in the form of marks, nicks, are detected after running-in, should be rectified in compliance with para 1.5.5 and should be subjected to subsequent additional running-in of the rectified areas or the entire shaft.

2. ACCEPTANCE RULES

2.1. While manufacturing the shafts, their compliance to the requirements of the present specifications and drawings are checked in the scope and sequence specified in Table 2.

Table 2

Scope of checking the shafts.

Parameter being checked.	Para No.of present specifications		Volume of sample selection
	Para No. of tech-nical require-ments.	Check procedur-res.	
(1)	(2)	(3)	(4)
1. Incoming Inspection of metal.	1.2	3.2	1 bar of the same dimension, of each melt.
1.1. Chemical combination			
1.2. Mechanical properties			
1.3. Macrostructure			
2. Absence of overheating	1.3	3.3	1 shaft from the heat-batch.
3. Quality of heat treat-ment of shafts.	1.4	3.4	
3.1. Hardness	1.4.1	3.4.1	100% shafts
3.2. Straightness of shank	1.4.4.	3.4.2	100% shafts

(1)	(2)	(3)	(4)
4. Periodical check of quality of heat treatment.		3.5	
4.1. Hardness of shaft surfaces and along the sections.	1.4.1.	3.5.2	Not less than once in a quarter.
4.2. Mechanical properties of steel for shafts.	1.4.2.	3.5.4	
4.3. Depth of decarburized layer.	1.4.3	3.5.3	
5. Checking of shafts after grinding.	1.5	3.6	
5.1. Travel of shank to head.	1.5.1	3.6.1	100% shafts
5.2. Absence of grinding burns.	1.5.2.	3.6.2	100% shafts
5.3. Absence of surface defects	1.5.4	3.6.3	100% shafts
6. Checking the quality of running-in of shank and intermediate sections;			
6.1. Adherence to the technological process for running-in.	1.6.1-1.6.4.	3.7.1	Daily
6.2. Tolerance for squareness of rollers to the surface being run-in.	1.6.5	3.7.2	While certifying the fixture for running-in.
6.3. Difference of outer diameters of rollers set to the fixture.	1.6.6	3.7.3	While setting the rollers
6.4. Position of rollers in the same plane.	1.6.7	3.7.4	While setting the rollers
6.5. Dimensions of rollers, hardness and condition of operating surface.	1.6.8	3.7.5	100% rollers

(1)	(2)	(3)	(4)
6.6. Wear of working surface of rollers during running-in.	1.6.9	3.7.6	Prior to each running-in. Rollers may be replaced twice a month, but not later than, after 200 shafts.
6.7. Force on rollers.	1.6.10	3.7.7	During running-in.
7. Quality of surfaces of shank and intermediate sections after running-in.	1.7	3.8	100% shafts.

2.2. The metal supplied as melt of steel (para 1.2) shall be released for production, only if the certificate of the supplier plant and the positive results of incoming inspection of metal for its compliance to the requirements TY 14-1-1725-76, GOST 4543-71 and specifications are enclosed in the scope, agreed upon with the customer's representative.

2.2.1. Incoming inspection of the batch of metal for compliance to the chemical compound, mechanical properties and macrostructure are checked on the test pieces, cut from bars of uniform size of each melt.

2.2.2. On non-compliance of any of the parameters to the requirements of present specifications repeated tests are carried out on double quantity of test pieces, cut from other bars of the same batch and melt.

On obtaining satisfactory results of repeated check, the batch of bars of same size and melt is released for production.

If non-compliance to the specifications is confirmed, the batch of bars of said dimension and melt is rejected.

2.3. Thg batch of blanks after up setting the heads (para 1.3) is accepted if the result of check for the absence of overheating is satisfactory.

Shafts of same description and same melt are considered as a batch.

2.3.1. Samples, cut from the heads of the same shaft of each batch melt, subjected to heat treatment as per the technological process, are presented for checking the absence of overheating.

2.3.2. Tf the results are unsatisfactory, repeated tests are carried out on two other samples of shafts of the given batch-melt.

2.3.3. Tf the results of repeated check is unsatisfactory, the batch-melt is rejected and seperated from the accepted ones.

2.3.4. Heat No; quantity and shaft No. in the batch and results of check for the absence of overheating are recorded in the QID log book.

2.4. Upon heat treatment, the following are to be checked on each shaft;

2.4.1. Hardness of shaft. Area for testing hardness is shown in the drawings.

If the hardness is not complying with the requirements of drawing, repeated full heat treatment of shafts may be carried out as per the mode, stipulated by the cheif

metallurgists Department Number of temperings is not specified.

Results of checking the hardness of shafts are recorded in the QIP Log Book indicating the shaft No and heat No.

2.4.2. Deviation of shafts from straightness along the entire length of shank. Shafts, possessing deviation above what is specified by para 1.4.4, are to be subjected to straightening in press in cold or hot condition.

While straightening in hot condition, temperature for heating the shafts prior to straightening should not exceed 180°.

All the shafts after checking for straightness and straightening should be tempered in compliance with the technological process.

2.5. Technological inspection for the quality of heat treatment should be carried out periodically.

Periodicity of technological inspection should be agreed upon with the customer's representative and inspection should be carried out not later than once in a quarter.

2.5.1. Procedure and quantity of selection of shafts for periodic check is to be agreed upon with the customer's representative.

2.5.2. The scope of periodic technological inspection for the quality of heat treatment of shafts of each nomenclature consists of the following;

Inspection of chemical compound of steel; Inspection of surface hardness of shaft and of surface hardness along the section; Inspection of depth of decarburized layer on the test

test pieces, cut from the middle portion of shaft longitudinal to rolling.

2.5.3. Results of periodic tests are applicable to the batch of shafts, from the date of the proceding periodic test in compliance with GOST B-15.307-77.

2.5.4. During technological inspection if non-compliance for any of the parameters-being-checked to the requirements of present specifications is detected, repeated check is to be carried out on double quantity of shafts of the same charge.

On obtaining satisfactory results for repeated test, the batch of shafts shall be sent for further production.

On obtaining unsatisfactory results for repeated test, on the basis of the reasons for detected defects, measures are worked out for their elimination, and are agreed upon with the customer's representative and decision regarding the given batch is taken.

2.5.5. The necessity for changing the periodicity and scope of checking the quality of heat treatment is determined as per the results of periodic check and is agreed upon with the customer's representative.

2.6. The device for checking the absence of surface defects should correspond to GOST 21105-87.

Results of checking for the absence of surface defects are entered in QID Log Book indicating the shaft No.

2.7. Results of checking the finished shaft are considered satisfactory, if the shaft, the requirements of drawing and present specifications.

2.7.1. On obtaining unsatisfactory results and when it is impossible to rectify the defects, the saft is rejected and kept aside from the fit ones.

2.8. Periodicity for checking the technology of running-in of shank and intermediate sections (para 1.6).

2.8.1. Inspection of adherence to the technological process of running-in of shank and intermediate sections is carried out daily by the production foremen and QID personnel.

2.8.2. Inspection of size difference of rollers, set to the fixture, as well as their position in the fixture (para 1.6.6, 1.6.7) are checked while setting the rollers.

2.8.3. Inspection of the condition of working surface of rollers (para 1.6.9) is carried out before each running-in.

Instead of checking the width of belt, rollers may be replaced twice a month, but not less than, after running-in of 200 shafts.

Results of checking the rollers are entered in the Log Book and certificate for rollers.

2.8.4. Effort on rollers (para 1.6.10) is checked during running-in as per the rading of manometer in the hydraulic system of the machine.

3. METHODS OF CHECK

3.1. Checking of dimensions of shafts (para 1.1) for compliance to the requirements of drawing is to be done with the measuring devices, ensuring the required accuracy in the Design Documents.

3.2. Checking of chemical compound, mechanical properties and macrostructure of steel during incoming inspection (para 1.2) is carried out in compliance with the requirements TY 14-1-1725-76 and GOST 4543-71.

Quantity, sizes of test pieces and scope of carrying out the incoming inspection should be fixed upon agreement with the customer's representative.

3.2.1. Checking for the absence of crazes is carried out on the samples, obtained by step turning. Length of each of the three steps should not be less than 50 mm.

Sizes of steps are given in Table 3.

Table 3

Diameter of bar	Diameter of steps, mm		
	I	II	III
56	47	45	43
58	54	52	48
68	64	60	56

3.3. Inspection for the absence of overheating (para 1.3) is carried out as per the shape of break of test pieces by comparing with the standard test piece. In this case presence of stone-like and naphthalenised break is not allowed.

The scale for checking the absence of overheating is to be agreed upon with the customer's representative. The standard test piece is approved as per GOST B15-307-77.

3.4. While checking the shafts after heat treatment, the following are checked;

3.4.1. Hardness para 1.4.1. as per GOST 9012-59.

3.4.2. Deviation of shafts from straightness para 1.4.4 with indicator as per GOST 577-68.

3.5. During technological inspection of quality of heat treatment of shafts the following are checked .

3.5.1. Chemical compound of steel as per GOST 4543-71.

3.5.2. Hardness as per GOST 9012-59.

3.5.3. Depth of decarburized layer para 1.4.3 as per GOST 1763-68.

3.5.4. Mechanical properties during stretching (para 1.4.2) as per GOST 1497-84 on the samples, cut from the shaft in compliance with GOST 7564-73 (appendix 2, fig 2), and impact strength on test pieces of type 1 as per GOST 9454-78.

3.6. While checking the quality of surface of shafts after grinding the following are checked;

3.6.1. Smoothness of transition of shank of shaft to the head (pafa 1.5.1) with a gauge.

3.6.2. Absence of grinding burns on the surface of shaft (para 1.5.2) visually. Etching is not allowed.

3.6.3. Absence of surface defects (para 1.5.4) as per GOST 21105-87. Presence of marks and nicks - visually.

3.7. Checking the quality of running-in of shank and intermediate sections:

3.7.1. Checking of requirements of paras 1.6.1.-1.6.4 is ensured by adhering to the technological process for running-in.

3.7.2. Tolerance for sequareness of rollers to the surface being run-in (para 1.6.5) is checked during certification of the fixture for running- in.

3.7.3. Difference of outer diameters of rollers, set to the fixture (para 1.6.6) is determined by universal measurement means.

3.7.4. Position of rollers in the same plane (para 1.6.7) is checked as per the diagram; given in Appendix 1.

3.7.5. Dimensions of rollers, hardness and condition of their working surface (para 1.6.8) are checked by checking the accompanying documents for rollers (certificates).

3.7.6. Condition of working surface of rollers during running-in (para 1.6.9) is checked by visual inspection.

3.7.7. Force of running-in (para 1.6.10) is evaluated as per the reading of manometer of accuracy class not less than 1 GOST 8625-77. Value of pressure is specified in the technological process.

3.8. Quality of surface of shank and intermediate sections after running-in (para 1.7) is checked by visual inspection and by compresion with the standard test piece of shaft, approved as per GOST B.15.307-77.

4. MARKING, TRANSPORTATION AND STORAGE

4.1. Marking.

4.1.1. The finished shaft should have the following marking on the face of head consisting of the following;

Heat NO;

Serial No. of shaft

Marking is done by punch marking with type ∏ 0-5 GOST 2930-62.

4.1.2. While up setting the head of shaft, apply the Heat No., corresponding to the marking of metal to the face of head.

4.1.3. Upon machining, apply heat No. to the face of any head.

4.1.4. Prior to heat treatment, apply serial No. of shaft to the face of any head.

4.2. TRANSPORTATION

4.2.1. Shafts may be transported by any means of transport, in a container, protecting from mechanical damages and direct full of sunlight on the shafts.

4.3. STORAGE

4.3.1. Shafts are stored in a dry room on special racks with non-metalic covers.

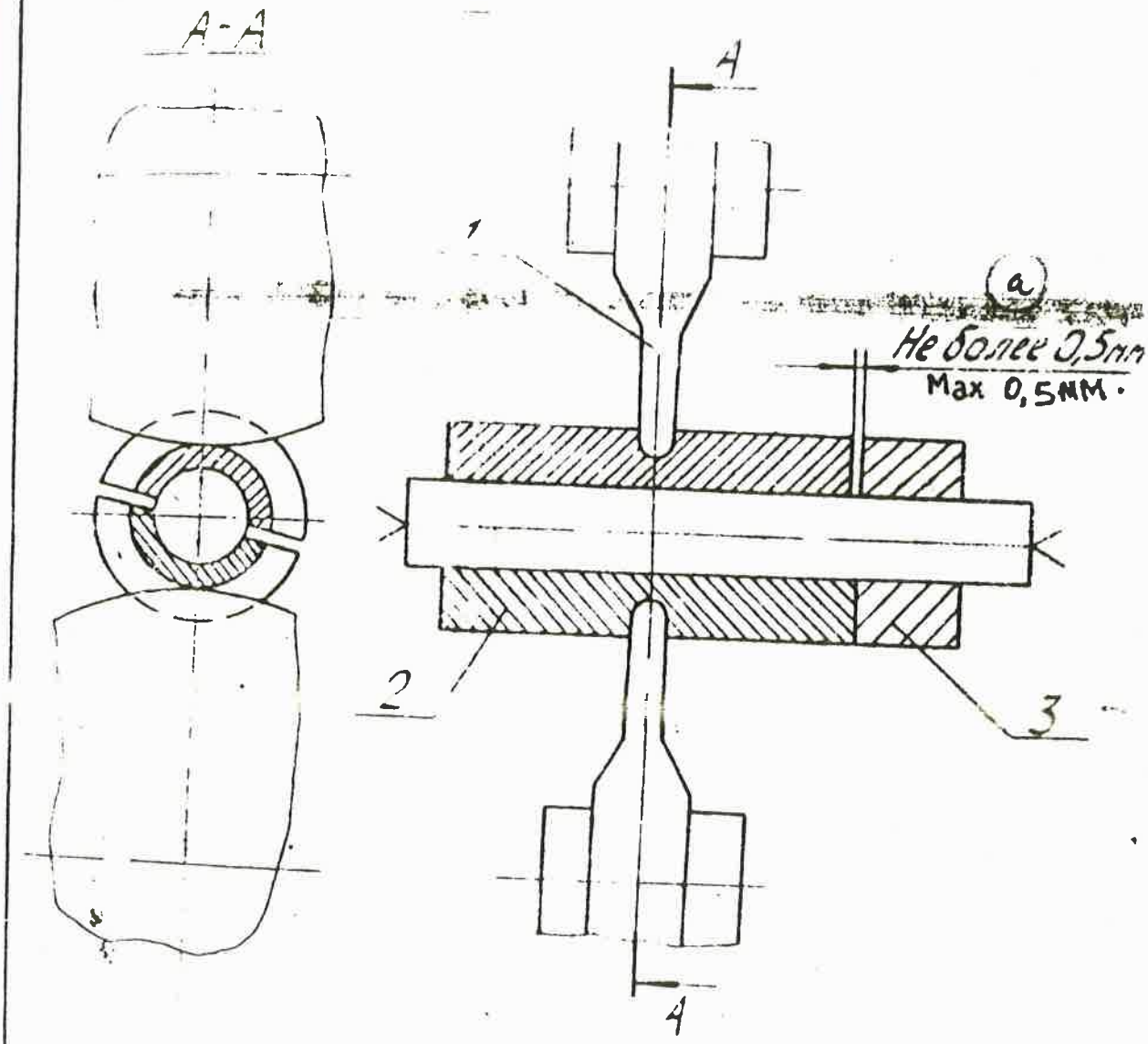
4.3.2. Storage, conservation and packing of shafts, used as spares, is done as per OST B3-9-008-82.

5. GUARANTEE

The manufacturer guarantees compliance of shafts to the requirements of design documents and their operation capacity within the limits of guarantee period of the Article from the date of mounting to the Tank.

Appendix 1

Diagram for checking the position of rollers in one plain.



Rollers 1 are brought upto contact with the slotted bush 2. Ring 3 is brought upto contact with slotted bush of fixture 2.

In this case, shift of movable parts of bush relative to the ring may not exceed 0.5 mm.

List of reference documents

Designation of GOST, OST, TY.	Sheet Nos. in which reference is made	Remarks
GOST 577-68	~~19~~	
GOST 1497-84	~~20~~	
GOST 1763-68	~~19~~	
GOST 4543-71	~~3, 12, 18, 19~~	
GOST 7564-73	~~20~~	
GOST 8625-77	~~21~~	
GOST 9012-59	~~19~~	
GOST 9454-78	~~20~~	
GOST 21105-87	~~16, 20~~	
GOST 2930-62	~~22~~	
GOST B15,307-77	~~15~~, ~~19~~, ~~21~~	
OST B3-9,008-82	~~23~~	
TY 14-1-1725-76	~~3~~, ~~12~~, ~~18~~.	

RECORD SHEET FOR AMENDMENTS

Issue	Sheet Nos. (pages) Amended.	Replaced	New	Total sheets (pages) in the Document	Document No.	Accompanying Document and date.	Signature.	Date
18		26		26	172M.599."A-89" (In original copy)			8 12.8