1.1 Units of measurement

1.5.1 Information in the standard АPI 5CТ is given according to the International system (Si-system) as well as according to the 115C system of units used in the USA. During the preparation of an order, it is assumed that there is only one system of units in use without the simultaneous expression of data in the other system.

The products are manufactured according to the specifications expressed in one of these systems of units and are considered equivalent and completely interchangeable. Therefore, compliance with the requirements of this International Standard, expressed in the units of one system, ensures compliance with the requirements expressed in another system.

1.5.2 The standard API 51\_ uses the units of measurements of the Si-system as well as standard American units of measurement. Only one system of measurement must be used in respect of a separate order, unless otherwise stipulated, regardless of the other.

For the data expressed in the Si-system units, the comma is used as a decimal separator in decimal fractions and the space is used to separate thousands. For the data expressed in ordinary American units, the dot (in a line) is used as a decimal separator; the space is used to separate thousands.

**2 Requirements for finished pipes**

2.1 Requirements for the finished pipes on key parameters (outer diameter, wall thickness, weight, angle of flexure) are shown in Table 2.1. Minimum and maximum values ​of the outer diameter and wall thickness of pipes according to Standards API 51\_, API 5CT, AZTM A106/A106M, AZTM A53/A53M are shown in Tables 1, 2, 3 and 4 of Annex C. Limits of​ angles of flexure (depending on the length of pipes) according to Standards API 51\_ 5CT and API are shown in Table 5 of Appendix C.

In accordance with the requirements of Standard API 5CT the sizes of coupling blanks, including the tolerable limits of the diameter and wall thickness and straightness requirements for pipe coupling blanks shall be agreed upon during the process of ordering between the customer and the manufacturer.

2.2 Length of pipes

2.2.1 according to Standard АРI 5CT

Tubes are supplied in lengths given in Table 2.2

\* The deviation for a carload is not applicable for orders less than a carload consignment weighing 18,144 kg. For any carload weighing 18,144 kg or more, shipped to the final destination without reloading or unloading of the car, the deviation must apply to each car. For any order, consisting of a carload weighing 18,144 kg or more and shipped by rail not to the final destination, the carload deviation should be extended to the entire order, but not on individual carloads.

\*\* Upon the agreement of the customer with the manufacturer a full range of lengths of tubing for range 1 can be 6.10 m - 8.53 m.

\*\*\* Upon the agreement of the customer with the manufacturer the maximum length can be increased up to 13.72 m.

Sweeping-up of casing pipes made in accordance with the requirements of Standard API 5CT must be carried out in accordance with the requirements of TI-NTZ Tr4-07-2007 (or instructions published to replace it) and MI-NTZ-IL-63-2007 (or techniques published to replace it).

2.2.2 According to Standard АРI 51

If the customer does not indicate the random length of the supplied pipes, it must be within the limits specified in Table 2.3. Approximate length must be within the limit of ± 500 mm (20 inches).

**2.2.3 According to Standard AZTM A106/A106M.**

Length of pipes is specified in the order. The following pipes can be ordered:

- single random length - from 4.8 m to 6.7 m (16 \* 22 feet) including up to 5% with the length of

3.7 + 4.8 m (12 - 16 feet).

- double random length - a minimum of 6.7 m (22 feet), minimum average

10.7 m (35 feet), including up to 5% with the length of 4.8 -4- 6.7 m (16 + 22 feet).

2.2.4 According to Standard AZTM A53/A53M, unless otherwise specified in the order:

for the pipes with the weight lower than ultraheavy - from 4.88m to 6.71m (16-22 feet), including up to 5% of the pipes can have a length of 3.66m to 4.88m (12 + 16 feet);

for ultraheavy and heavier pipes - from 3.66 m to 6.71 m (12 +22 feet), including up to 5% of the pipes can be supplied in lengths from 1.83 m to 3.66 m (6 + 12 feet);

-for ultraheavy and lighter pipes, ordered with double random length - the length should not be less than 6.71 m (22 feet) with a minimum average length of pipe in the order of 10.67m (35 feet).

When the required length of pipes is greater than single random length with wall thickness greater than that of heavy-duty pipes it must be specified in the order.

2.2.5 Conversion table for pipe length from the American System of Units (feet) to the metric (meter) is given in Appendix D.

2.3 Requirements to pipe surface.

2.3.1

According to Standard of API 5CT all pipes must be free of defects listed below:

4

- any hardening flaws and layerings (rolling skins);

- any defect on the surface, which reduces the actual wall thickness and it is less than 87.5% of the predetermined wall thickness;

- when non-destructive testing (except visual) is set out according to Standard API 5CT or it id specified in this Purchase Agreement any discovered defect that does not destroy the surface which, when its contour is viewed on the outer surface has an area of more than 260 mm2 (0.40 inches2);

- any linear defect in the outer or inner surface, of any orientation, with a depth greater than specified in Table 2.4.

All pipe coupling blanks shall be without any hardening flaws. All pipe coupling blanks must be free of (or have pronounced) defects on the outer surface with a depth of more than 5% caused during manufacture of the wall thickness, or which decreases outer diameter or wall thickness to a value which is lower than the specified tolerable deviation. In addition, the requirements laid down for the pipes above in this paragraph must be applied.

The maximum allowable depth of linear defects - Table 2.4.

|  |  |  |
| --- | --- | --- |
| Class | Depth as a percentage of the nominal wall thickness | |
| Outer | Inner |
| H40 - 355 - K55 - M65 - N80 type 1- N800 1.80 - C95 - P110 of pipes made without the requirements of carrying out of the Charpy impact test in accordance with Section A. 10 (ZR16) of Standard API 5CT | 12,5% | 12,5% |
| S90 - Т95 — R110 — 0125 | 5% | 5% |
| P110 pipes are made without the requirements of the Charpy impact test under Section A. 10 (ZR16), but with the additional requirement A. 10 (ZR2) of Standard AЗШ 5СT | 5% | 5% |

Note: Linear defect: defect includes (but is not limited to) check cracks, riffles, cracks, tearings, undercuts and dents.

Nonlinear defect: defect, which includes (but not limited to) cavities and dents with round bottom.

2.3.2 According to Standard API 51 the following defects are not allowed on the surface of pipes:

- any cracks, leaks, liquations, layerings.

Layerings or long impurities in pipe ends or slants, the circular length of which can be visually determined and are >6.4 mm (0.250 inches), are classified as defects.

Geometric deviations from the standard geometric pipe contour arising due to technological operations with depth of more than 3.2 mm (0.125 inches), measured as the gap between the extreme end of deviation and the length of the standard pipe circuit, are regarded as defects.

Dents with a size in any direction of ^0.50 are allowed, and the depth is measured as the gap between the extreme point of the dent and the length of the standard contour of the pipe shall not exceed:

a) 3.2 mm (0.125 inches) for acute chamfer nicks formed in the cold state,

b) 6.4 mm (0.250 inches) for other dints

Any solid inclusions larger than 50 mm (2.0 inches) in any direction are classified as defects if its hardness exceeds 35 HPC, 345 NYU or 327 IVUCH on the dent.

Other visually detected surface defects should be investigated and are classified and examined as follows:

a) defects with depth of <0.125 3 and not reaching minimal tolerable wall thickness are classified as tolerable,

b) defects with a depth of ^0,125 3 and not reaching the minimal tolerable wall thickness are classified as defects and are removed through bright scraping,

c) discrepancies that exceed the minimal tolerable wall thickness are classified as defects.

All correctable defects on the surface should be removed through bright scraping. Bright scraping should be carried out so that the corrected the area blends smoothly with the contour of the pipe.

2.3.3 According to the standard AZTM A106/A106M the following defects are not allowed on the surface of the pipes:

- any defects with a depth of more than 12.5% of the nominal wall thickness (measured from the surface of the pipe) or making the wall thickness intolerable;

- any cracks and layerings (rolling skins).

The following defects must be removed by grinding:

- Mechanical marks and gallings (cable traces, delaminations, guide marks, rolled marks, scratches, cavities, etc.) deeper than 1.6 mm;

- defects visible to the naked eye (such as slivers, check cracks, folds, tearings, etc.), which have a depth exceeding 5% of the nominal wall thickness.

2.3.4According to the standard AZTM A53/A53M the following defects are not allowed on the surface of the pipes:

- any defects with a depth of more than 12.5% of the nominal wall thickness (measured from the surface of the tube) and making wall thickness intolerable.

- any cracks and layerings (rolling skins).

Defects can be removed by grinding while maintaining tolerable wall thickness. The pipe should not have dints comprising more than 10% of the diameter of the pipe or 6.0 mm. Whichever is less.

2.4 Packing.

At the request of the consumer, tube ends are packed with breaking pieces (caps). Material and geometric parameters of the breaking pieces are specified in the order.

Subject to an agreement, the pipe is supplied with a temporary coating for protection against corrosion during storage and transportation.

For pipes with threaded ends with d ^ 60.3 mm (2.375 inches) thread protectors should have the design, material and mechanical strength that protect the thread and pipe end from damage during loading and transportation.

Material of the protective cover should not contain compounds that cause corrosion and promote adhesion of threaded protective cover. It also must be suitable for use at temperatures from -45 °C to + 65 °C

2.5 Chemical composition and mechanical properties.

Requirements for chemical composition and mechanical properties of pipes are given in MS NTZ-03-2008 and TI NTZ-12-2008 (or in the grade guide and instructions issued to replace them).

2.6.Requirements to tube ends according to АРI 51 standard.

- mechanisms of rolls rotation in the horizontal plane;

- mechanisms for raising and lowering of upper yokes;

- mechanisms for raising and lowering of lower yokes;

- entry guides;

- lubrication systems;

- indication and control equipment.

Upper and lower yokes with leveler rolls move on each pairs of columns. End pairs of rolls are power-driven. The middle pair is idle. Grinding effort is cased due to the change of the gauge of middle rolls in relation to end rolls and pipe bend during double rolling movement through the gauges.

3.1.2 Specifications of the leveling machines 6x1500 and 6x2000 are shown in Table 3.1.

3.1 Calibration of leveling machines

3.2.1 Depending on the size of the leveled pipes the calibration of the leveling machines is carried out with the first pipe of appropriate size.

3.2.2 The pipe is delivered into the machine by opening the entry roller table of the front lifting table onto the first lower roll (roll No. 4). Up to this point all the top rolls have to be raised on a height sufficient for free passage of the tube between the rollers.

3.2.3 After the pipe is delivered on the roll No.4, the roll No. 1 (first top) must be lowered to come in contact with the pipe in order to allow the passage of the pipe in the machine.

3.2.4 The machine must be stopped and calibrated at the moment of the release of the front end of the tube from the machine:

- lower the 2nd (middle) upper and the third upper rolls until they come in contact with the pipe;

- with the help of the 2nd and the 5th (lower middle) rolls set the desired bend in accordance with Table 3.2, the deviation value is set according to the scale given on the cassette of the lower roll;

- swivel all the rolls so that the moving line of the roll comes in full contact with the pipe.

3.2.5 Turn on the machine and at underspeed to release the pipe.

3.2.6 During the correction of subsequent pipes, a final adjustment of the machine is carried out to provide a complete adjoining of rolls with the moving line of the pipe and the lack of a spiral dent on the tube.

Correctness of the calibration of the straightener (with TCD) is determined by measuring the outer diameter of the first three tubes of the melt using adjustable external gauge and the angle of flexure using a testing straight edge and a set of gap gauges (on the rack of initial examination)

3.2.7 The axis tilt angle changes depending on the tube diameter is set approximately by Table 3.3.

The value of rotation is set by the dial scale on the roll cassette.

3.2 Proper calibration of the proper machine ensures pipe manufacturing with an angle of flexure within tolerable limits according to the standards (see. Tab. 2.1), as well as the highest wear resistance of the rolls. .Improper setting of the rolls causes uneven opening, which contributes to the formation of spiral dents on the tubes.

3.3 Uniform opening of rolls is caused during operation and calibration of the machine in accordance with this instruction. Control over the opening of rolls is performed by the calibrator of the plant at least once a month in the presence of a chief foreman of rolling with the use of templates (made in accordance with the standards T4-SH-4-82 and 4-SH-5-82) and a ruler (GOST 427 -75). The test results are recorded in the log of monitored parameters (Appendix E).

With uniform wear the permissible opening of rolls on the diameter at the neck should not exceed 20 mm, control measurements are made with the use of a caliper and a metal ruler.

3.4 Entry guide should match the diameter of the pipes subjected to correction:

diameter of the filler 250mm for pipes with an outer diameter of 168-I94 mm;

diameter of the filler 300mm for pipes with an outer diameter of 219n-245 mm;

diameter of the filler 500mm for pipes with an outer diameter of 273^-377 mm.

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NOTES: 1. Correction of pipes must be carried out at minimal table displacement values. In case of insufficient levelling of the curvature it is allowed to increase the displacement value, but within the value indicated in the table.

2\* To be used upon the direction of the Chief foreman of rolling.

Table 3.3.

It is prohibited to work with fillers that do not match the diameter of the levelled pipes.

3.5. It is prohibited to deliver pipes into levelling machines with an angle of flexure exceeding 10 mm per meter and overall angle of flexure exceeding 150 mm as well as pipes with frayed ends and large "whiskers". Measurement of the angle of flexure of the pipes is carried out visually by the leveler and in case of arbitrage situations angle of flexure measurement is performed with the use of a testing straight edge and a set of gap gauges, total angle of flexure is measured with a string and a ruler.

3.6. Incorrect calibration of the rolling mill leads to production of faulty pipes: dents, spiral marks, deviation of diameter etc.

3.8. In case of damaged pipes the machine must be stopped, the rolls and entry guides must be examined, the levelling machine must be adjusted and the quality of correction on the first corrected pipe must be examined.

3.9 During the correction it is prohibited to adjust the position of upper yokes.

3.10 After the correction the pipes are delivered to the machine for scale blowing and then to the racks of initial inspection.

3.11 Leveler makes a mark of the end of melt according to the information on the sizing mill on the last tube of the melt.

**4 Initial inspection and cutting of pipes and coupling blanks after correction**

4.1. General requirements.

4.1.1 Pipes are delivered to the racks of initial inspection on the melt-by-melt basis. Pipe leveler is responsible for separation marking (chalk spiral line on the front end of the last pipe of the melt). Before the inspection of a new melt the TCD inspector must make sure the separation marking is correct according to the marking on the pipe (marking is carried out after the sizing). The roller of the sizing mill is responsible for the quality of marking (No. of melt. wall thickness). Unclear marking is restored on the direction of the Chief foreman of rolling (refer to foremen) manually by a member of the personnel on the racks of initial inspection. To avoid the formation of dents it is allowed to produce pipes without hot stamping but with a clear marking of the melt number.

4.1.2 The temperature of the pipes delivered for initial inspection must be minimal to ensure safe working conditions (approximately 50 ±10 °С).

4.1.3 Scale must be removed from the interior of the pipes. The chief foreman, the shift foreman (job foreman) of the finishing floor of flat pipes and the console operator are responsible for proper operation of the machine for scale blowing. In case of improper performance of the machine for scale blowing the chief TCD inspector in the production of ferrous metals has a right to stop the reception of pipes. After the measures to address the causes of improper operation of the machine are taken, the pipes from which the scale was not removed are delivered for repeat scale blowing.

4.1.4 TCD inspectors in the production of ferrous metals and shop inspectors of initial inspection must immediately inform shift rolling and TCD floor foremen in case of discovery of defects of rolling origin on pipes or deviations of geometrical dimensions from regulatory documents to take measures to prevent these defects. Faulty pipes are marked with three stripes with white paint on the distance of 1-2 meters from the end of the pipe. Pipes are stored in designated hold area.

4.2. Initial inspection and cutting of pipes.

4.2.1 Inspection of pipes is carried out with the following goal:

- inspection of geometrical dimensions and quality of pipe surface on compliance with standards;

- sampling for production of pieces for conducting inspection of pipes on compliance with standards;

- grading of pipes;

- meeting the requirements of further processing of pipes (marking of shearings, lengthwise cutting and repair).

4.2.2. TCD inspectors inspect the outer diameter, wall thickness, length, angle of flexure, surface quality and depth of defects. Requirements for the finished pipes are given in section 2 of this TD. Inspection of geometrical dimensions of pipes is carried out according to the requirements of MI NTZ-IL-07-2007, MI NTZ-IL-87-2005 (or procedures issued to replace them).

4.2.3 The pipes are inspected on the outer diameter by the barrel and the ends. Inspection of the pipes diameter by the barrel is carried out in the middle part and from the two ends at the distance of 500 mm from each end with the adjustable external gauge (GOST 2216-84) circularly in each of the markings. The inspection is performed by the TCD inspector in the production of ferrous metals of the initial inspection floor beginning with the first pipe of the melt delivered on the racks for checking and inspection.

The pipes with outer diameter of the barrel lower than the minimal tolerable limit according to the technical documentation (TD) are considered faulty or transferred to other orders (if available).

The pipes with the outer diameter on the barrel greater that the maximum tolerable limit according to the technical documentation are marked by the inspector with "p/m" or "D+". These pipes are subject to repeat calibration and correction after preheating depending on the chosen route: on the five-stand sizing mill of the heat-treatment bay (in case of introduction into service), leveling machine RVK 1600x3 on the twelve- or five-stand sizing mill of the rolling floor.

The pipe ends with outer diameter outside the established limits are marked by the inspector "m/m" or "D-" on the usable part of the pipe.

These pipes are either subjected to calibration on sizing presses or on recovery are transferred on other orders (if available).

4.2.4 The pipes which have the wall thickness outside the established limits are marked with chalk "3+" or "8-" on the usable part of the pipe from side of the end with the defect. The length of shearing is determined by measuring the wall thickness with indicating pipe wall thickness gauge (GOST 11358-89). If the area with deviation in wall thickness is larger than the capacity of the thickness gauge the length of shearing is determined with a portable ultrasonic thickness gauge.

The final grading of such pipes is performed of the recovery floor after cutting of the ends.

4.2.5 TCD inspector in the production of ferrous metals inspects the overall curvature of pipes along the length and end areas.

The overall curvature is determined randomly with a stretched string on the side of the pipe. The distance from the string to the pipe surface measured with a ruler should not exceed the values given in Table 5 of the Annex C.

The curvature of pipe ends is inspected according to API 5CT is inspected with the use of a straight ruler with the length of over 1.5 m. and a set of gap gauges. Moreover the maximum gap between the ruler and the surface of a pipe must not exceed 3.18 mm. The end curvature according to API 51\_ must not exceed 4 mm/1000 mm of length.

4.2.6 In case of delivery on racks of pipes with high overall curvature TCD inspectors in the production of ferrous metals notify the straightener and the mill roller of the sizing mill of the fifth category (refer to rolling foremen) to correct the calibration of the levelling machine and the sizing mill. Such pipes are marked "curved" and are send on repeat correction.

4.2.7 If the bend of the front ends of the casing tubes on the length of 1 m exceeds 3 mm the TCD inspector in the production of ferrous metals informs the foreman of hot finishing, TCD and rolling foremen on the improper state of the rolling products.

Depending on the bend of the front ends the TCD inspector in the production of ferrous metals marks the amount of end shearing which allows to achieve the tolerable end curvature:

- if the end curvature amounts to 1.3 mm only process shearing is marked (up to 50 mm);

if the end curvature amounts to

1.5 mm-100 mm

2.0 mm- 200 mm

2.5 mm- 280 mm

3.0 mm- 340 mm

3.5 mm- 400 mm

4.2.8 Visual examination of the pipe surface is performed to subsist defects according to the requirements of the standard MI 243-128-02 (or standard issued to replace it).

Defects are classified according to "Defects classification album".

4.2.9 Areas of pipes with surface defects the depth of which causes the wall thickness to exceed the negative tolerance, are marked with an indication of the type of defect. During the cutting of pipe ends on 9K157 machines the areas of pipes with such defects are cut.

S.V. Besednov REVIEWED BY: SIGNATURE:

Date SIGNATURE

Deputy chief engineer of pipe manufacture

Copy No.

TI NTZ-Тr4-33-2008 Page 19 Total: 84

4.2.10 Defects with undefined depth are hacked by the shop inspector with a chisel and the TCD inspector measures the depth of defects with a depth meter. Pipes with defects with depth within the minimal limit of the wall thickness are directed by the TCD inspector for repair.

4.2.11 Repair of defects of the outer surface of the pipes is carried out with the use of grinders by bright scraping with abrasive disks. Bright scraping must be round. The defect must be removed by bright scraping so that the grinded surface becomes even with the finished pipe surface. The defect that is completely removed must be inspected and the wall thickness in the grinded area must conform to the standards taking into account the negative tolerance.

Repaired pipes are presented to the TCD to determine their conformity with the standard (order) and grading. After repairing, the wall thickness is measured with a portable ultrasonic thickness gauge according to TI NTZ-NK-19-2006 (or the instruction issued to replace it). The place of repair works is determined depending on the production capabilities.

4.2.12The length of shearing of seed ends and pilger heads that were not completely removed is determined after measuring the wall thickness along the length limited by the capacities of measuring facilities. The pipes actual length of which does not conform to the requirements of para. 2.2 of this TD is directed for further processing.

4.2.13 The pipes intended for measured cutting with the length of 5-6 meters must be marked by TCD inspectors in the production of ferrous metals according to the schemes provided in Fig. 5.1 and 5.2 and marked with paint on both ends according to the requirements to the technical marking (refer to para. 4.3)

4.2.14 If the pipe has no defects the end shearing must be less than 50 mm. TCD inspector in the production of ferrous metals is responsible for proper marking of the pipes and their grading.

4.2.15 TCD inspector in the production of ferrous metals performs the pipe marking for cutouts and production of pieces for pipe inspections according to TI NTZ-12-2008 (or instructions issued to replace it).

4.3 Process marking of pipes.

4.3.1 All the pipes that went through initial inspection receive intrashop marking. Lacquer of BT-577 grade (GOST 5631-79) is used for marking.

4.3.2 Pipe marking must include: melt number, strength group (steel quality), wall thickness and the consecutive number of the pipe made with nitrocellulose enamel (according to the pipe numbering book). E.g.:256 K 55 10.03.

4.3.3 Pipes subject to final rejection receive additional marking in the form of three cross stripes with indelible paint or the word "Rejected" with quick lime. Pipe ends can be marked with reed paint (according to I NTZ-S-39-2006 or the one issued to replace it). The pipes that do not conform to the requirements of the normative documentation (standard, order) are marked by the TCD inspector with chalk stating the reason of rejection.

4.3.4 The pipes marked with three cross stripes or with the word "Rejected" are directed to the designated hold area.

4.3.5 Shop and TCD inspectors are responsible for the quality of marking.

4.4 After the inspection, localization of faults and cutting of pipes, TCD inspectors fill out the report according to the established form (Annex H) which includes the quantity of pipes, faults, shearing waste and pipe repair with the indication of defects that caused the loss of grading or metal as well as the open-ended report of the 1S form (Annex A).

4.5. Separation of pipes (proper, rejected, repair) is performed by the shop inspector.

A buffer pipe must always stay before the dosing unit for discharge of pipes on the racks in order to maintain safety.

It is prohibited for the persons whose functions are not associated with initial inspection of pipes to be in the rack area on the side of the rolling of the pipes from the dosing unit.

4.6.The pipes intended for further processing are sent melt-by-melt accompanied with the open-ended report to the cutting floor where the cutting in lengths, cutting of ends and faulty areas as well as cutting out of pieces for inspection tests.

Chief TCD inspector in the production of ferrous metals is responsible for melt-by-melt marking during the initial inspection.

**5 Mechanical processing of pipe ends, cutout of pieces and cutting of pipes in specified length on the machines of 9K157 model**

5.1 General provisions

5.1.1 Cutting of ends, cutting of pipes and cutout of pieces is performed according to the markings of the TCD inspector of initial inspection on pipe-cropping machines of 9K157 model or on the machines equipped with air plasma burners and chisels.

5.1.2 Specifications summary of the machine:

- range of the processed pipe diameters, mm - 140+ 426;

- pipe wall thickness, mm - 4.5+77;

- height of the spindle axis above the support, mm - 1100

- maximum collet action along the diameter from the nominal pipe size (automated), mm – 25

- number of spindle speed rates – 12

- maximum spindle rotation speed, RPM 143-113

- spindle hole diameter (without sleeve), mm 492

9 Availability for service of the plasma burner is checked from the control panel without sending the pipes to the chuck jaws (availability of the pilot arc).

5.2.10 In case of leakage of the cooling water from the plasma burner the cutting is halted and the shearer replaces the cutting block of the plasma burner.

5.2.101Replacement of the cutting block with the cathode and the nose piece of performed in the following order:

- disconnect the power supply of the plasma burner;

- turn off the high-voltage wire of the pilot arc for what one-pin plug out of the hole in the casing of the cutting block ;

- disable the supply of air and cooling water;

- unscrew the acorn nut with a key and remove the cutting block of the plasma burner from its stationary piece fixed on the machine's support.

5.2.13 Installation of the cutting block of the plasma burner calibrated by the setup technician in the shop must be performed in reverse sequence.

5.2.13 Axis of inclination of the plasma burner to the plane of the pipe end (hereinafter referred to as "plasma burner tilt") to the total assortment of processed pipes varies from 0 to 40 °.

5.2.14 Plasma burner tilt for all sizes of casing pipes without chamfers amounts to 0+10°.

5.2.15 Technological process of pipe cutting of the 9K157 machines remodeled for plasma arc cutting is carried out in a single pass.

5.2.16 During the plasma arc cutting of pipes the following requirements must be met:

- after the delivery and clamping of the pipe in the jaws the distance from the outer cut of the plasma burner to the surface of the cut pipe must be within 10+15 mm.

- plasma arc cutting should be initiated only after turning on the pipe rotary actuator. If this requirement is not met there is a possibility of abridgement in the nosepiece-pipe area which may cause a breakdown of the nosepiece of the plasma cutter.

- to preclude the burning of the casing pipes' ends during the plasma arc cutting of the ends and additional thermal treatment the pipe end is heated with a gas-oxygen burner and depending on the pipe wall thickness the end is heated with a burner: in 2 - 3 passes - if the pipe wall thickness is between 8 - 10 mm and in 3-4 passes is the pipe wall thickness is between 10.1 and 14 mm which on such speed allows to remove the burnt layer and only after this the pipe is removed from the machine.

If the heating of pipe ends of the strength groups N40, 355 и K55 is not performed, this fact is registered in the open-ended report.

5.2.17 Plasma arc cutting is carried out in the following modes: arc current, А - 260 +280 arc voltage, V - 160 + 180

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No.

TI NTZ-Tr4-33-2008 Page 23 Total:

plasma arc cutting of pipes speed, m/min:

- for the wall 6.0 - 10.0 mm - 3.0 - 3.2

- for the wall 10.1-^24.0 mm - 1.0 - 2.2

5.2.18Tuning cutting is performed before the initiation of pipe cutting. The pipe is delivered by the machine operator into the pre-calibrated machine according to para. 5.2.16 and 5.2.17 and test cutting of the pipe is performed on the rejected area to test the calibration parameters.

Correction of geometrical dimensions of the end pipe shearing and the jaws of the plasma arc cutting is performed if necessary.

5.2.19 Operating staff of the plasma arc cutting machines must strictly adhere to the safe operation regulations stipulated in the documentation.

5.2. Mechanical processing of the pipe ends on the pipe-cutting machines of the 9K157 model.

5.3.1 Pipe-cutting machines of the 9K157 model is intended for cutting of pipe ends.

5.3.2 The machine operates according to the principle of rotation of the processed pipe. The pipes are fixed on the spring chuck of the machine. Cutting is performed simultaneously with two parting tools (cutting with one parting toll is allowed).

5.3.3 Quality of pipe ends must conform to the requirements of para. 2.6.

5.3.4 Pipe shearer carries out the inspection of proper chamfer processing and circular dulling on the first processed pipe, on every 10-th pipe and after the replacement of the parting tool, as well as after the change of melt and pipe size. Chamfer angle is inspected with an angle finder (GOST 5378) and template NKL-2-97, the end dulling (1.6+0.8 mm) - with a template according to MI NTZ-IL-07-2007 or the one issued to replace it.

Perpendicular alignment of the end and the pipe axis (deviation from the sharp angle) is maintained by the cutting instrument. The value of deviation from the sharp angle is inspected by the shearer during the calibration of the machine with a square elbow (GOST 3789) or an end sharpness control template and a set of gap gauges (TU2-034-0221197-011-91) according to MI NTZ-IL-07-2007 or MI NTZ-IL-87-2005 (or operations issues to replace them)

During the process of pipe inner bore the shearer carries out the inspection of the angle of the inner female cone with an angle finder similarly to the control of the outer chamfer angle inspection.

Inspection results are registered by the shearer in the "Journal of the testing parameters" (Annex I)

5.3.5 Machine calibration.

5.3.5.1 Machine operator performs the machine calibration before work for the processed diameter of pipes with a corresponding set of sponges in the holder. Then in is necessary to:

- fix the cutting tools in the cutter support,

- calibrate the machine on the cutting mode;

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- send the pipe on rolls, to the machine spindle and fix the processed end in the spring chuck.

5.3.5.2 The pipe is set for the end cutting according to the TCD inspector's mark on the pipe. During the cutting the TCD mark must stay on the pipe. If there is not TCD mark on the pipe the size of shearing must be as small as possible

**5 НОЙ.**

5.3.6 Operation procedure.

5.3.6.1 Turn on the advance of cut-off rests, cut the end of the pipe and remove the outer chamfer. Removal of the outer chamfer is performed during the pipe end cutting and is simultaneous with the cutting procedure.

5.3.5.2 Remove the inner chamfer and burrs with a folding cutter support.

5.3.5.3 Release the pipes from the machine and send them on the rack.

5.3.7 Cutting modes are given in table 5.1.

5.3.8 Processing of pipe ends on 9K157 machine is performed with cutters using the metal-cutting oil (MCO) 4-5-7% solution of SVK Emulsol of the C grade prepared according to TI NTZ-28-2008 or the instruction issued to replace it is used as MCO. It is permitted to use other MCO equal in the intended functions.

5.3.9 During the pipe end cutting the following cutting instruments are used:

- parting tool 8x32x250 (blueprint A15-OP-U1), tool material - high-speed steel R18, R6M5;

- chamfering tool 20x25x160 (blueprint 084а), tool material high-speed steel R6M5.

Worked-out parting tool fixed on a special support is used for burr removal.

During the fixation of the front and back cutting tools their tolerable shift is 3 mm so that the groove width is greater than the cutting tool.

5.3.10 After cutting the pipes are delivered on the handing over racks of the oil assortment.

5.3.11 Maintenance of the 9K157 machines is performed according to the "Guidelines" to these machines.

5.3 Cutout of pieces.

Cutout pf pieces for production of templates for pipe inspections on the conformity with the standards is carried out according TCD inspector's marking as specified in TI NTZ-12-2008 (or the instruction issued to replace it).

5.4 Pipe cutting in measured length.

5.5.1 Pipe cutting is carried out on a melt-by-melt basis.

5.5.2 Pipes are send to the skid bed of the 7th pair of 9K157 machines.

5.5.3 The pipe is sent to machine No.1 and is cut on the chalk mark (the cross line must stay on the proper pipe) and the pipe end is heated with gas-oxygen burners during 2-2.5 turns of the machine spindles.

5.5.1 Then the pipe is sent up to the throw-out stop on a moving bolster and cut with simultaneous heating of the cut ends. The plasma burner must be adjusted 6050 mm away from the throw-out stop during this procedure. The stop must be lowered during the cutting. The pipe is discharged into the collection bin.

5.5.2 The rest of the pipe is sent to machine No. 2. The pipe is sent on machine No. 2 into the spindle on the clearance that allows to lift the throw-out stop on the lifting table. Then the pipe brought to the stop (the plasma burner must be adjusted 6050 mm away from the throw-out stop at this point) fixed on the machine spindle, the stop is lowered, the pipe is cut with simultaneous heating of the end with gas-oxygen burners. After cutting the pipes are discharged into the collection bin. Later the pipes of this length are sent to NEU machines for later mechanical processing.

5.5.3 The length of the proper part of the tube must be over 10300 mm during the initial inspection to get two tubes with a length of 5-6 m with a length tolerance of+50 mm and taking into account the cutting tolerance (+ 150 mm).

Depending on the length of the proper part of the tube the length of finished pipes may vary between 5050-6000 mm.

5.5.4 During the cutting of pipes on the 9K157 machine the pipe is sent to machine No. 1. The front end of the pipe is cut of the required length of the shearing exceeds 100 mm.

5.5.5 Later the pipe is advanced up to the marks on the middle of the pipe and the pipe is cut in two pieces. The cutting is carried out approximately on the same distance from the marks. The pipe is discharged into the collection bin.

5.5.6 The rest of the pipe is sent to machine No. 2 where it is discharged into the collection bin without cutting.

5.5.7 The pipes are dispatched from the collection bins with the use of electric overhead type cranes to the 3rd and 4th pair of 9K157 machines where the pipe ends are cut on chalk marks.

The scheme of pipe cutting is given in Fig. 5.1. and 5.2

**Nondestructive inspection on the «ТР115СОРЕ» machine**

Nondestructive inspection of pipes on the «ТР115СОРЕ» machine is carried when necessary after cutting of ends.

The pipes that are not subjected to ultrasound inspection on other areas when necessary and technologically feasible are subject to nondestructive inspection on the «ТР115СОРЕ» machine according to TI NTZ-NK-31-2004 or the standard issued to replace it.

According to standard АР1 Зрес 51\_ all Р51\_ 2 and Р51\_ 1 pipes of the 1245 or B grade that were hardened and drawed, other Р81\_ 1 pipes (subject to an approval) must be subjected to nondestructive inspection (on method or a combination of methods) along the length (100%) on the «ТР115СОРЕ» machine according to TI NTZ-NK-25-2006 and TI NTZ-NK-27-2006 (or the standards issued to replace them) and the pipe ends that were not cut into the length of 300 mm after the ultrasound inspection and the magnetic particle test according to TI NTZ-NK-22-2006 (or the standards issued to replace them).

The pipes are subjected to ultrasound inspection according to the requirements stipulated in the standards according to the instructions mentioned above as an alternative to hydrotesting (upon the approval of the client) or in addition to hydrotesting (if it is stated in the order) in conformity with standards АZТМ А53/А53М and АZТМ А106/А106М.

355 and К55, Р51\_-2 pipes must undergo ultrasound inspection along the length to identify longitudinal faults on the inner and other surfaces according to the reception level 14 (Table C. 63 АРI 5СТ).

М65, N80 pipes of the type 1 and N800, Р31\_-2 must undergo the inspection along the length to uncover longitudinal and transversal faults on the inner and other surfaces according to the reception level 1\_3 through the ultrasound inspection according to А.2 АРI 5СТ (pipes must undergo inspections for faults exceeding 12.5% of the normalized wall thickness and decrease the actual wall thickness to the value less than 87.5% of the normalized wall thickness.

180 pipes of the type 1, С95, RZ-2 and R110 (all levels) must undergo inspections along the length to uncover longitudinal and transversal faults on the inner and other surfaces according to the reception level 1\_2 through the ultrasound inspection.

N800, 180, С90, С95, Р110, Р51\_-1 pipe chamfer templates must undergo unltrasound inspection along the length to uncover longitudinal and transversal faults on the inner and other surfaces according to the reception level !\_2.

180, С90, С95, Р110, Р51\_-2, Р51\_-3 pipe chamfer templates must be inspected along the length to uncover longitudinal and transversal faults on the inner and other surfaces according to the reception level 1\_3 .

Pipe ends and chamfer template ends manufactured according to АР1 5СТ and subjected to automated ultrasound inspection along the length and not cut in the length of 300 mm must be subject to magnetic particle test according to TI NTZ-NK-22-2006 (or the instruction issued to replace it).

After the finalization of level Р31\_-2 the wall thickness must be measured and registered along the length of pipes of all thickness groups with minimal coverage of 25% of the whole surface subjected to automated inspection.

If the order contains additional requirements in relation to ultrasound inspection of defects (Annex A АР1 5СТ) then:

- the pipes of Н40, 355, К55 and N80 grades of the type 1 must undergo inspections along the length to uncover faults that exceed 12.5% of the normalized wall thickness and decrease the actual wall thickness to the values lower that 87.5% of the normalized wall thickness (8141).

- the pipes of Н40, 355, К55, N80 grades of the type 1, N800, М65, 680, С95 and Р110 with requirements for impact bending must undergo ultrasound inspections along the length to uncover faults that exceed 5% of the normalized wall thickness and decrease the actual wall thickness to the values lower that 87.5% of the normalized wall thickness (ZP2).

Ultrasound inspections along the length are carried out after thermal treatment and correction.

Faults that correspond to the requirements to the material and do not exceed the size of the defect stated in the para. 2.3.1 are allowed on the pipes. Otherwise the defects are removed by grinding provided that the remaining wall thickness stays within tolerable limits.

Grinding must be carried out so that the treated are smoothly merged with the pipe frame.

Pipe repair is carried out according to the requirements of TI NTZ-31-2005 (or the standard issued to replace it).

Repeat ultrasound inspection or magnetic particle test of the surface (depending on the location of the repaired pipe section) is performed after the repair. The pipes undergo ultrasound inspection of the wall thickness and it is measured in the repaired area with a mechanical pipe wall thickness gauge (depending on the location of the repaired pipe section) on the conformity with the standard.

After the finalization of level Р36-3 the wall thickness must be measured and registered along the length of the pipes of all toughness groups with minimal coverage of 100% of the whole surface covered by an automated inspection. Minimal measured length of the wall for each pipe must be entered into the report.

Inspection of wall thickness of the pipes with smooth ends and chamfer templates on the length of 300 mm (all the levels of specifications) are performed by TCD inspector in the production of ferrous metals with level-type mechanical pipe wall thickness gauges.

Otherwise the inspection of ends is performed manually according to TI NTZ-NK-19-2006 (or the standard issued to replace it) or the pipe ends must be cut on the length of 300 mm.

**7 Reception and separation by length**

7.1. The reception of pipes delivered without thread and the additional quality and geometry inspection of casing pipes as well as their separation by length before the package-by-package transfer to the thermal treatment aisle or to one of the casing areas is performed on the turnover racks of the oil assortment.

7.2 Checking and reception of pipes is carried out in the direction of:

- inspection of geometrical dimensions and the surface quality on the conformity with the requirements of the standards with the corresponding separation;

- separation of pipes by length taking into account the limit tolerances stipulated in the standard (refer to

7.3 TCD inspectors carry our inspections of every pipe on their outer frame and ends diameter, wall thickness, curvature, end quality, outer and inner surface on the reception racks of oil pipes.

Tolerable limit values of the diameter and wall thickness are given in Tables 2.1 - 2.4.

7.3.1 The inner diameter is inspected with adjustable external gauges (GOST 2216-84) and the pipes ends delivered according to standard API 51 with rings manufactured according to standard NKL 1-93.

The inspection is carried out by putting rings on the pipe ends. The inner diameter of ring gauges must correspond to Table

2.1 and Table 1 of the Annex C.

The front end of the ring gauge during the inspection must reach the mark of not less than 101.6 mm set with the use of a ruler (GOST 427-75).

Out-of-roundness of pipes is determined simultaneously with the measurement of the diameter as the difference between the largest and lowest diameter in one profile (MI NTZ-IL-87-2005).

7.3.2 The wall thickness is inspected with indicating pipe wall thickness gauge SMT-30 according to GOST 11358-89. It is possible to use tube micrometer MT according to GOST 6507-90 or other devices that ensure the required precision of measurement for inspection.

7.3.3 Pipe curvature (0.2% of the length) is determined by measuring the value of maximum bend with the use of a string and a ruler according to GOST 427-75. The tolerable bends depending on length are given in Table 5 of the Annex C.

7.3.4 The quality of outer and inner surface is determined visually through thorough examination of the whole pipe surface, the depth of defects is inspected with a depth meter and the outer surface is examined by lighting the pipe from both ends.

7.3.5 In case of finding defects and deviations of geometrical dimensions on pipes the cutting and separation of pipes is carried out according to para. 4.2.

7.3.6 Pipes with deviations of wall thickness after cutting pf ends are directed for repeat cutting after measuring according to para. 4.2.4.

7.3.7 The pipes with the wall thickness outside the tolerable limits for this nominal thickness are transferred to the closest nominal wall thickness provided that it is given in the SD, there are relevant orders and the wall thickness along the length of the pipe is within the tolerable limits for this value.

7.4 The pipe ends must but cut at a right angle or with the removal of the chamfer at an angle of 30°+5° and with the dulling of ends of 1.6 mm± 0.8 mm (para. 2.6).

For the pipes that require the inner mechanical processing to ensure the limit width of the flat surface of pipe ends, the angle of the female cone, measured from

If the quality of the pipe ends does not satisfy the stated requirements the pipes are sent to the 4th aisle for processing on Heid machines.

7.5 Measurement of length is carried with gauge tape RZ according to GIST 7502-89. Separation of pipes is performed after length measuring according to para. 2.2. of this PI and the order.The batch must contain pipes of the same range of length. The pipes with the length outside the tolerable limits are delivered on other orders.

7.6 The pipes that were not rejected by TCD are put on the charging roller table of the scales on which a single-piece inspection of pipe weight is carried out (if necessary).

The calibration of scales on a shift basis is performed according to the requirements of NTZ-S-09-2003 (or the standard issued to replace it).

The pipe weight inspection is carried out in the following order.

7.6.1 It is necessary for the staff member to do the following before the initiation of the procedure:

- turn on the device and warm it up for 30 minutes;

- examine the carrier and, if necessary, adjust the gaps in the limiters.

- there should be not foreign objects on and under the carrier;

- tilt the carrier in the transverse direction and ensure its mobility;

- prepare the weighting device by tapping the buttons located on the door of the instrument cabinet in the following order:

a) tap the "Reset" button - the screen of the device must show zeros.

b) tab the "Set the zero" button - the screen must show zeros and both of the light guides "Balance" must light up.

c) tap the "Measuring" button - the screen must show numbers on the two last positions in the range between 0 and 2 (if the screen shows the number over 2 - to repeat the above stated actions until the last two positions show the numbers between 0 and 2).

7.6.2 It is necessary to put the pipe on the carrier to weight it (the pipe must lay on the platform axis without evident skews and shifts),

- tab the "Measuring" button - the screen must show the pipe weight;

- remove the pipe from the carrier.

- put the next pipe and repeat the pipe weight measurement operation.

Note:

1) in case of doubts of the precision of weighting repeat the nulling of the device;

2) check the operation of the scales by weighting the telltale pipe.

7.6.3 The foreman of the 3rd aisle (refer to foreman) is responsible for weighting of pipes.

7.6.4 Weighting is performed under the supervision of TCD.

7.6.5 The result of weighting is entered into the TCD delivery report from the digital screen.

The weight of a specific pipe must be within the tolerable limits according to Table 2.1. and the table of pipe weights of 29.12.2002.

The permissible error of the strain-gauge weighting unit used for weighting of pipes manufactured according to standards АРI 51 and 5СТ, А8ТМ А106/А106М, АZТМ А53/А53М is ±0.2% of the scale capacity.

7.7 The results of reception of pipes on the oil pipe racks are entered into the tracking report (Annex B), TCD report (Annex F) and into the open-ended report (Annex A).

7.8 It is allowed to hand over the pipes cut in measured lengths (length in the range of 5 - 6 m) to other floors without repeat examination on the commercial pipe examination floor after their cutting on the freestanding pair of 9K157 machines.

**8 Sizing of pipe ends on the Heinrich Rau and Layers presses**

8.1 The sizing is performed to increase the precision of the geometrical dimensions of the pipe ends (diameter, out-of-roundness).

8.2. The ends of pipes delivered for sizing must be free of burrs.

8.3The pipe ends are sized of the following presses:

- Heinrich Rau according to TI NTZ-Tr4-08-2005 (or the standard issued to replace it);

- Layers according to TI NTZ-Tr4-14-2007 (or the standard issued to replace it);

**9 Processing of pipe ends on Heid and Cri-Dan pipe-threading machines**

9.1 Specification summary of the machines.

Specification summary of the 5RH-[CHSS 800/324 machine.

Diameter of the processed pipes - 140-324 mm

Length of the processed pipes, mm – 13000

Action range of the cross slide, mm – 350

Action range of the longitudinal slide, mm – 500

Spindle rotation rate, RPM - (14,2-355)

C1 - (0,23-6,0)

Rate of working feed, mm/m - 4000

Rapid traverse speed, mm/m – 10000

Rate of pipe feed, m/s - 0.2 - 0.3

Number of positions in the turret head - 6

Action range of the centering unit poppet sleeve, mm 102

Main drive motor capacity, kW – 75

Electric feed drive capacity, kW – 4.3

DPC discretization, mm – 0.001

Specification summary of the Т5-16 machine.

Diameter of the processed pipes - 140-340 mm

Maximum length of the processed pipes - 13000 mm

Total range of the speed rate of the spindle, adjustable, multistage, RPM - 71.0 -356 ±10%

Maximum working feed, mm per minute - 2000±5%

Rate of rapid traverse, mm/min - 6000±10%

Rate of pipe feed, m/s - 0.2 - 0.3

Main drive motor capacity, kW over - 100

9.2 The machines operate on the principle of rotation of the processed pipe. The pipe is fixed in two-three jaw pneumatic chucks.

9.3 Centering of the pipe is made with the concentric jaw chuck that is installed on the poppet of the machine.

9.4 The machine operator must be aware of the following before turning on the machine:

- size of the processed pipes;

- thread type;

- material of the processed pipes;

- which pipe-processing program must entered into the digital-program control machine.

9.5 The operator-setter carried out calibration of the ЗйХ - 1МСС 800/324 Heid and TZ-16 Cri-Dan machines taking into account the standard size of the processed pipes in the following order:

- installs the top jaws on the front and back chucks;

- installs wear direction sleeves;

- installs the top jaws of the centering device and calibrates with a telltale pipe;

- calibrates the steady rest and the mechanization lifting table with a telltale pipe;

- installs the cutting instrument on the machine;

- sets the corresponding pipe processing program;

- carried out the telltale pipe processing;

- if the pipe end quality conforms to the standard he carries out the processing of the whole pipe batch. Otherwise he carries out calibration of the digital-program control system parameters.

9.6 The machine is put into operation by tapping the "Machine on" button on the maintenance panel of digital control. Hydraulics and the centralized lubricating system turns on simultaneously with the machine.

9.7 Automatic cycle is turned on by tapping the trigger button. The following conditions must be met for this purpose:

- the program of pipe processing and instrument correction must be entered into the control system;

- the control system must remain in initial condition;

- the slide must be position into the point of tool change and the operation mode must be chosen.

9.8. The squaring up of the pipe end must be carried out at a right angle. Removal of the chamfer and the dulling on Heid and Cri-Dan machines: The squaring up of the pipe end at a right angle:

1. Fast advance of IR-206 cutter to the pipe end.

2. Squaring up of the end at 90° (downwards).

3. Dulling of the chamfer at 30 ± 5°.

4. Fast advance of the cutter to remove the rough chamfer.

5. Removal of the rough chamfer.

6. Fast advance of the cutter to the initial dulling point.

7. Dulling and chamfering (chamfer size according to the standard).

8. Output of the cutter to the point of tool change.

9. Female cone bore.

10. Turning of the turret head on Heid machine and advance of the second slide on Cri-Dan machine with a specialized tool (reconditioned IR-206) for female cone bore.

11. Fast advance to the cutting point.

12. Female cone bore (according to the standard).

13. Positional datuming.

9.9 All the operations on pipe end processing are performed with IR-206 squaring up cutter (blueprint IR-206.22.667) with mechanical mounting of PSMH1606МО carbide blade from ЬR2002 or 11S6010, СТ25 alloy with the use of MCO. 4-7% of SVK emulsol solution of C grade prepared according to TI NTZ-28-2008 or the one issued to replace it is used as the MCO. It is permitted to use other MCO equal in the intended functions.

9.10 The pipe processing on the machine is carried out according to the program entered into the memory unit of the control system by the tender of machines with digital-program control.

9.11 The pipes are discharged piece-by-piece on the feed roller table which sends the pipes through the bored spindle into the machine against stop. Then the pipe is moved to the processing position with the use of the centering unit. The front end of the pipe is centered and the pipe simultaneously clutched by the jaws of the back chuck. The slide is located at the datum point during this procedure. The centered pipe is fixed by the outer chuck jaws. The pipe end is processed.

After the pipe end is processed the turret head (of the slide) is withdrawn under fast feed to the datum point. The steady rest is lowered, the jaws of the front and back chuck are released. The pipe is pushed from the hollow spindle by backward rotation of the rolling table rolls.