



**GUIDELINES
FOR USE**

**RE PS
02-036-2017**

**USE OF
TMK UP CENTUM THREAD CONNECTION FOR TUBING**

Revision 3

Introduction

The present guidelines are worked out taking into account the requirements of the following documents:

- API RP 5C1 Recommended Practice for Care and Use of Casing and Tubing;
- API RP 5B1 Gaging and Inspection of Casing, Tubing and Pipe Line Threads;
- ISO 10405 Petroleum and Natural Gas Industries – Care and Use of Casing and Tubing.
- TR CU 010/2011 – Technical Regulations of EAEC “on the Safety of Machinery and Equipment”.

Information about the guidelines for use

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3 Revision 3 Effective date is May 6, 2018 with an option of early use.

4 The present revision is completely reworked in relation to the previous revision. Thus amendments and additions introduced in this revision are not highlighted.

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USE OF

TMK UP CENTUM THREAD CONNECTION FOR TUBING

Effective date is May 06, 2019

With an option of early use

1 Scope

The present guidelines contain recommendations for maintenance and use of tubing with TMK UP CENTUM thread connection under field conditions, including pipe preparation and make-up, string running and pulling operations, as well as guidelines for pipe handling, storage and inspection during operation.

2 Normative references

The present guidelines contain normative references to the following documents:

API RP 5A3/ISO 13678 Recommended Practice on Thread Compounds for Casing, Tubing and Line Pipe;

GOST 15150-69 Machines, Instruments and Other Industrial Products. Modifications for Different Climatic Regions. Categories, Operating, Storage and Transportation Conditions as to Environment Climatic Aspects Influence;

RD 39-7-904-83 Instruction on Material, Equipment and Spare Parts Storage in Warehouses on Facilities of Production and Technical Servicing and Completing, Enterprises and Entities of Ministry of Oil Industry;

TU 0254-001-46977243-2002 RUSMA-1, RUSMA-1 (3) Thread Compounds;

TU 0254-031-46977243-2004 RUSMA R-4, RUSMA R-4 (3) Thread Compounds;

TU 0254-068-46977243-2009 RUSMA R-14, RUSMA R-14 (3) Special Thread Compounds;

TU 0254-158-46977243-2013 RUSMA Storage Compound.

N o t e – The specified document revision shall be applied for dated references. The latest valid revision shall be applied for undated references.

3 Terms and definitions

For the purposes of the present guidelines the standard terms as well as the following terms and definitions shall be applied:

3.1 **rotation on shoulder:** Preset movement of thread connection in circumferential direction after thread connection surfaces shouldering.

3.2 **box (box connection):** The product with a thread connection on an inside surface.

3.3 **pin (pin connection):** The end of pipe with a thread connection on an outside surface.

3.4 **thread connection (make-up result):** Make-up of pin and coupling by means of thread.

3.5 **thread connection (structural element):** Thread, seals, shoulders and other auxiliary elements of structure on pin or coupling.

3.6 **thread seals:** Pin sealing groove and coupling sealing bore ensuring tightness of thread connection upon pin and coupling make-up.

3.7 **thread shoulders:** Pin shoulder and box shoulder acting as an arrester upon pin and coupling make-up.

4 Transportation, handling operations and storage

4.1 Transportation

4.1.1 When pipes are transported by sea, railroad (railcars) or trucks, Cargo Shipping Rules and Technical Provisions for Cargo Handling and Fastening applicable to the particular transport type shall be observed.

4.1.2 Pipe transportation, handling and storage shall be carried out with thread protectors screwed on pin and coupling end faces in order to protect thread surface, thread shoulders and thread seals from exposure.

4.1.3 Pipe bundles of different lots and standard sizes can be loaded into same means of transportation, but have to be separated.

4.1.4 Pipe bundles shall be securely fastened during transportation to avoid any movement. Wooden blocks can be used for fastening purposes.

When several pipes bundles are stacked or not bundled pipes are stacked into several ranks, pipe bundles and pipe ranks shall be separated by at least three wooden blocks, with the thickness from 1.3780 inch to 1.5748 inch each, so that weight of upper pipe ranks is not distributed onto couplings of lower ranks.

4.1.5 When transported by sea, pipe bundles shall not be placed in water inside the vessel's hold or in any other corrosive environment. Dragging of bundles along the piles or hitting bundles against hatches or rails is strictly forbidden.

4.1.6 When loading pipe bundles into railway cars or trucks, wooden girders (blocks) shall be provided for car floors or vehicle beds to ensure required distance between the products and uneven bottom of the vehicle. No blocks shall be placed under couplings.

4.1.7 Pipes from chromium and corrosion-resistant steel shall be packaged using wooden or plastic beds.

4.1.8 In order to avoid hitting of pipes against vehicle metal elements or protruding parts of neighbouring pipe bundles, it is recommended to use load platforms with protecting covers.

4.1.9 When attaching chromium and corrosion-resistant steel pipe bundles to loading platform or deck it is required to use nylon cables.

4.2 Handling operations

4.2.1 All handling operations with pipes shall be carried out with thread protectors screwed on pin and coupling ends.

4.2.2 Handling operations with pipe bundles shall be carried out only with the help of hoisting transportation clamps.

In case of manual unloading, rope slings shall be used and pipes shall be rolled along guides in parallel to the pile, avoiding quick movement and collision of pipe ends.

When using the crane, spreader beams with slings shall be used according to approved slinging diagrams.

4.2.3 Pipes shall not be allowed to fall down from heights or be picked up by the pipe end with a hook or be dragged or subjected to any other actions that might damage pin and coupling threads, surfaces or shapes.

4.2.4 Handling operations with chromium steel pipes shall be performed using nylon or steel harnesses with plastic braid. When using a forklift, gripping forks, frames and clamps with nonmetallic coating shall be used.

4.2.5 Handling operations for chromium steel pipes shall exclude collision of pipes.

4.3 Stockholding and storage

4.3.1 Pipe storage conditions shall comply with GOST 15150 for Group 4 (long-term storage) or Group 8 (short-term storage up to three months and service interruptions).

4.3.2 Pipes, equipment and spare parts storage in warehouses on facilities of production and technical servicing and completing, enterprises and entities shall be according to RD 39-7-904-83.

4.3.3 Pipe bundles shall be stacked on supports spaced in a manner avoiding sagging or thread connection damage. Rack supports shall be located in one plane and shall not sag under the pile weight. Rack bearing surface shall be minimum 11.8110 inch above the ground or floor.

**Pipe bundles shall not be stocked on the ground, rails,
steel or concrete floor!**

4.3.4 When several pipes bundles are stacked or not bundled pipes are stacked into several ranks, pipe bundles and pipe ranks shall be separated by at least three wooden blocks, with the thickness from 1.3780 to 1.5748 inch each, so that weight of upper pipe ranks is not distributed onto couplings of lower ranks.

The height of the pipe pile shall not exceed 9.8425 ft.

4.3.5 Stockholding of unbundled pipes is allowed provided vertical posts are installed in the racks.

4.3.6 If pipes are rolled on the racks, any movements at an angle to the rack axis shall be excluded as this may result in collision of pins and damage of thread connection or thread protectors.

4.3.7 During pipe storage, availability and integrity of thread protectors, as well as compound underneath and its expiration date shall be inspected. Pipe corrosion shall not be allowed.

4.3.8 During pipe storage before use for more than 6 months, the compound under thread protectors shall be renewed except for the pipes which thread connections are covered with thread compound of longer period of storage or with Green Well thread compound.

For this purpose the following actions shall be performed:

- Unpack the package and roll the pipes;
- Remove thread protectors according to para. 5.3;
- Remove initial compound according to para. 5.4;
- Apply storage compound (Kendex OCTG, BESTOLIFE Storage Compound (BSC), Total Jet Marine, RUSMA storage compound or thread compound with storage properties) with the expiration date of minimum 6 months – till the next compound renewal or pipe usage;
- Install the thread protectors that were previously removed, make sure they are cleaned from old compound, or install new thread protectors according to para. 5.8.

– After completion of operation, package the pipes in compliance with packing list or store separately.

4.3.9 Pipes damaged during transportation, rejected during inspection, prepared for repair or awaiting a final decision shall be stored on separate racks with the corresponding tags.

4.3.10 During chromium steel pipes storage, wood or plastic gaskets shall be placed onto all pipe supports.

4.3.11 Drilling site shall have a special area for pipe stockholding in compliance with above-listed requirements.

4.3.12 Required quantity of racks shall be installed at drilling site in order to provide for stockholding of full set of pipes.

While stacking onto racks it is important to consider the order of string running (if it is specified in the work instruction), to exclude the risk of additional reasorting.

5 Preparation of pipes for make-up

5.1 General provisions

Prior to lifting the pipes onto the rig site, proceed as follows:

- Perform visual inspection of pipes and couplings;
- Remove thread protectors from pipes and couplings;
- Remove preservation compound from external and internal thread connections;
- Inspect surfaces of external and internal thread connections;
- Drift pipes along the entire length;
- Measure the length of each pipe;
- Re-install clean thread protectors on pipes and couplings.

5.2 Visual inspection

5.2.1 Visual inspection of pipes, couplings and thread protectors shall be performed in order to detect bent pipes, dents and damages.

5.2.2 Visual inspection of pipes and couplings shall be carried out with thread protectors screwed on.

5.2.3 Pipes, couplings and thread protectors with damages, discovered during visual inspection shall be put aside awaiting decision on their suitability for use.

Amount of damaged pipes shall be specified in the Product Quality Non-Conformity Protocol and all damaged areas shall be documented on photographs.

5.3 Thread protectors removal

5.3.1 Thread protectors shall be removed after visual inspection of thread connections.

5.3.2 Thread protectors shall be removed manually or using a special tong with one person's effort. In case of difficulties when removing thread protectors, heating of thread protectors with steam is allowed as well as striking slightly with a wooden hammer at a protector end to eliminate a possible distortion.

5.4 Compound removal

5.4.1 After removal of thread protectors, external and internal thread connections shall be cleaned from compound by hot soapy water or with a steam cleaner. It is recommended to supply water under pressure. In case of freezing temperature, compound may be removed by using a solvent (Nefras, white spirit or similar). After removal of compound, thread connection shall be purged with compressed air or cleaned with dry rags.

***Compound shall not be removed using
diesel, kerosene, salty water, barite or metal brushes!***

5.4.2 Barite or metal brushes can cause scratches on surfaces of sealing elements resulting in loss of tightness.

5.4.3 After removal of compound, thread connections shall be purged with compressed air or cleaned with dry rags.

5.4.4 When pipes are supplied with thread compound RUSMA-1 (3), RUSMA R-4 (3), RUSMA R-14 (3) under thread protectors, it is allowed to perform the first running and pulling operation with mill compound if mill thread protectors are screwed on and are not damaged. When thread protectors are screwed off, it is necessary to make sure that:

- The compound is free of foreign particles;
- The compound is applied onto thread in an even layer (make the surface even and/or add the compound of the same type if necessary);
- The pipe was manufactured not more than 1 year ago according to the Certificate.

5.5 Thread connection inspection

5.5.1 Thread connection shall be inspected by the following specialists:

- Crews for tubing assembly;
- Companies specialized in tubing inspection;

When running tubing for the first time, representatives of the tubing supplier shall be present.

5.5.2 When inspecting pin and coupling connections surfaces specified in Figure 1, make sure you pay due attention to the following:

- Damages resulting from pipes collisions or other impacts;
- Damages resulting from installation of thread protectors;
- Rust, corrosion or other chemical damages caused as a result of environmental exposure or due to aggressive agents.

5.5.3 Under low light condition (twilight, night), individual portable light sources shall be used during inspection.

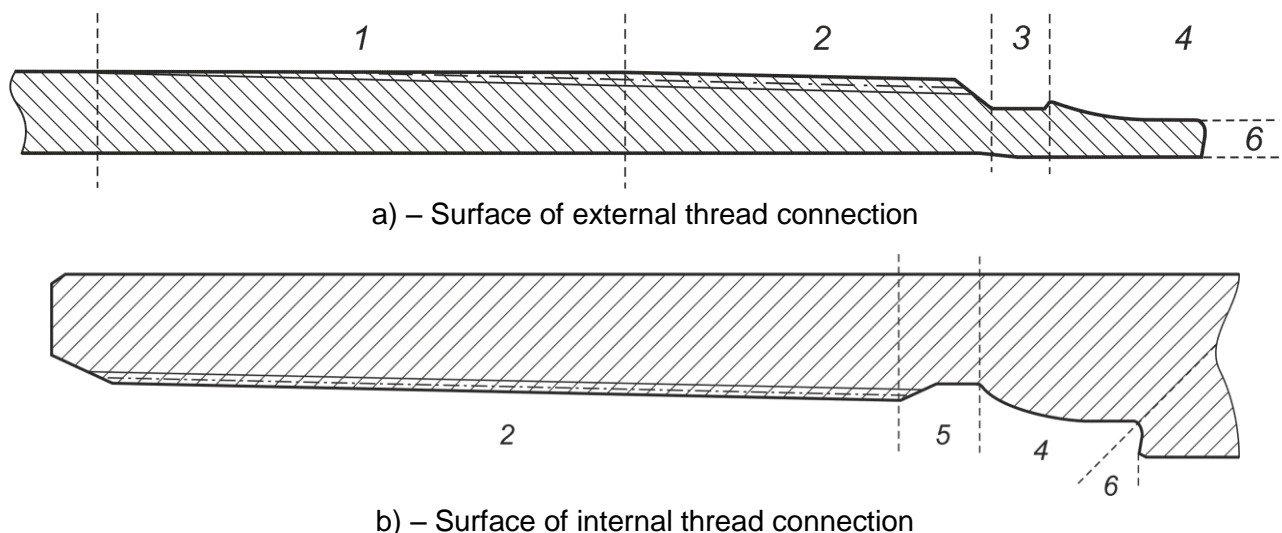
5.5.4 Possible damages that might occur on areas of thread surfaces, thread seals, thread shoulders of external and internal thread connections before putting into operation and the ways of their elimination are listed in Table 1.

5.5.5 Determination of corrosion depth, scratches, tears, burrs height shall be performed using:

- A mould taken from a detected defect using a special tape (X Coarse material of Testex company for defects up to 0.0039 inch deep, for deeper defects: X-Coarse Plus or equivalent one). Mould height shall be measured with a thickness gage, measurement accuracy shall be at least 0.0004 inch G2-127 PEACOCK gage or equivalent one);

- Depth gage with a needle-type contact point (contact point diameter shall be maximum 0.0039 inch), measurement accuracy shall be at least 0.0004 inch (T-4 PEACOCK gage or equivalent one).

5.5.6 If any unacceptable damages are detected on pipes, such pipes shall be rejected then and reported accordingly specifying pipes serial numbers, describing defects found with photos attached.



- 1 – imperfect profile thread; 2 – perfect profile thread; 3 – cylinder groove; 4 – thread seal; 5 – coupling bore; 6 – thread shoulder

Figure 1

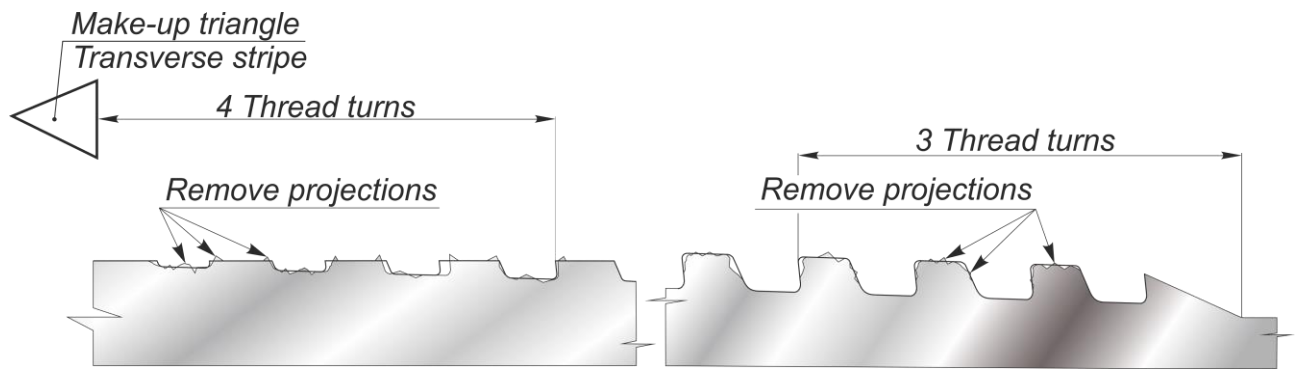
Table 1 – Types of damages and methods of repair before operation

Surface area (Figure 1)	Type of damage	Damage repair method
1, 2, 6	Pit or surface corrosion less than 0.0039 inch deep	Manual repair (removal) using non-metal brush with soft bristle or polishing paper with grain 0
	Pit corrosion more than 0.0039 inch deep	Not to be repaired
	Burrs less than 0.0118 inch wide Tears and scratches less than 0.0039 inch deep	Manual repair using needle file or polishing paper with grain 0
	Dents, nicks and other mechanical damages	Not to be repaired
3.5	Pit or surface corrosion less than 0.0039 inch deep	Manual repair using a needle file or polishing paper.
	Pit corrosion more than 0.0118 inch deep	Not to be repaired
	Burrs less than 0.0118 inch wide. Tears and scratches less than 0.0118 inch deep	Manual repair using needle file or polishing paper with grain 0
4	Pit corrosion of any depth	Not to be repaired
	Film of rust without surface penetration	Buffing
	Burrs, tears and scratches	Not to be repaired
	Nicks	Not to be repaired
	Small grooves	Buffing

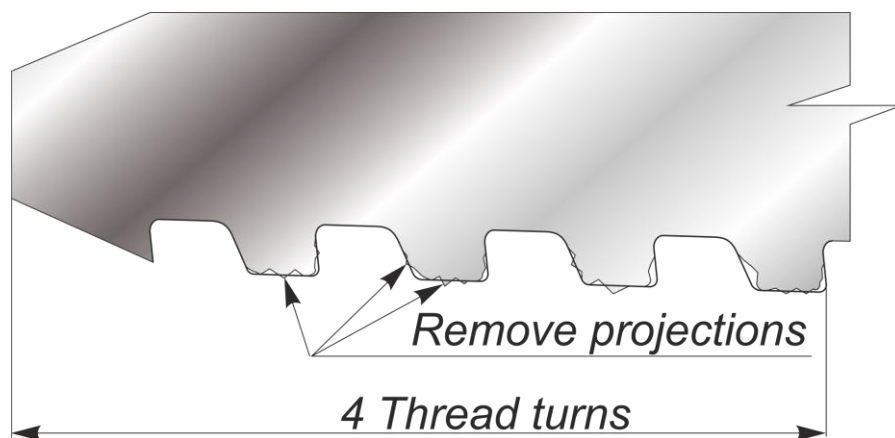
5.5.7 Possible types of damages of thread, thread seals and thread shoulders surfaces of pins and couplings during make-up, as well as repair methods are specified in Table 2 and Figure 2.

Table 2 – Types of damages and methods of repair during make-up

Surface area	Type of damage	Method of repair	Maximum time allowed for repair
4, 6 Figure 1	Any damages	Not to be repaired	-
1, 2, 3, 5 Figure 1	Severe damages	Not to be repaired	-
1, 2, 3, 5 Figure 1	Light damages	Manual repair. Use polishing paper with grain 100÷150 micron	10 min
1, 2 Figure 1; Figure 2 (a, b)	Moderate damages on a thread length maximum 3 turns	Manual repair. Use a needle file No.2, No.3, and polishing paper with grain 100÷150 micron for further treatment	10 min



a) – Surface of external thread connection



b) – Surface of internal thread connection

Figure 2

5.6 Drifting

5.6.1 Drifting shall be performed using a mandrel along the entire length of pipes. For drifting of pipes made of chromium and corrosion-resistant steels, polymer or aluminium mandrels shall be used.

5.6.2 During drifting, the pipe shall be positioned in such a manner as to avoid sagging. If any ropes or bars are used for the drifting process, they shall be clean. In case of freezing temperatures pipes shall be heated prior to drifting to remove snow and ice.

5.6.3 Pipe and drift shall be of the same temperature during drifting process.

5.6.4 Dimensions of the mandrel effective part shall comply with values specified in Table 3. According to customer's request and in case of additional requirements in an order, use of special mandrels which sizes differ from those specified in Table 3 is allowed.

5.6.5 The mandrel shall pass through the entire pipe, when pulled manually without significant effort.

5.6.6 Pipes rejected during drifting process, shall be put aside until further decision on their validity and recorded in product quality non-compliance report.

Table 3 – Dimensions of the effective part of the mandrel

Pipe outside diameter, inch	Effective length of the mandrel, inch	Diameter of the effective part of the mandrel, inch
Up to 2 7/8 including	42.0079*	$d^{**} - 0.0937$
above 2 7/8	42.0079*	$d^{**} - 0.1252$
* Drifts with the effective part 49.2126 inch are allowed to be used. ** d – pipe inside diameter		

5.7 Measurement of length of pipes

5.7.1 Length of each pipe shall be measured from free (without a thread protector) coupling end face to free (without a thread protector) pin end face.

It is recommended to compare measured pipe length with the marked length. In case of discrepancies the measured length shall be marked on the pipe body with a marker or a chalk.

5.7.2 The total length of the string shall be calculated by the formula specified below

$$L = \sum L_{\phi} - n \Delta L \quad (1)$$

where L – the total length of the string;

$\sum L_{\phi}$ – the total length of all the pipes in a string, measured from pin end face to free coupling end face;

n – number of pipes in a string;

ΔL – decrease of pipes length during make-up according to Table 4.

Table 4 – Decrease of pipes length during make-up process

Pipe outside diameter, inch	Decrease of pipe length during make-up ΔL , inch
2 7/8	2.8937
3 1/2	3.6969
4 1/2	4.1339

5.8 Thread protectors installation

5.8.1 After inspection and control, thread protectors or caps shall be re-installed on pin and coupling ends.

5.8.2 Before installation thread protectors shall be thoroughly cleaned and shall have no significant damages, affecting protection of thread and seal against direct contact with exposure.

6 Make-up of pipes

6.1 Application of thread compound

6.1.1 To ensure optimum conditions for make-up and to avoid burrs of mating surfaces, thread compound shall be applied on all the surfaces of thread, thread seals and thread shoulders of pins and couplings.

Thread compound shall comply with requirements specified in API RP 5A3/ISO 13678.

The following types of thread compound are recommended:

- RUSMA-1 and its modifications;
- RUSMA R-4 and its modifications;
- Bestolife API Modified;
- Bestolife 72733;
- JET-LUBE API Modified.

While making-up pipes of chromium steels RUSMA R-14 compound and its modifications shall be used.

By agreement with the developer of the connection, other thread compounds that meet requirements of API RP 5A3/ISO 13678 are allowed.

6.1.2 Thread compound for make-up shall only be taken from original packages, delivered by the supplier, the container shall show name, batch number and manufacturing date.

Compound from packages without proper identification shall never be used.

It is prohibited to empty one package into another and to dilute the compound.

Compound applied shall be homogeneous, of ointment consistency, free from any solid inclusions (stones, sand, dry compound, fine chips, etc.).

Prior to use, check compound's expiration date on the package.

Never apply compound with expired shelf life.

6.1.3 Make sure you follow the recommendations specified below when using thread compound:

- Use the same compound (the same type) when assembling one casing string;
- Use a new compound package for each running, if the compound from opened package is used, make sure it is free from foreign inclusions;
- Stir the compound thoroughly before use;
- Warm up the compound before application in case of freezing temperatures.

Compound shall be stored in closed overturned packages at the temperature specified by the manufacturer. When storing partially unused compound, always specify the date of the first use on the package.

6.1.4 Thread compound shall be applied in an even layer on the whole thread surface, thread seals and thread shoulders of pins and couplings connections. Figures 3 and 4 demonstrate proper and improper application of compound.

Compound shall be applied only on thoroughly cleaned and dried surfaces of thread connection.

Never use metal brushes for compound application!

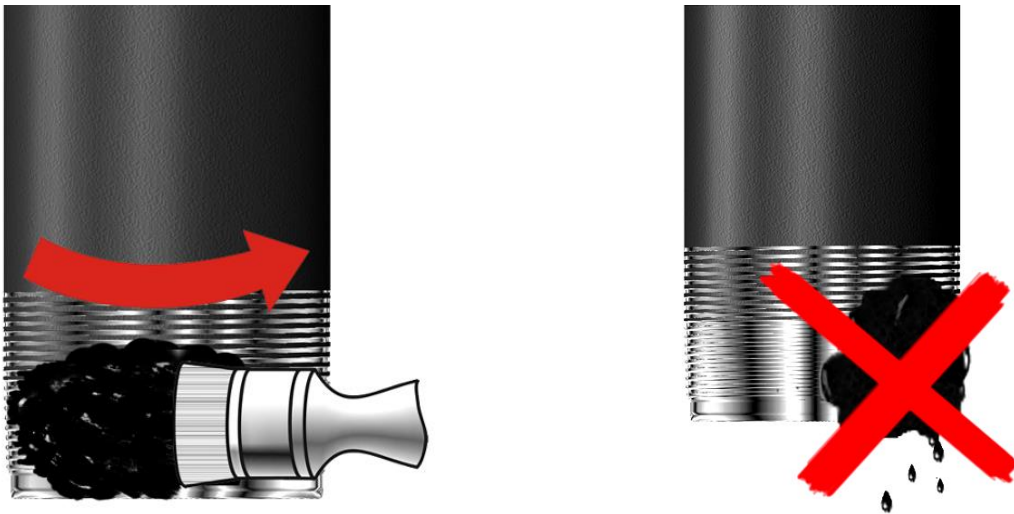


Figure 3

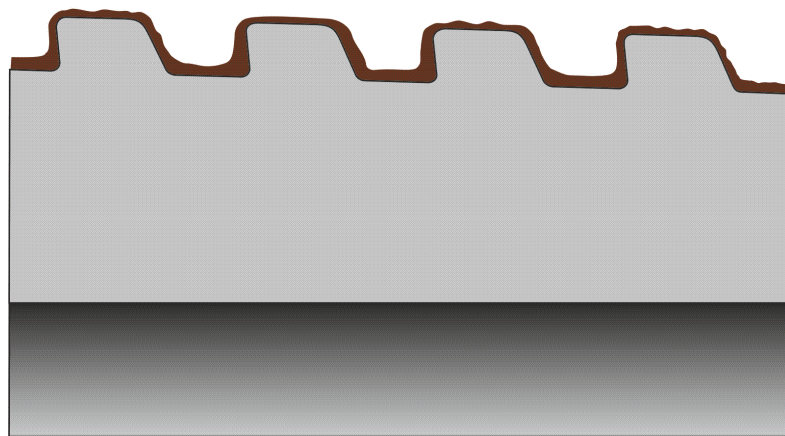


Figure 4

6.1.5 Required amount of thread compound shall be distributed between coupling and pin end as follows: two thirds shall be on the coupling end and one third shall be on the pin end.

Minimum and maximum compound mass m_{\min} and m_{\max} in gr for make-up of one thread connection shall be calculated as follows:

$$m_{\min} = 0.20 D \quad (1)$$

$$m_{\max} = 0.25 D \quad (2)$$

where: m_{\min} is the minimum compound mass in gr rounded to an integral value;
 m_{\max} is the maximum compound mass in gr rounded to an integral value;
 D is the outside diameter of the pipe in inch/mm rounded to one decimal place.

Example – The minimum quantity of thread compound required for make-up of one thread connection of coupling and pipe with an outside diameter of 88.9 mm (3 1/2 inch):

$m_{\min} = 0.2 \times 89 \approx 18$ gr with at least 12 gr per coupling and at least 6 gr per pin.

6.1.6 To determine the quantity of compound required for determined number of pipes, a package of compound with specified volume shall be used.

Prior to pipes running down the hole, make sure that required thread compound of one type is available.

6.1.7 In case a customer decides to use thread sealant (glue, jell, electric rivets) for making-up pipes with crossovers or other elements of a string – there is no warranty of thread connection tightness. In such a case all the risks and responsibility for tightness are fully born by the customer.

6.2 Running and pulling

6.2.1 Casing shall be assembled by a qualified operator. To ensure declared operational features of thread connection, make-up shall be performed with make-up torque registration system applicable.

If make-up torque registration system is not available then the following shall be used in priority-oriented order:

- Manometer of breakout tong (conversion of pressure into torque shall be in compliance with the tong manufacturer recommendations);
- Make-up triangle (cross stripe);

Above inspection methods are secondary, and they do not provide for assessment of make-up quality.

6.2.2 A special stab guide or bell guide is recommended for running and pulling operations (Figure 5). This device helps to align pin and coupling and prevent the connection from damage.

6.2.3 In order to decrease the risk of new damages during running and pulling operations, it is recommended to use pipe weight balancer.

In case of non-operating state of pipe weight balancer or its absence, a driller shall control constant weight on hook taking into consideration pipe weight.

6.2.4 While running a string of chrome steel pipes it is recommended to use an elevator and special wedge claws to avoid pipe body damages.



Figure 5

6.2.5 Rotary tongs shall be equipped with a speed governor and ensure speed of 1-2 rpm at the final stage of make-up.

Tongs shall be equipped with clamps for used pipe size taking into consideration 1% plus tolerance from the nominal pipe outside diameter. Clamps shall be adjusted in such a way that they hold the pipe tightly and never slip.

For make-up and break-out of chromium steel pipes, the rotary tongs shall be equipped with non-metal or non-injurious tong dies.

Prior to make-up, tongs shall be positioned as per Figure 6.

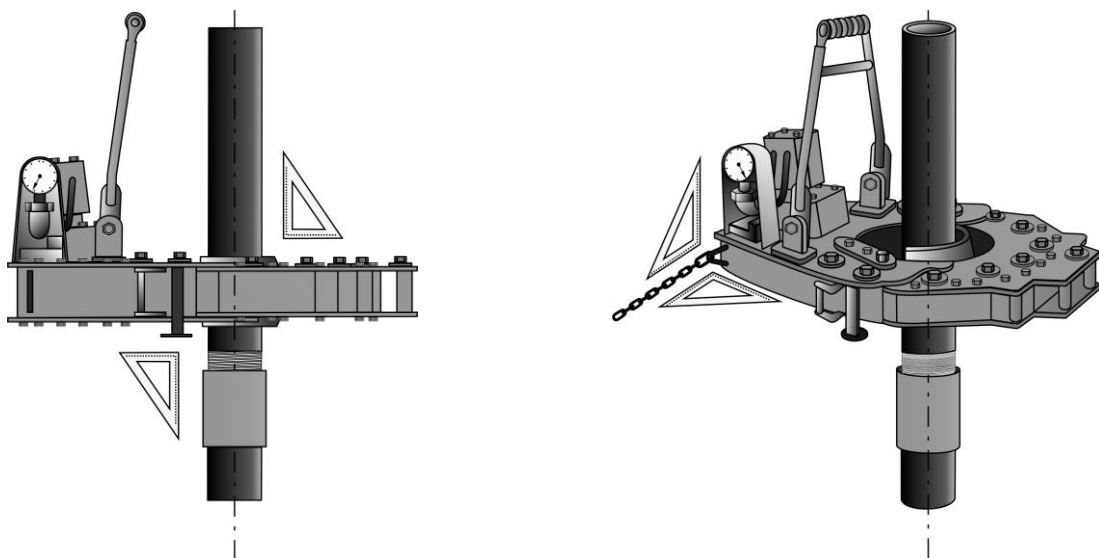


Figure 6

6.2.6 Make-up equipment shall ensure torque at least 30 % greater than recommended maximum make-up torque.

6.3 Assembly of string

6.3.1 Make sure thread protectors are secured in place prior to lifting pipes onto the rig floor.

Lifting pipes to the rig floor without thread protectors or end caps is not allowed!

6.3.2 Prior to assembly of the string, remove thread protectors or end caps and check surfaces of thread seals and thread shoulders of the free pin for any mechanical damage according to Figure 7.

6.3.3 During make-up process, if a derrick man is absent, it is required to control alignment of upper pipe coupling end (decline) with lower pipe rotation axis and correct the situation timely by directing a driller accordingly (topdrive turn, elevator movements up and down, etc.) (Figure 8).

Maximum misalignment of connected pipes shall not exceed 0.7874 inch.

6.3.4 Compound shall be applied according to para. 6.1. It is recommended to perform air blasting of external and internal threads prior to compound application.

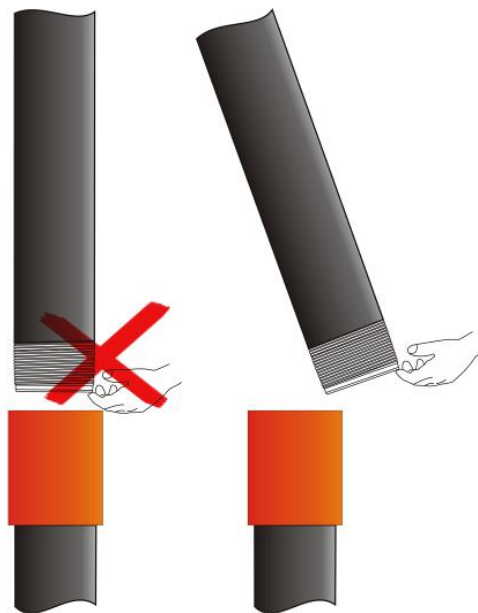


Figure 7

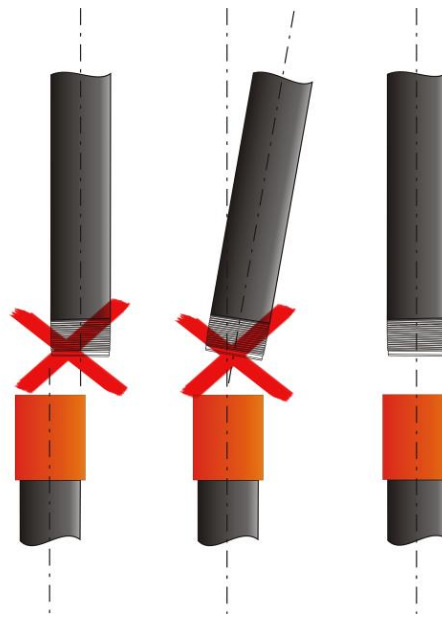


Figure 8

6.3.5 Make sure prior to make-up, that surfaces of thread, thread seals and thread shoulders with applied compound are free from mud or mud laden fluid with small contaminations, hindering tightness of connection. In case of mud or mud laden fluid on connection surfaces, clean them and apply thread compound again.

6.3.6 When stabbing a pin into a coupling, pin end face shall not hit coupling end face, pin sliding down into the coupling is not allowed.

6.3.7 The make-up torque for a thread connection shall be within the range from the minimum up to the maximum torques for grades and sizes as specified in Table 5.

Note. The grades specified without types include all the types. For grades not specified in Table 5, refer to the data provided in regulatory documentation for pipes.

If thread connection make-up with torque within the limits shown in Table 5 is not in compliance with specified requirements, M_{opt} may be corrected but not more than by $\pm 15\%$. At that the values M_{min} and M_{max} shall also be corrected but not more than by $\pm 15\%$ of corrected M_{opt} .

6.3.8 During make up of pipes and couplings made of steels of different grades, the make-up torque value shall be chosen according to the lowest steel grade of both pipe and coupling.

6.3.9 Make-up of pins and couplings shall be performed with the use of make-up registering equipment, by make-up diagrams, at that it shall meet the requirements specified in Annex A.

Make-up without equipment for make-up registration is performed using make-up torques and make-up marks (in light paint) applied by the manufacturer on free ends of pipe and coupling, and the make-up triangle on a pipe (Figure 9). A transverse stripe (in light paint) can be made on the pipe instead of the make-up triangle, in such a case a triangular sign (in light paint), denoting position of the make-up triangle, shall not be painted.

Above inspection methods are secondary, and they do not provide for assessment of make-up quality.

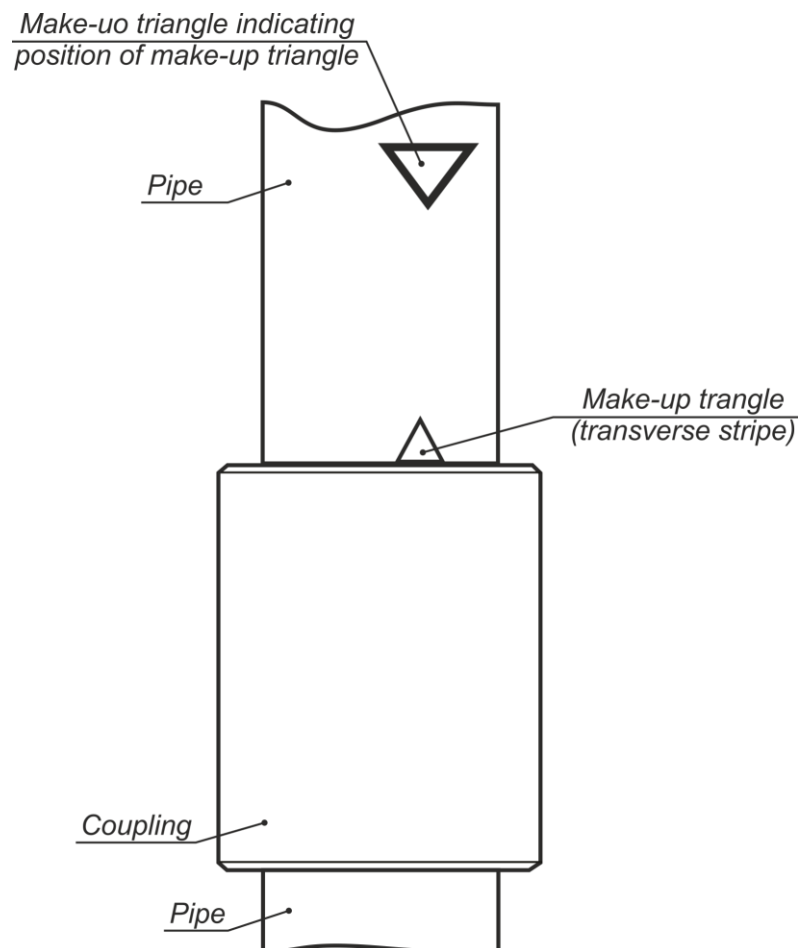


Figure 9

6.3.10 At the initial stage of assembling it is recommended to perform the first two revolutions of pipe using strap tongs (chain tongs are allowed for use only with the safe gasket which is set between the pipe body and the tong thus avoiding pipe body damage) to assure connection of external and internal threads, i.e. entering of external thread profile in mating profile of internal thread.

At this stage pipe reversal half-revolution is allowed for steady continuation of make-up without threads overlapping and high-quality assembly.

Table 5 – Make-up torques

D, Inch	S, Inch	Torque, ft lb for steel grades																								
		J55, K55			N80, L80			C90			R95, C95, T95			C110, P110			Q135			TMK140			TMK150			
		M _{min}	M _{opt}	M _{max}	M _{min}	M _{opt}	M _{max}	M _{min}	M _{opt}	M _{max}	M _{min}	M _{opt}	M _{max}	M _{min}	M _{opt}	M _{max}	M _{min}	M _{opt}	M _{max}	M _{min}	M _{opt}	M _{max}	M _{min}	M _{opt}	M _{max}	
2 7/8	0.2169	1700	1800	2100	1700	1900	2100	1800	2000	2200	1800	2000	2200	1800	2100	2300	1800	2100	2300	1900	2100	2400	2000	2200	2400	
	0.2760	1900	2100	2400	2000	2200	2400	2100	2300	2500	2100	2300	2500	2100	2400	2600	2100	2400	2600	2200	2400	2700	2300	2500	2700	
	0.3079	2100	2400	2600	2200	2400	2700	2300	2500	2700	2300	2500	2700	2400	2600	2900	2400	2600	2900	2400	2700	2900	2400	2700	3000	
	0.3402	2300	2500	2700	2400	2600	2900	2400	2700	2900	2400	2700	2900	2400	2700	3000	2400	2700	3000	2500	2800	3100	2600	2900	3200	
	0.3921	2500	2800	3100	2600	2900	3200	2700	2900	3200	2700	2900	3200	2700	3000	3300	2700	3000	3300	2800	3100	3400	2900	3200	3500	
	0.4402	2700	3000	3300	2800	3100	3400	2900	3200	3500	2900	3200	3500	2900	3200	3500	2900	3200	3500	3000	3300	3700	3000	3400	3800	
3 1/2	0.2161	2600	2900	3200	2700	3000	3300	2800	3100	3400	2800	3100	3400	2900	3200	3500	2900	3200	3500	3000	3300	3700	3000	3400	3800	
	0.2539	2900	3200	3500	3000	3400	3800	3100	3500	3800	3100	3500	3800	3200	3500	3900	3200	3600	4000	3300	3700	4100	3400	3800	4100	
	0.2890	3200	3500	3900	3300	3700	4100	3400	3800	4100	3400	3800	4100	3500	3800	4200	3600	4000	4400	3700	4100	4500	3700	4100	4600	
	0.3748	3900	4400	4800	4100	4500	4900	4100	4600	5000	4100	4600	5000	4200	4600	5100	4400	4800	5300	4400	4900	5400	4400	4900	5500	
	0.4299	4400	4900	5400	4500	5000	5500	4600	5100	5600	4600	5100	5600	4600	5200	5700	4800	5300	5800	4900	5400	5900	4900	5500	6000	
	0.4760	4700	5200	5800	4900	5400	5900	4900	5500	6000	5000	5500	6100	5000	5600	6200	5200	5800	6300	5200	5800	6400	5300	5900	6500	
	0.5299	5200	5800	6300	5300	5900	6500	5400	6000	6600	5500	6000	6600	5500	6100	6700	5700	6300	6900	5700	6300	7000	5800	6400	7100	
4 1/2	0.2709	5100	5700	6300	5200	5800	6300	5200	5800	6300	5200	5800	6400	5200	5800	6400	5300	5900	6500	5400	6000	6600	5400	6000	6600	
	0.2902	5100	5700	6300	5200	5800	6300	5200	5800	6300	5200	5800	6400	5200	5800	6400	5300	5900	6500	5400	6000	6600	5400	6000	6600	
	0.3370	7000	7700	8600	7100	7900	8700	7100	7900	8700	7200	8000	8800	7200	8000	8800	7400	8200	9000	7400	8300	9100	7400	8300	9100	
	0.3799	8200	9100	10000	8300	9300	10300	8400	9400	10300	8500	9400	10400	8500	9400	10400	8600	9600	10500	8800	9700	10700	8800	9800	10800	
	0.4299	9600	10600	11700	9700	10800	11900	9900	11000	12100	10000	11100	12200	10000	11100	12200	10300	11400	12500	10300	11500	12700	10400	11600	12800	
	0.5000	11600	12800	14100	11800	13100	14500	11900	13300	14600	12000	13300	14700	12200	13500	14800	12300	13700	15100	12500	13900	15300	12600	14000	15400	

Note. Make-up with special couplings shall be performed using torques 20% less than the specified ones.

6.3.11 When making-up chromium steels pipes, the first two turns shall be carried out manually, or strap tongs can be used (Figure 10). Chain tong is allowed for use only provided that the pipe body is secured from damage (e.g. by the safe gasket which is set between the pipe body and the tong).



Figure 10

6.3.12 Make-up rotation speed during connection make-up with the rotary tong shall correspond to the values specified in Table 6.

Table 6 – Rotation speed during make-up

Start of make-up		End of make-up (rotation on shoulder)
First two turns	Further turns	
Speed maximum 2 rpm, Better manually	Speed maximum 10 rpm	Speed maximum 5 rpm

6.3.13 Even longitudinal movement of the pipe resulting from gradual increase of number of engaged revolutions shall be watched, significant warming of the connection (not more than 122° F of the ambient temperature) shall not be allowed.

6.3.14 Make-up shall not cause significant mechanical damages like galling, jamming or other imperfections on pipe and coupling body.

The outer surface of coupling shall be free of damages with the depth larger than 0.5% of the coupling nominal outside diameter.

Damages from tong clamps are allowed on the pipe outer surface provided that the actual pipe wall thickness, taking into account depth of the damage, shall be not less than 87.5% of the nominal pipe wall thickness.

After make-up of chromium steel pipes, the trace depth on the pipe body shall be not more than 0.0079 inch.

6.3.15 When using hydrotongs with back up, the following conditions shall be observed:

During the first rotations (better manually, using a chain tong), back up shall be opened, and make-up shall be performed without make-up torque increase. At that it is possible to make horizontal movements of hydrotong (right/left) to prevent thread bite during make-up.

Upon increase of make-up torque (on the last 3 turns), it is required to stop, fix the back up on lower pipe body and continue make-up.

6.3.16 When the value of the final make-up torque equal to M_{max} value is achieved, turning of coupling from the side of mill connection is allowed, if the make-up diagram has not been changed (Figure 11). The final make-up torque values shall be within M_{min} to M_{opt} limits in order to reduce the probability of turning.

6.4 Make-up inspection by the make-up diagram

6.4.1 General provisions

6.4.1.1 The shoulder torque M_{sh} of thread shoulders (box shoulder and pin shoulder) shall be within the range between 15 % and 80 % of the optimum make-up torque M_{opt} .

6.4.1.2 The final make-up torque shall be within the range from the minimum M_{min} to the maximum M_{max} make-up torques.

6.4.1.3 Typical cases of make-up diagram shape non-compliance are shown in Figures 12 – 16.

Any time the make-up curve is of improper shape, giving rise to doubt in make-up quality, break out the connection. Remove compound from the surface of pin and coupling thread connections and inspect it. If there are no damages found during visual inspection, or damages can be repaired, reapply thread compound of the appropriate type and quality on the connection, check the equipment setting and repeat make-up. If the result of make-up is the same as the first time, the pin and coupling shall be rejected.

6.4.2 Correct make-up diagram

6.4.2.1 If make-up is performed correctly and all the thread connection geometric parameters comply with the requirements of the regulatory documentation, the make-up diagram clearly shows defined areas, which correspond to torque increase upon mating of thread (area I), thread and guiding surface (area II), thread and sealing element (area III), thread, sealing and shoulder elements (area IV), as shown in Figure 11 below.

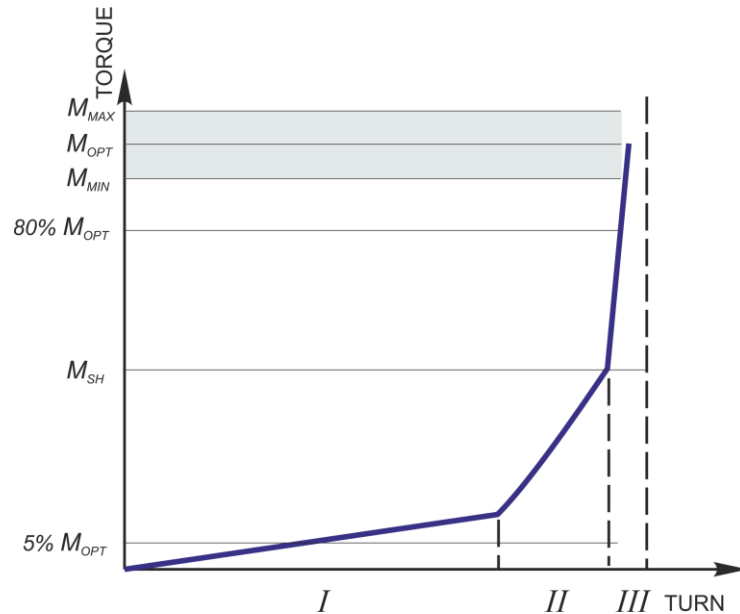


Figure 11

6.4.2.2 The torque increase on the first revolutions of make-up corresponding to the initial mating of thread shall be smooth and even. Torque shall increase upon further mating of thread and guiding surface, mating of sealing elements. The moment of shouldering is followed by sharp increase of torque thus confirming correct process of make-up. Value of torque increase from the moment of the connection shouldering shall be at least 1000 Nm per 0.015 of rotation.

6.4.2.3 Depending on the rotary tong used, its adjustment, and other factors, the make-up diagram (especially in area I) can show areas with insignificant deviations from the straight line: oscillations, leaps, etc. Such deviations shall be deemed acceptable, provided that peak values and shoulder torque M_{sh} value are not exceeded, and it is possible to track areas of mating of thread surfaces, seals and shoulders on the diagram.

6.4.3 Make-up diagram when torque increase stops

If torque increase stops and a horizontal section appears during the final make-up stage (section IV, Figure 12) and there is no slippage of the clamp jaws, the connection shall be broken out and thread surface, thread shoulders and thread seals of pin and coupling shall be visually inspected.

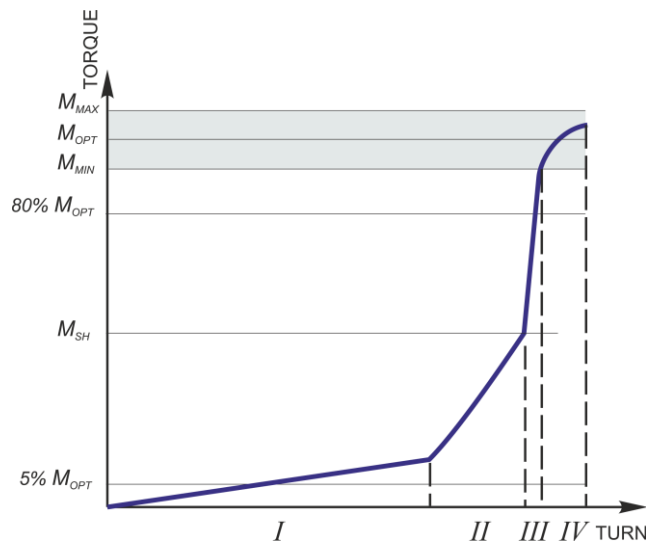


Figure 12

If during inspection no damages and shape distortion such as decrease of pin or box shoulder inside diameter, sagging on coupling inside surface are observed, or damages, that can be repaired, are observed, re-assembly of the connection can be performed upon elimination of all the damages.

6.4.4 Make-up diagram when torque is low

Too low value of shoulder torque (M_{sh}) (below 15% of M_{opt}) on the make-up diagram (Figure 13) may result from:

- Application of wrong type of compound;
- Compound contamination or its poor storage conditions.
- Defects of load sensor.

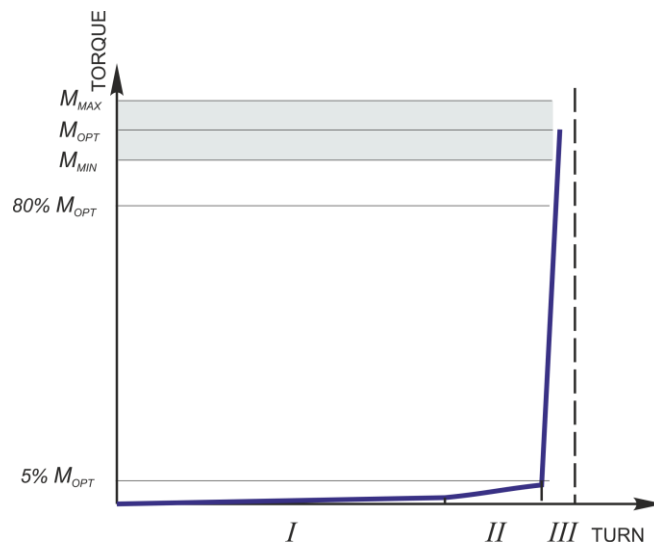


Figure 13

Break out the connection, clean off the compound and inspect it. If the visual inspection is satisfactory, reapply thread compound of the appropriate type and quality and make-up the connection again.

6.4.5 Make-up diagram when torque is high

Too high value of shoulder torque (M_{sh}) (over 80% of M_{opt}) on the make-up diagram (Figure 14) may result from:

- Damage of thread and/or thread seals;
- Improper thread cleaning;
- Application of wrong type of compound;
- Thread compound contamination or high density of thread compound (for example, at low temperatures);
- Defects of load sensor.

Break out the connection, clean off the compound and inspect it. If the visual inspection is satisfactory, reapply thread compound of the appropriate type and quality and make-up the connection again.

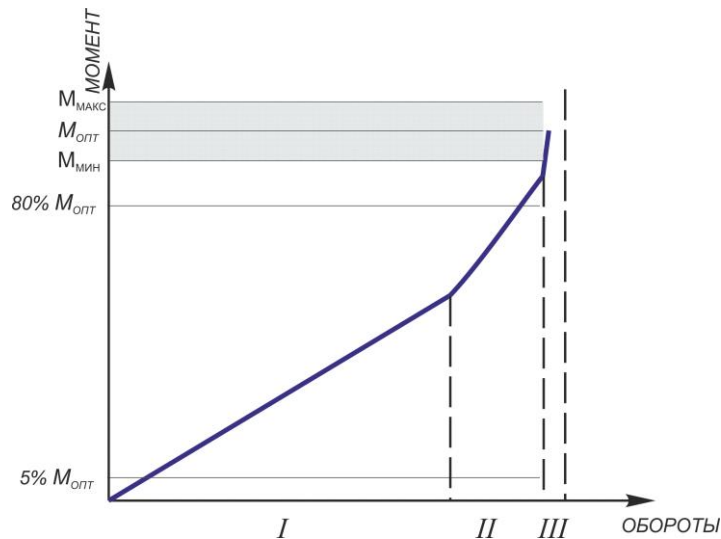


Figure 14

If the shape of the make-up diagram after re-make-up has not changed, the pipe shall be laid aside and make-up with another pipe shall be performed. The laid aside pipe is allowed to be used for further make-up if no damages are observed or the damages can be repaired. After the damages are repaired, reapply the thread compound of the appropriate type and quality, check the settings of equipment and repeat make-up. If the shape of the make-up diagram, when being made-up with another pipe, has not changed, the connection shall be broken-out and the previous pipe shall be replaced.

6.4.6 Make-up diagram with torque leaps

Torque leaps on the make-up diagram (Figure 15) may result from:

- Uneven application of thread compound;
- Misalignment of coupling make-up equipment;
- Insufficient force of rotation on shoulder;
- Slippage of clamp jaws.

Such a diagram is considered good and may be accepted according to requirements specified in para. 6.4.2.4.

Otherwise break out the connection, clean off the compound and inspect it. If the visual inspection is satisfactory, reapply thread compound of the appropriate type and quality, check tongs placement, alignment of made-up pipes, make sure there is no slippage of clamp jaws and make-up the connection again.

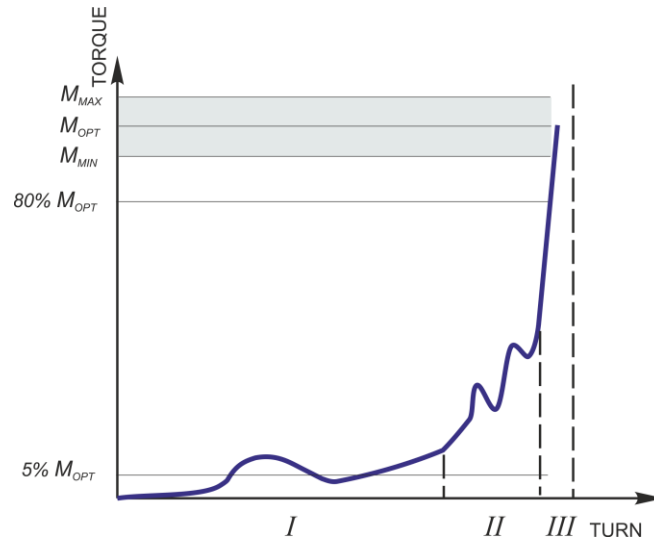


Figure 15

If the shape of the make-up diagram after re-make-up has not changed, the pipe shall be laid aside and make-up with another pipe shall be performed. The laid aside pipe is allowed to be used for further make-up if no damages are observed or the damages can be repaired. After the damages are repaired, reapply the thread compound of the appropriate type and quality, check the settings of equipment and repeat make-up.

If the shape of the make-up diagram, when being made-up with another pipe, has not changed, the connection shall be broken-out and the previous pipe shall be replaced.

6.4.7 Make-up diagram with a wave-like effect

Make-up curve with a wave-like effect (Figure 16) may result from:

- Improper thread cleaning;
- Thread compound contamination or high density of thread compound (for example, at low temperatures);
- Excess of compound.

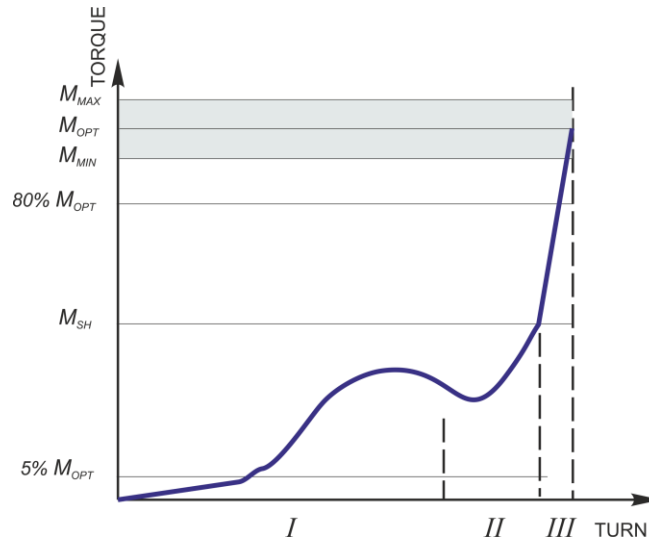


Figure 16

Such a diagram is considered good and may be accepted according to requirements specified in para. 6.4.2.4, otherwise or in case of any doubts concerning the make-up quality, the connection shall be broken out, cleaned and inspected for damages. If there are no damages, reapply thread compound of the appropriate type, quality and quantity, and make-up the connection again.

6.5 Break-out of string

6.5.1 When the string is being pulled out of the well, pin end faces are not allowed to hit against coupling end faces.

6.5.2 Even longitudinal movement of the pipe resulted from gradual increase of number of engaged turns, shall be watched when the connection is broken-out.

A driller fixes the weight on a hook load free, provides tension within 100÷150 kg, and tries to maintain these values in the process of breaking-out. On the last turn pipe moving up shall be stopped in order to fix thread run-out (a click) and after that the pin shall be moved out of the coupling.

6.5.3 Prior to break-out, the rotary tong shall be positioned as per Figure 6.

6.5.4 Break-out torque shall provide for the connection disassembly.

Reduce of thread connection break-out torque by 20% relative to the recommended optimum make-up torque M_{opt} is allowed.

6.5.5 Speed of connection break-out by rotary tong shall correspond to the speed, specified in Table 7.

Table 7 – Rotation speed during break-out

Start of break-out		End of break-out
First two turns	Further turns	
Speed maximum 2 rpm,	Speed maximum 10 rpm	Speed maximum 5 rpm

6.5.6 Make-up shall not cause significant mechanical damages like galling, jamming or other imperfections on pipe and coupling body.

The outer surface of coupling shall be free of damages with the depth larger than 0.5% of the coupling nominal outside diameter.

Damages from tong clamps are allowed on the pipe outer surface provided that the actual pipe wall thickness, taking into account depth of the damage, shall be not less than 87.5% of the nominal pipe wall thickness.

After break-out of chromium and corrosion-resistant steel pipes, the trace depth on the pipe body shall be not more than 0.0079 inch.

6.5.7 When the string is disassembled, immediately after break-out thread protectors shall be installed on pin and coupling ends.

6.5.8 If it is necessary to store used pipes after string disassembly, the following preparations shall be carried out:

- Visual inspection of thread protectors for damages;
- Visual inspection of pipes and couplings for significant mechanical damages (like galling, jamming etc.);
- Cleaning of external and internal thread connections from compound and contaminations;
- Visual inspection of thread, thread seals and thread shoulders surfaces of pins and coupling (ref. para. 5.5). In case of any damages detection according to Table 1 perform repair or reject the pipes and couplings;
- Cleaning of thread protectors from previously applied compound and contaminations (ref. para. 5.8);
- Application of storage compound Kendex OCTG, BESTOLIFE Storage Compound (BSC), Total Jet Marine, RUSMA storage compound or thread compound with storage properties on thread connections of pins and couplings and installation of thread protectors.

6.6 Make-up inspection by make-up triangle

When optimum make-up torque value is reached, coupling end-face shall coincide with the base of make-up triangle (transverse stripe) on the pin with allowable deviation not more than ± 0.0197 inch.

7 Developer's warranty

Provided that the present recommendations are met, TMK UP CENTUM thread connection shall withstand at least 3 make-up and break-out cycles preserving the same technical characteristics.

Annex A (mandatory)

Equipment for make-up registration

TMK UP CENTUM thread connection shall be made-up using equipment for make-up registration and saving of make-up diagram (make-up curve) in a graphical or electronic format.

The curve is plotted based on torque values along the vertical axis and number of turns along the horizontal axis which shall have a linear scale. Only two last revolutions shall be displayed as torque increases at the end of make-up.

When using a computer, a make-up diagram shall have the following characteristics:

- Sufficient resolution (at least 800×600 pixels) for precise curve profile display. Display shall be at least 25 cm in diagonal, herewith make-up curve shall take at least 80 % of display;
- Display of minimum and maximum torque with horizontal lines (if required, optimum torque shall be displayed);
- Display of minimum and maximum shoulder torque of thread shoulders with horizontal lines;
- Automatic and manual determination of shoulder torque of thread shoulders;
- Display of rig floor number of each make-up;
- Display of date and time of each make-up;
- Availability of comments;
- Display of company-customer name, well number, pipe diameter, weight, steel grade, type of thread connection, thread compound data and pipe manufacturer;
- When applicable, superimposing of the latest make-up curve over the curves of previous satisfactory make-up diagrams;
- When applicable, display of make-up speed in rpm, either on the make-up curve or on a separate graph.

Acceptance or rejection of make-up operations shall not be based on displayed make-up results. Correctness of make-up shall be confirmed by a competent specialist.

***Prior to running the casing downhole
the calibration certificate with the latest and next planned equipment
calibration dates shall be checked!***