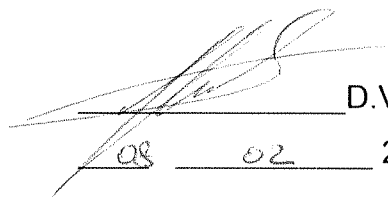




**APPROVED BY**

Director of Development

TMK - Premium Services LLC

  
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D.V. Nikiforov  
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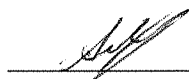
**Guidelines  
For Use of Casing  
with TMK UP MAGNA Thread Connection**

**RE PS 02-018-2015**

**Revision 2**

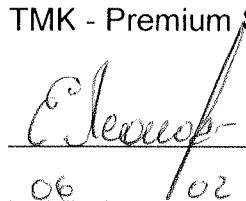
**CHECKED BY**

Head of Experimental Design Bureau  
TMK - Premium Services LLC

  
\_\_\_\_\_  
A.S. Myslevtsev  
07 02 2017

**DESIGNED BY**

Head of Serial Design Bureau  
TMK - Premium Services LLC

  
\_\_\_\_\_  
E.V. Leonov  
06 02 2017

**2017**

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## 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”.

# Guidelines for Use of Casing with TMK UP MAGNA Thread Connection

Effective date: February 17, 2017

## 1 Scope

The present guidelines contain recommendations for maintenance and use of casing with TMK UP MAGNA 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;

TU 0254-001-46977243-2008 RUSMA-1 I Thread Compound;

TU 0254-028-46977243-2004 RUSMA P-5 inhibited Thread Compound;

TU 0254-031-46977243-2004 RUSMA P-4 Thread Compound;

TU 0254-068-46977243-2011 RUSMA P-14 Thread Compound;

TU 0254-102-46977243-2011 RUSMA SP Thread 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:** Excessive turns after shoulder to ensure thread connection tightness.

3.2 **pin (pin connection):** A thread connection on Oil Country Tubular Goods (OCTG) that has external (male) threads and/or seal, shoulder.

3.3 **box (box connection):** A thread connection in Oil Country Tubular Goods (OCTG) that has internal (female) threads and/or seal, shoulder.

3.4 **thread shoulders:** Pin shoulder and box shoulder.

3.5 **pin shoulder:** Pin face which serves as an arrester during make-up.

3.6 **box shoulder:** Internal barrier which serves as an arrester during 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 and thread shoulders 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 11.1811 to 1.5748 inches 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 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 that might result in pipe and coupling thread damage even with protectors in place.

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 upper pipe end in a bundle 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 forklift, gripping forks, frames and clamps with nonmetallic coating shall be used.

4.2.5 Handling operations for chromium steel pipes shall exclude collision with hard bodies having sharp edges that can result in sufficient local increase of pipe surfaces hardness and affect the sulphide stress cracking resistance.

### 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 stockholding shall be performed in compliance with Materials, Equipment and Spare Parts Stockholding and Storage Guidelines at production and technical maintenance facilities ensuring their preservation and avoiding damage of pin and coupling threads, surfaces or shapes.

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

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

**There shall be no stones, sand, and dirt on racks!**

4.3.4 When several pipe 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 inches 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 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 with RUSMA-SP compound for more than 6 months or for more than 12 months the compound under safety parts shall be renewed before usage.

For this purpose the following actions shall be performed:

- remove thread protectors according to para. 5.3;
- remove initial compound according to para. 5.4;
- apply rust-preventing compound (Kendex OCTG type or similar) 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 new thread protectors according to para. 5.8.

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 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 be sure that the first pipe according to the work plan is not under the pipes that shall be run later. Pipes shall be placed onto racks in such a way so that to ensure couplings are facing the wellhead.

## **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 pin and coupling thread connections;
- inspect pin and coupling surfaces of thread connections;
- drift pipes along the entire length;
- measure the length of each pipe;
- re-install clean thread protectors on pins and couplings.

### **5.2 Visual inspection**

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



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

Pipes, couplings, thread protectors with significant 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**

Thread protectors shall be removed after thread connections are visually inspected.

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

### **5.4 Compound removal**

Upon removal of thread protectors, pin and coupling 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 solvent (Nefras, white spirit or similar). After compound is removed, 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!***

Barite or metal brushes can cause scratches on surfaces of thread shoulders resulting in loss of tightness.

After compound is removed, thread connections shall be purged with compressed air or cleaned with dry rags.

When using RUSMA-1 **I** thread compound, RUSMA-SP or similar thread compound under thread protectors, the compound removal is not required. At that make sure that:

- the compound is free of foreign particles;
- 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 service life of compound is not expired and the pipe was manufactured not more than 3 months ago.

## 5.5 Thread connection inspection

Thread connection shall be inspected by the following specialists:

- crews for casing strings assembly;
- companies specialized in casing inspection;

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

When inspecting pin and coupling connections, including thread surface and thread shoulders 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 compound components.

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

Possible types of damages of thread and thread shoulders surfaces of pins and couplings, as well as repair methods are specified in Table 1.

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

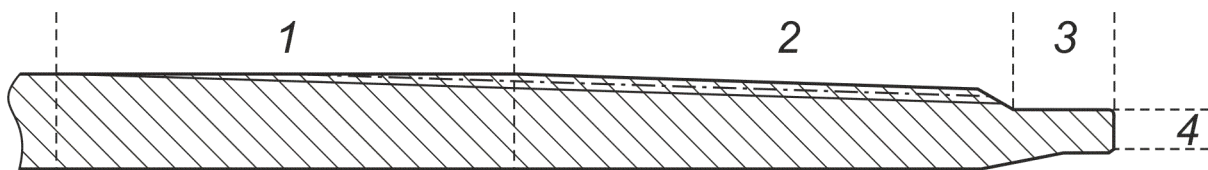
- a mould taken from a detected defect using special tape (X Coarse material of Testex company for defects up to **0.0039 inches** deep, for deeper defects: X-Coarse Plus or equivalent). Mould height shall be measured with a thickness gage, measurement accuracy shall be at least **0.0039 inches** (PEACOCK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

- depth gage with a needle-type contact point (contact point diameter shall be maximum **0.0039 inches**), measurement precision shall be minimum **0.0039 inches** (PEACOCK T-4 or equivalent).

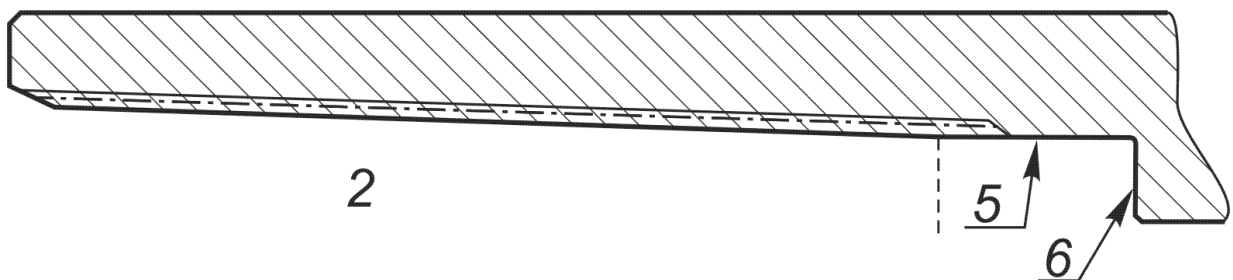
If any unacceptable damages are detected on pipes, such pipes shall be rejected then and reported accordingly specifying pipes serial numbers, describing defects found with photos attached.

**Table 1 – Types of damages and methods of repair**

Surface area (Figure 1)	Type of damage	Damage repair method
1, 2, 4, 6	Pit corrosion less than 0.0039 inches deep or insignificant surface rust	Manual repair (removal) using non-metal brush with soft bristle or polishing paper with grain 0
	Pit corrosion more than 0.0039 inches deep	Not to be repaired
	Burrs less than 0.0118 inches wide. Tears and scratches less than 0.0039 inches deep	Manual repair using needle file or polishing paper with grain 0
	Dents, nicks and other mechanical damages	Not to be repaired
4, 6	Pit corrosion less than 0.0118 inches deep or insignificant surface rust	Manual repair using needle file or polishing paper.
	Pit corrosion more than 0.0118 inches deep	Not to be repaired
	Burrs less than 0.0118 inches wide. Tears and scratches less than 0.0118 inches deep	Manual repair using needle file or polishing paper with grain 0



a) – Surface of external thread connection



b) – Surface of internal thread connection

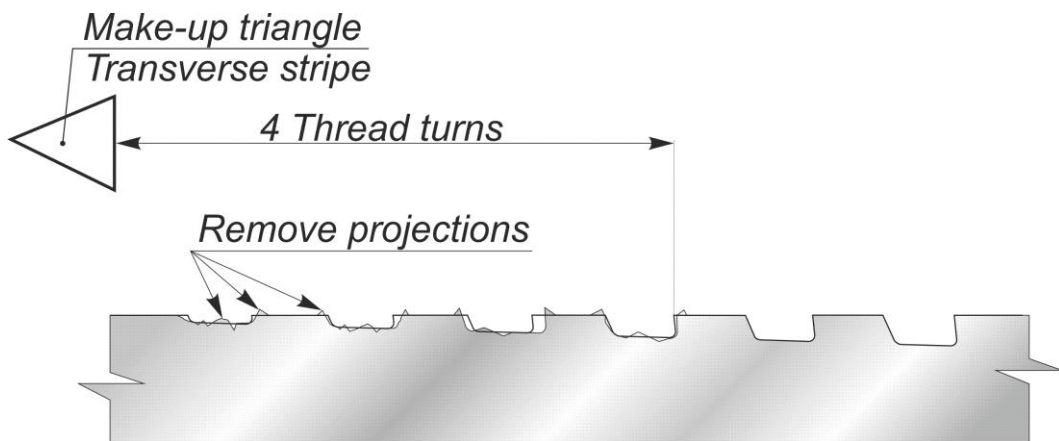
1 – imperfect profile thread; 2 – perfect profile thread; 3 – cylinder groove; 4 – pin shoulder; 5 – cylinder bore  
6 – box shoulder;

**Figure 1 – Surfaces of pin and coupling connections**

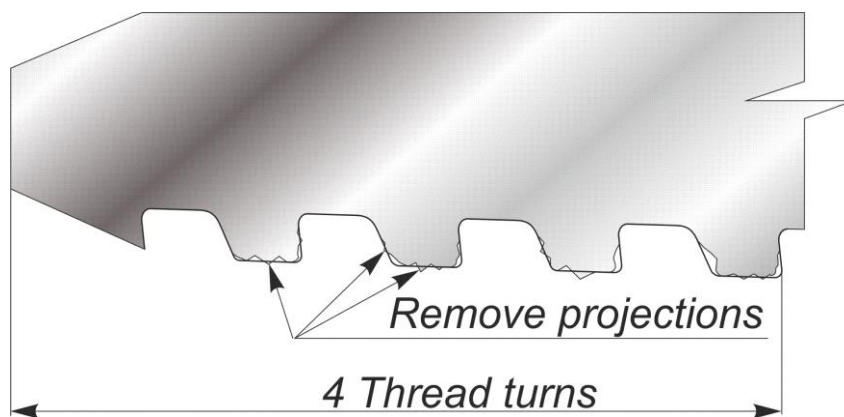
Possible types of damages of thread, thread seals and thread shoulders surfaces of pins and couplings during make-up, as well as repair methods are specified in Table 2.

**Table 2 – Types of damages and methods of repair**

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



a) – Surface of external thread connection



b) – Surface of internal thread connection

**Figure 2 – Surface of pin and coupling connections**

## 5.6 Drifting

Pipes should be checked by drift along the entire length of the pipe. For pipes made of chromium and corrosion-resistant steels polymer or aluminium drifts shall be used.

Before 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 crust.

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

Dimensions of the drift effective part shall comply with those specified in Table 2. Diameter of the effective part of the drift shall be checked in three planes along the entire length after each 50 pipes check. If the diameter decreases by more than 0.0197 inches in any of the three planes, such a drift shall be rejected.

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

If the drift cannot pass through the pipe, such a pipe shall be replaced with another pipe.

Pipes rejected during drifting process, shall be put aside until further decision on their validity.

**Table 2 – Dimensions of the effective part of the drift**

Pipe outside diameter, inch	Length of the effective part of the drift, inch	Diameter of the effective part of the drift, inch
8 5/8	5.9843	$d - 0.1252$
9 5/8 to 13 5/8 incl.	12.0079	$d - 0.1563$
14 – 20	12.0079	$d - 0.1874$

Note –  $d$  is a nominal pipe inside diameter.

## 5.7 Measurement of length of pipes

Length of each pipe shall be measured from free (without a thread protector) coupling end-face to free (without 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 pipe body with a marker or chalk.

When calculating the total length of the string, one should use the formula specified below

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

where  $L$  – the total length of the string;

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

$n$  – number of pipes in a string;

$\Delta L$  – decrease of length of pipes during make-up (ref. Table 3).

**Table 3 – Decrease of pipe length during make-up process**

Pipe outside diameter, inch	Wall thickness, inches	Decrease of pipe length during make-up $\Delta L$ , inches
8 5/8	All the walls	4.6378
9 5/8	All the walls	4.6378
9 7/8	All the walls	4.6378
10 3/4	All the walls	4.6378
10 3/4	All the walls	4.6850
13 3/8	All the walls	4.6850
14	Above 0.4921	4.7165
16	Up to 0.4921	4.2756
	Above 0.4921	4.7165
16 3/4	Up to 0.4921	4.2756
18 5/8	Above 0.4921	4.3386
20	Up to 0.4921	4.3386
	Above 0.4921	4.7795

### 5.3 Thread protectors installation

Upon performance of inspection and control, thread protectors or caps shall be re-installed on pin and couplings ends.

Removed thread protectors can be re-used on the condition that prior to installation they have been thoroughly cleaned (including cleaning from conservation compound that was earlier applied) and do not have considerable damages, affecting protection of thread and thread shoulders from direct environmental impact.

Cleaning of protectors from conservation compound shall comply with the requirements for cleaning of pin and coupling thread connections according to para. 5.4.

## 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, all surfaces of thread and thread shoulders of pins and couplings shall be provided with thread compound. Thread compound shall comply with requirements specified in API RP 5A3/ISO 13678.

The following thread compounds are recommended:

- RUSMA-1 I as per TU 0254-001-46977243 [REDACTED];
- RUSMA P-5 as per TU 0254-028-46977243;
- RUSMA P-4 as per TU 0254-031-46977243 [REDACTED];
- RUSMA SP as per TU 0254-102-46977243.

While making-up pipes of chromium steels, RUSMA-14 compound shall be used per TU 0254-068-46977243.

Upon coordination with the connection designer, other than mentioned thread compounds may be applied; provided they comply with RP 5A3/ISO 13678 requirements and provide for thread connection sealability, as well as for protection from galling and corrosion.

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.***

***Compound shall never be placed in other packages or dissolved***

***!***

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.

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;

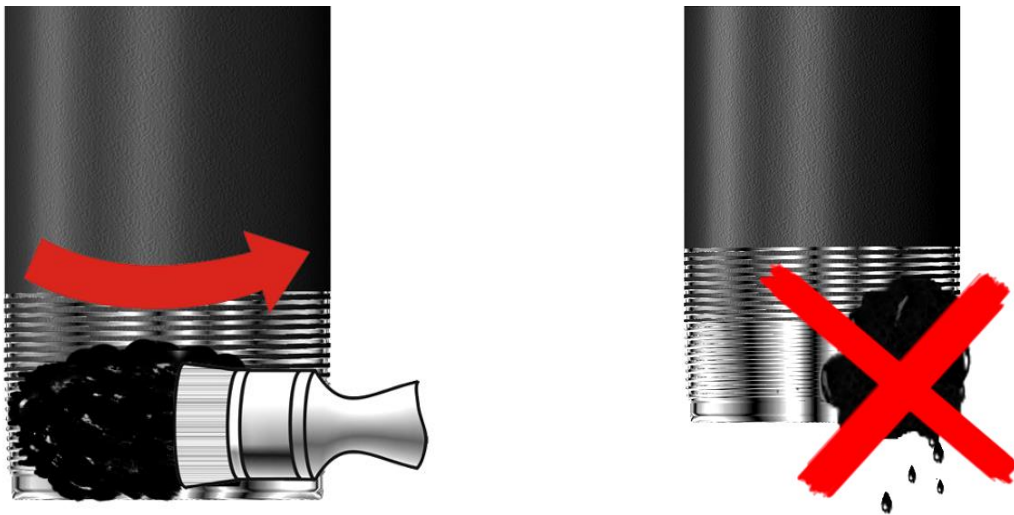
- warm up compound before application in case of freezing temperatures.

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.

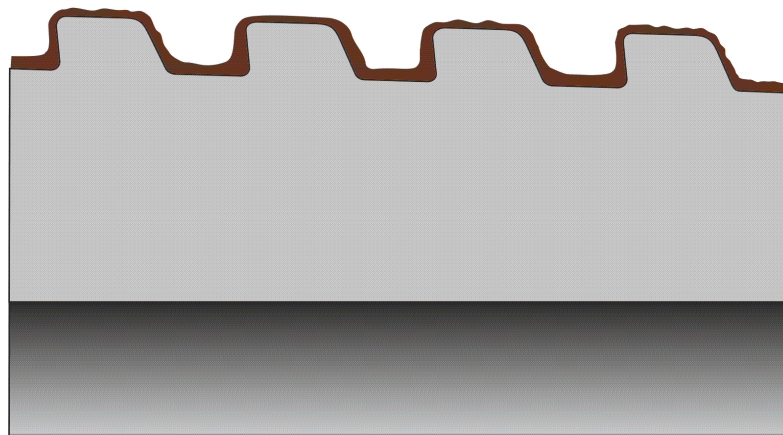
6.1.3 Thread compound shall be applied with an even layer on the whole thread surface and thread shoulders of pins and couplings connections. Figures 3 and 4 demonstrate proper and improper application of compound.

Compound shall be applied only on thoroughly cleaned and dried (as per para. 5.4) surface of thread connection.

***Never use metal brushes for compound application!***



**Figure 3 – Proper and improper application of thread compound**



**Figure 4 – Proper distribution of thread compound over thread profile**



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

The minimum and the maximum compound mass  $m_{min}$  и  $m_{max}$  in grams for make-up of one thread connection shall be calculated as follows:

$$m_{min} = 0.014 \times D \quad (2)$$

$$m_{max} = 0.017 \times D \quad (3)$$

where  $m_{min}$  is the minimum compound mass in grams rounded to an integral value;

$m_{max}$  is the maximum compound mass in grams rounded to an integral value;

$D$  is the nominal outside diameter of pipes, in inches, rounded to an integral value.

**Example – The minimum quantity of thread compound required for make-up of one pin connection with an outside diameter of 16.7717 inches:**

$$m_{min} = 0.014 \times 16.7717 = 0.2348 \approx 0.23$$

**at that at least 0.156 lb shall be applied on coupling end and at least 0.077 lb on pin.**

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 is available.

6.1.5 Thread sealant can be used for make-up of pipes with crossovers or other string elements provided the below conditions are followed:

- Shoulder torque of thread shoulders is within the limits of minimum and maximum make-up torques;
- Shoulder torque of thread shoulders is from 70 % to 80 % of optimum make-up torque, and the torque of rotation on shoulder is higher than optimum make-up torque;
- Shoulder torque of thread shoulders is higher than 80 % of optimum make-up torque and it does not result from thread jamming or damage, and 20 % of optimum make-up torque is applied after the shoulders interlock.

## 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 in compliance with the tong manufacturer recommendations);
- Make-up triangle (cross stripe).

6.2.2 A special stab guide or bell guide is recommended for running and pulling operations (Figure 5). The devices help to align pin and coupling and prevent the connections from damage.

6.2.3 In order to decrease 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, it is required to coordinate actions of a hydraulic tong unit operator and a driller (in the process of make-up it is required to provide longitudinal compensation controlled by weight sensor on a hook).

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



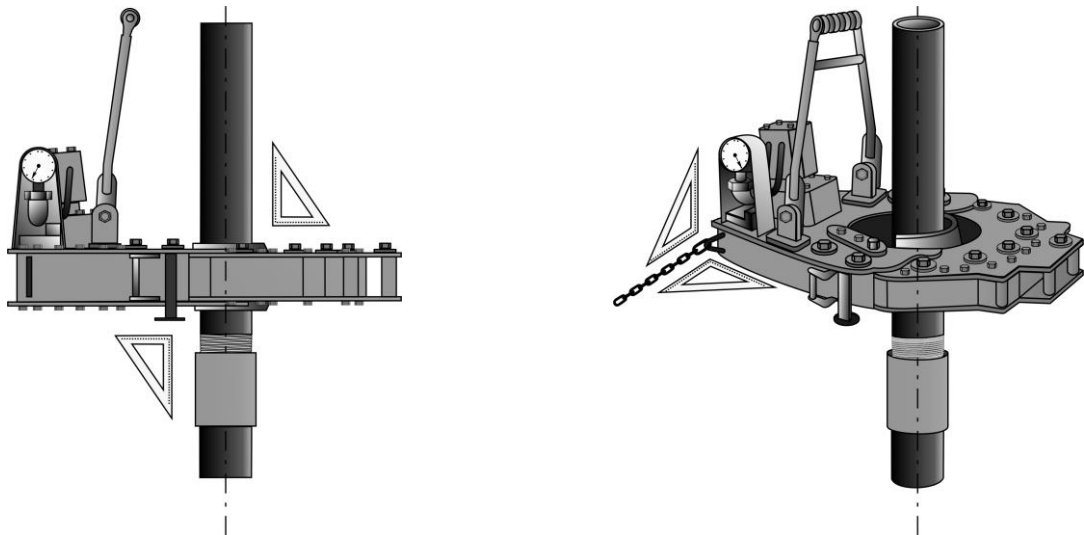
**Figure 5 – Make-up with special bell guide**

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 specific pipe sizes to ensure a larger contact area with the pipe body. Clamp diameter shall be 1% greater than 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 – Rotary tongs positioning before make-up**

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

### **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 and check by touch surfaces of thread shoulders of the free pin for any mechanical damage, check the assembled pipes for alignment (Figures 7 and 8).

6.3.3 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.

Maximum misalignment of connected pipes shall not exceed 0.7874 inches.

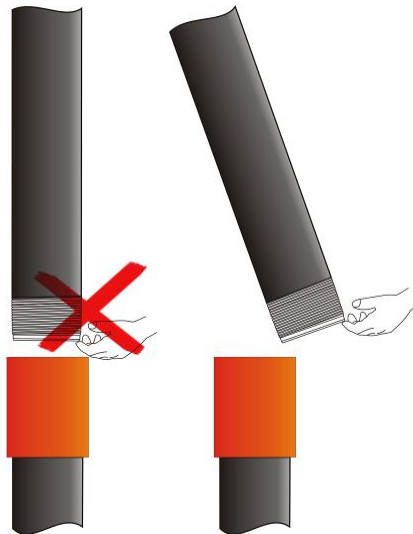


Figure 7 – Mechanical damage inspection

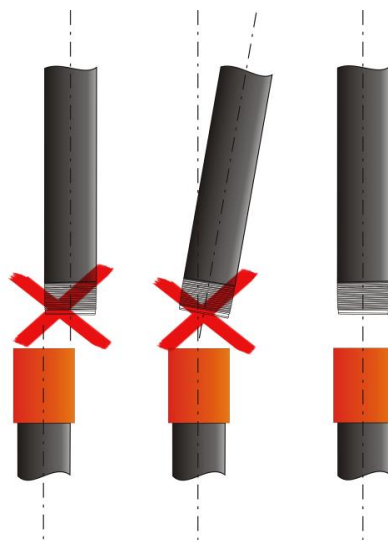


Figure 8 – Alignment inspection

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

6.3.5 Make sure prior to make-up, that surfaces of thread 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 Make-up shall be performed with the torque specified in Table 4.

If thread connection make-up with torque within the limits shown in Table 4 is not in compliance with specified requirements,  $M_{opt}$  can be corrected but not more than by  $\pm 10\%$ . At that, the values of  $M_{min}$  and  $M_{max}$  shall be corrected as well but not more than by  $\pm 10\%$  from corrected  $M_{opt}$ .

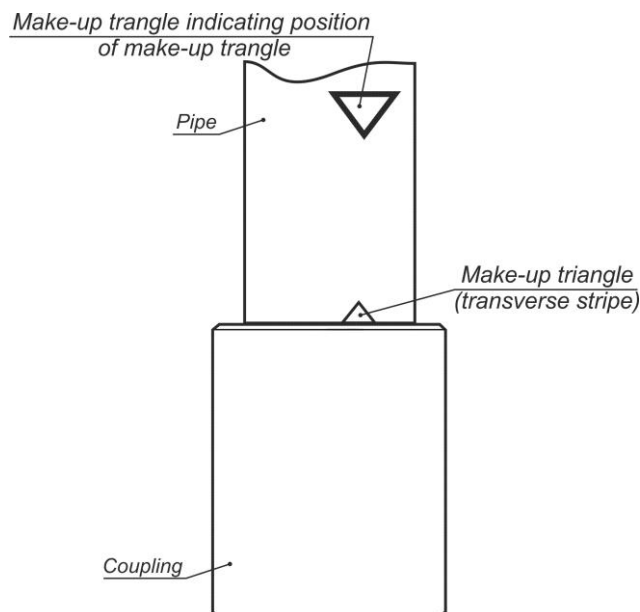
6.3.7 During make up of pins and couplings made of steels of different grades, the make-up torque value shall be chosen according to the lowest steel grade of both pin and coupling.

6.3.8 Make-up of pins and couplings shall be performed with the use of make-up registering equipment, by make-up diagrams, or without registering equipment, by visual make-up marks.

Make-up with make-up registering equipment is the preferred one as it allows assessing make-up quality by the diagrams. The equipment used shall comply with the requirements specified in the Attachment A.

Make-up without make-up registering equipment is performed using make-up torques and make-up triangle on a pin (Figure 9). A transverse stripe (in light paint) can be made on the pin 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.

6.3.9 When making-up pin and coupling, the first two turns shall be carried out manually. Application of chain tong is also allowed.



**Figure 9 – Make-up with make-up triangle**

Table 4 – Make-up torques

D, Inch	S, Inch	Torque, ft lb for steel grades																										
		J55, K55			N80, L80			C90			R95, C95,T95			C110, P110			Q125			Q135			TMK140			TMK150		
		Mmin	Mopt	Mmax	Mmin	Mopt	Mmax	Mmin	Mopt	Mmax	Mmin	Mopt	Mmax	Mmin	Mopt	Mmax	Mmin	Mopt	Mmax	Mmin	Mopt	Mmax	Mmin	Mopt	Mmax	Mmin	Mopt	Mmax
219.08	10.16	9300	10300	11400	10800	11900	13100	10800	11900	13100	10800	11900	13100	10800	11900	13100	10800	11900	13100	10800	11900	13100	10800	11900	13100	10800	11900	13100
	11.43	10200	11300	12400	11700	13100	14400	11700	13100	14400	11700	13100	14400	11700	13100	14400	11700	13100	14400	11700	13100	14400	11700	13100	14400	11700	13100	14400
	12.70	11100	12400	13600	12900	14300	15700	12900	14300	15700	12900	14300	15700	12900	14300	15700	12900	14300	15700	12900	14300	15700	12900	14300	15700	12900	14300	15700
244.48	10.03	9200	10300	11300	10700	11900	13100	10700	11900	13100	10700	11900	13100	10700	11900	13100	10700	11900	13100	10700	11900	13100	10700	11900	13100	10700	11900	13100
	11.05	9800	10900	12000	11400	12600	13900	11400	12600	13900	11400	12600	13900	11400	12600	13900	11400	12600	13900	11400	12600	13900	11400	12600	13900	11500	12800	14000
	11.99	10400	11600	12800	12100	13400	14700	12100	13400	14700	12100	13400	14700	12100	13400	14700	12100	13400	14700	12100	13400	14700	12100	13400	14700	12200	13500	14800
	13.84	11500	12800	14000	13300	14800	16300	13300	14800	16300	13300	14800	16300	13500	15000	16400	13500	15000	16400	13500	15000	16400	13500	15000	16400	13600	15000	16500
	15.11	12300	13600	15000	14300	15900	17500	14300	15900	17500	14300	15900	17500	14300	15900	17500	14300	15900	17500	14300	15900	17500	14300	15900	17500	14500	16100	17700
250.83	15.88	11700	13000	14300	13500	15000	16400	13500	15000	16400	13500	15000	16400	13500	15000	16400	13500	15000	16400	13500	15000	16400	13500	15000	16400	13500	15000	16400
	16.79	12100	13400	14700	13900	15500	17000	13900	15500	17000	13900	15500	17000	13900	15500	17000	13900	15500	17000	13900	15500	17000	13900	15500	17000	13900	15500	17000
	18.29	12700	14100	15500	14700	16300	17900	14700	16300	17900	14700	16300	17900	14700	16300	17900	14700	16300	17900	14700	16300	17900	14700	16300	17900	14700	16300	17900
273.05	10.16	8400	9400	10300	9700	10800	11900	9700	10800	11900	9700	10800	11900	9700	10800	11900	9700	10800	11900	9700	10800	11900	9700	10800	11900	9700	10800	11900
	11.43	9100	10200	11200	10500	11700	12900	10500	11700	12900	10500	11700	12900	10500	11700	12900	10500	11700	12900	10500	11700	12900	10500	11700	12900	10500	11700	12900
	12.57	9700	10800	11900	11300	12500	13800	11300	12500	13800	11300	12500	13800	11300	12500	13800	11300	12500	13800	11300	12500	13800	11300	12500	13800	11300	12500	13800
	13.84	10400	11600	12800	12100	13400	14700	12100	13400	14700	12100	13400	14700	12100	13400	14700	12100	13400	14700	12100	13400	14700	12100	13400	14700	12100	13400	14700
	15.11	11100	12400	13600	12900	14300	15700	12900	14300	15700	12900	14300	15700	12900	14300	15700	12900	14300	15700	12900	14300	15700	12900	14300	15700	12900	14300	15700
323.85	11.00	11900	13200	14500	13700	15300	16800	13700	15300	16800	13700	15300	16800	13700	15300	16800	13700	15300	16800	13700	15300	16800	13700	15300	16800	13700	15300	16800
	12.40	13000	14400	15900	15000	16600	18300	15000	16600	18300	15000	16600	18300	15000	16600	18300	15000	16600	18300	15000	16600	18300	15000	16600	18300	15000	16600	18300
	14.00	14200	15700	17300	16300	18100	20000	16300	18100	20000	16300	18100	20000	16300	18100	20000	16300	18100	20000	16300	18100	20000	16300	18100	20000	16300	18100	20000
339.72	10.92	11700	13000	14300	13600	15000	16500	13600	15000	16500	13600	15000	16500	13600	15200	16700	13600	15200	16700	13600	15200	16700	13600	15200	16700	13700	15300	16800
	12.19	12700	14100	15500	14700	16300	17900	14700	16300	17900	14700	16300	17900	14700	16400	18000	14700	16400	18000	14700	16400	18000	14700	16400	18000	14700	16400	18000
	13.06	13400	14900	16400	15500	17200	18900	15500	17200	18900	15500	17200	18900	15500	17200	18900	15500	17200	18900	15500	17200	18900	15500	17200	18900	15500	17200	18900
355.6	14.27	18900	20900	23000	21600	24000	26500	21600	24000	26500	21600	24000	26500	21600	24000	26500	21600	24000	26500	21600	24000	26500	21600	24000	26500	21600	24000	26500
	16.66	21800	24300	26700	25100	27900	30700	25100	27900	30700	25100	27900	30700	25100	27900	30700	25100	27900	30700	25100	27900	30700	25100	27900	30700	25100	27900	30700
406.4	11.13	19000	21200	23300	21900	24300	26800	21900	24300	26800	21900	24300	26800	21900	24300	26800	21900	24300	26800	21900	24300	26800	21900	24300	26800	21900	24300	26800
	12.57	22100	24500	26900	25400	28200	31000	25400	28200	31000	25400	28200	31000	25400	28200	31000	25400	28200	31000	25400	28200	31000	25400	28200	31000	25400	28200	31000
	16.66	26300	29300	32200	29900	33200	36500	29900	33200	36500	29900	33200	36500	29900	33200	36500	29900	33200	36500	29900	33200	36500	29900	33200	36500	29900	33200	36500
426.0	10.00	18100	20100	22100	20900	23200	25400	20900	23200	25400	20900	23200	25400	20900	23200	25400	20900	23200	25400	20900	23200	25400	20900	23200	25400	20900	23200	25400
	11.00	19900	22100	24300	22900	25400	28000	22900	25400	28000	22900	25400	28000	22900	25400	28000	22900	25400	28000	22900	25400	28000	22900	25400	28000	22900	25400	28000
	12.00	21700	24100	26500	24900	27700	30500	24900	27700	30500	24900	27700	30500	24900	27700	30500	24900	27700	30500	24900	27700	30500	24900	27700	30500	24900	27700	30500
473.08	11.05	22600	25100	27700	26000	28900	31800	26000	28900	31800	26000	28900	31800	26000	28900	31800	26000	28900	31800	26000	28900	31800	26000	28900	31800	26000	28900	31800
	12.32	25200	28000	30800	29000	32200	35400	29000	32200	35400	29000	32200	35400	29000	32200	35400	29000	32200	35400	29000	32200	35400	29000	32200	35400	29000	32200	35400
508.0	11.13	21800	24300	26700	25100	27900	30700	25100	27900	30700	25100	27900	30700	25100	27900	30700	25100	27900	30700	25100	27900	30700	25100	27900	30700	25100	27900	30700
	12.70	25400	28200	31000	29200	32400	35700	29200	32400	35700	29200	32400	35700	29200	32400	35700	29200	32400	35700	29200	32400	35700	29200	32400	35700	29200	32400	35700
	16.13	29500	32700	36000	29900	33200	36500	29900	33200	36500	29900	33200	36500	29900	33200	36500	29900	33200	36500	29900	33200	36500	29900	33200	36500	29900	33200	36500
N o t e. Make-up with special couplings shall be performed using torques 20% less than the specified.																												

6.3.10 When making-up chromium steels pipes, the first two turns shall be carried out manually, or a strap tong can be used (Figure 10). Chain tong is allowed for use only under condition 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 – Make-up start with strap tongs**

6.3.11 Make-up rotation speed during connection make-up with the rotary tong shall correspond to the values specified in Table 5.

**Table 5 – 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 2 rpm

6.3.12 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 50 °C of the ambient temperature) shall not be allowed.

6.3.13 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% from the coupling nominal outside diameter.

Damages from tong clamps are allowed on the pipe outer surface under condition that the actual pipe wall thickness taking into account depth of the damage shall be not less than 87,5% from the nominal pipe wall thickness.

After make-up of chromium steel pipes the mark on the pipe body shall not be deeper than 0.0079 inches.

6.3.14 At the initial stage of assembling it is recommended to perform the first two revolutions of pipe using chain 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.

6.3.15 When the maximum value of the final make-up torque ( $M_{max}$ ) is achieved, turning of coupling from the side of mill connection is allowed, if the diagram is not changed during correct make-up (Figure 10). 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

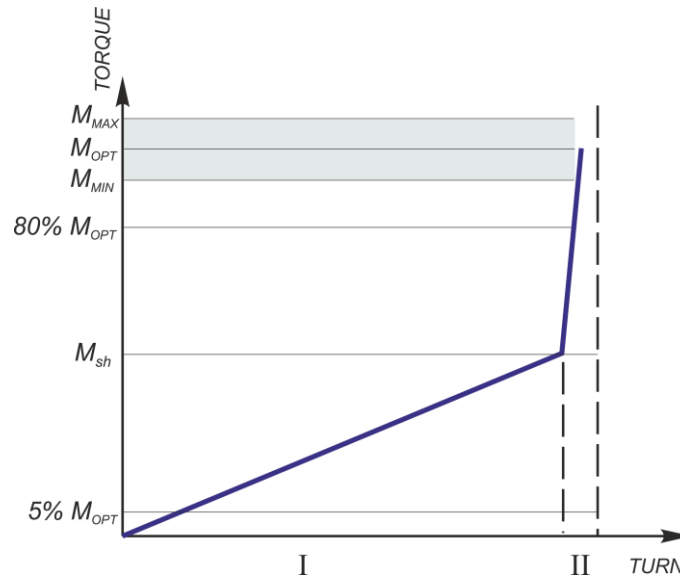
### 6.4.1 Make-up inspection by the make-up diagram

6.4.1.1 If the make-up is performed correctly and all the thread connection geometric parameters comply with the requirements of the regulatory documentation, the make-up diagram will show defined areas, which correspond to torque increase due to thread surfaces mating (area I), and the further mating of thread shoulders (area II), as shown in the Figure 11.

The rotary torque increase on the first revolutions corresponding to the initial mating of thread surfaces shall be smooth and even. Then upon mating of thread surfaces and thread shoulders, a sharp increase of torque is observed which confirms that make-up is performed correctly.

Depending on the rotary tong used and its adjustment the make-up diagram (especially in area I) can show areas with insignificant deviations from straight line: oscillations, leaps, etc. Such deviations shall be deemed acceptable if general view of the make-up diagram corresponds to the established requirements.





**Figure 11 – Correct make-up diagram**

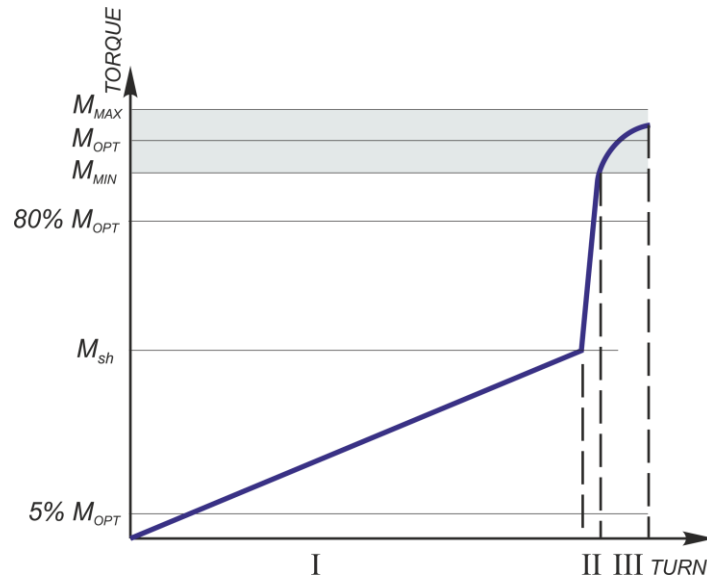
6.4.1.2 The make-up diagrams for the pipes from the same lot shall be close in shape.

6.4.1.3 The shoulder torque  $M_{sh}$  of thread shoulders (box shoulder and pin shoulder) shall be within the range between 5% and 80% of the optimum make-up torque  $M_{opt}$ .

6.4.1.4 The final make-up torque shall be within the range from the minimum to the maximum make-up torques.

6.4.1.5 Typical cases of make-up diagram shape non-compliance are shown in Figures 12 – 17.

6.4.1.6 If at the final step of make-up procedure torque increase stops and there appears a horizontal area (area II, Figure 12), but no slippage of clamp jaws is observed and the area II length is maximum 0.12 of revolution, then such a make-up shall be considered acceptable. If not, the connection shall be broken-out, inspected for absence of damages and deformations. If during inspection of thread and thread shoulders no surface damages or shape distortions, such as decrease of pin or box shoulder inside diameter, sagging on the box inside surface, are observed, re-assembly of the connection can be performed.

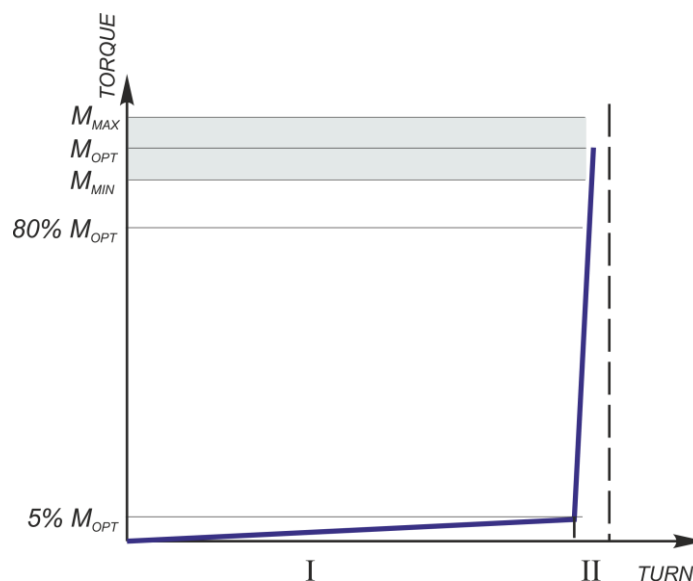


**Figure 12 – Make-up diagram. Torque increase stopped in the area III**

6.4.1.7 Too low value of shoulder torque  $M_{sh}$  of thread shoulders on make-up diagram (Figure 13) may result from:

- Unfavorable combination of technological parameters of the connection;
- Application of wrong type of compound,
- Compound contamination or its poor storage conditions.

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 13 – Make-up diagram. Low value shoulder torque of thread shoulders**

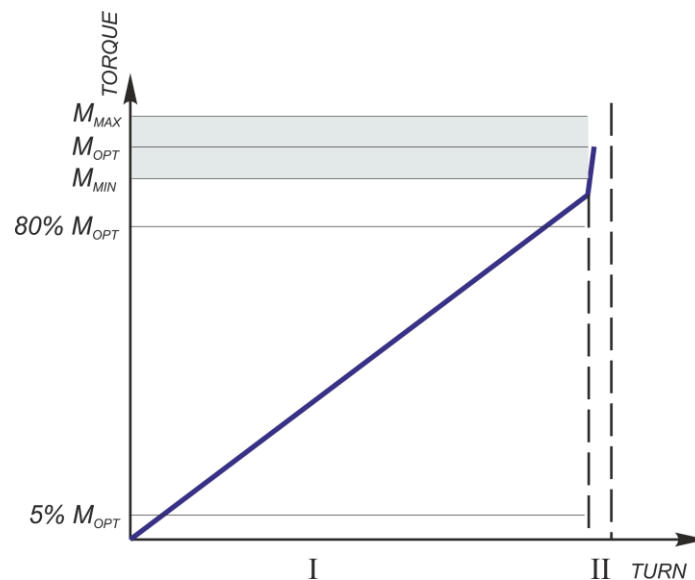
6.4.1.8 Too high value of shoulder torque  $M_{sh}$  of thread shoulders on make-up curve (Figure 14) may result from:

- Thread damage;
- Improper thread cleaning;
- Application of wrong type of compound;
- Thread compound contamination;
- High density of thread compound (e.g. at low temperatures);
- Unfavorable combination of technological parameters of the connection.

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.

If the shape of the make-up diagram after re-make-up is 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 of surface or changes of thread shape and thread shoulders are observed.

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



**Figure 14 – Make-up diagram. High value shoulder torque of thread shoulders**

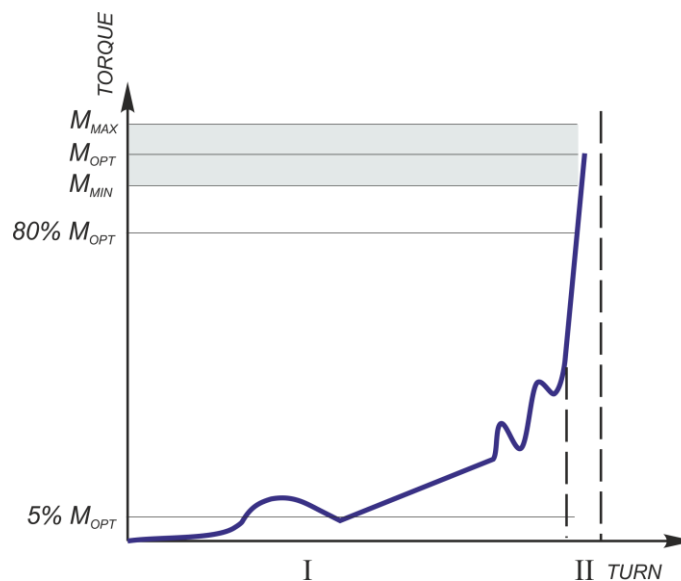
6.4.1.9 Torque leaps on the make-up diagram (Figure 15) may result from:

- Uneven application of thread compound and improper cleaning from preservation compound;
- Rotary tongs jam;
- Uneven force of rotation on shoulder.

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 check the tong setting and repeat make-up.

If the shape of the make-up diagram after re-make-up is 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 of surface or changes of thread shape and thread shoulders are observed.

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



**Figure 15 – Make-up diagram. Torque leaps**

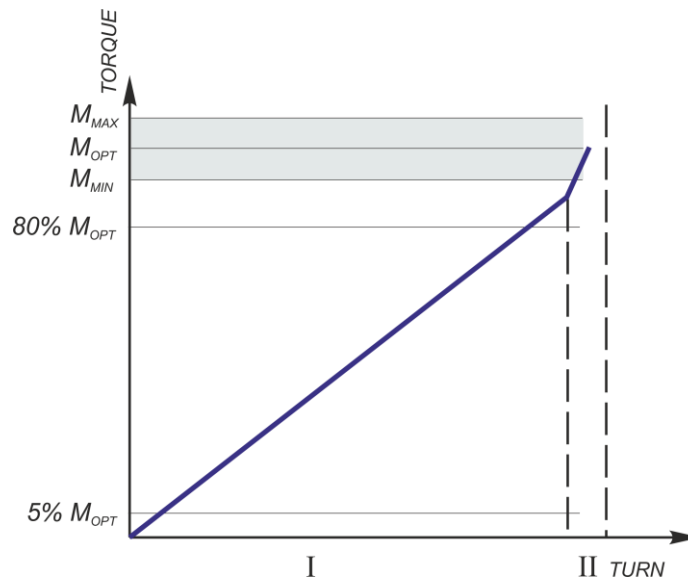
6.4.1.10 Make-up curve without clean shoulder torque  $M_{sh}$  (Figure 16) may result from:

- Thread damage;
- Improper thread cleaning;
- Unfavorable combination of technological parameters of the connection.

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.

If the shape of the make-up diagram after re-make-up is 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 of surface or changes of thread shape and thread shoulders are observed.

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

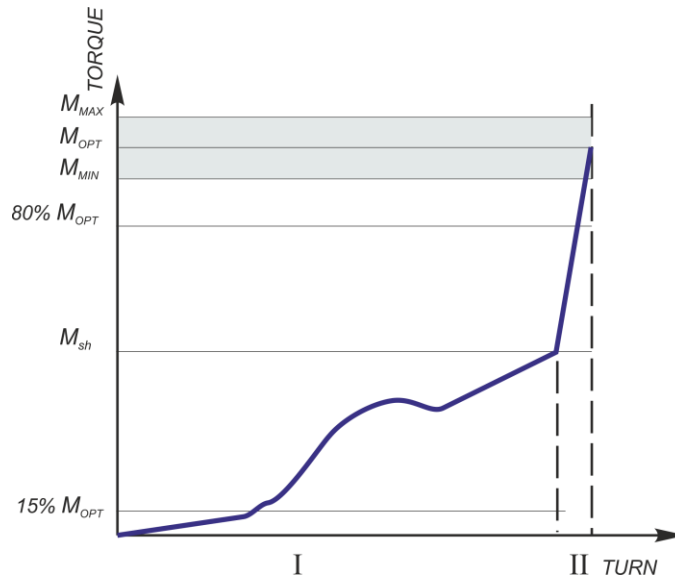


**Figure 16 – Make-up diagram. No clear shoulder torque of thread shoulders**

6.4.1.11 Make-up curve with a wave-like effect not exceeding shoulder torque  $M_{sh}$  (Figure 17) may result from:

- Improper thread cleaning;
- Thread compound contamination or high density of thread compound (e.g. at low temperatures);
- Excess of compound.

Break out the connection, make sure the wave-like effect is not caused by the quality or application of the compound, and repeat make-up. Otherwise clean the connection, reapply thread compound of the appropriate type and quality, and repeat make-up.



**Figure 17 – Make-up diagram. Wave-like effect**

6.4.1.12 In any case, when the make-up curve is of improper shape, break out the connection. Remove compound from the surface of pin and coupling thread connections and inspect them. If there are no damages found during visual inspection, reapply thread compound of the appropriate type and quality to the connection, check equipment setting and repeat make-up. If the result of re-make-up is the same as the first time, the pin and coupling shall be rejected.

#### **6.4.2 Make-up inspection by make-up triangle**

When 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  $\pm 0.0197$  inches.

#### **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.

6.5.3 Prior to break-out, the rotary tongs shall be positioned as per Figure 5.

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

6.5.5 Speed of connection break-out by rotary tong shall correspond to the ones, specified in Table 6.

**Table 6 – Speed of thread connection 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 2 rpm

6.5.6 Break-out shall not cause significant mechanical damages like galling, jamming, etc. 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% from the coupling nominal outside diameter.

Damages from tong clamps are allowed on the pipe outer surface under condition that the actual pipe wall thickness, taking into account depth of the damage, shall be not less than 87,5% from 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 inches.

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

6.5.8 To store used pipes after string disassembly, if necessary, the following preparations shall be carried out:

- Visual inspection of thread protectors for damages (ref. para. 5.2);
- Visual inspection of pipes and couplings for significant mechanical damages (like galling, jamming etc.) (ref. para. 5.2);
- Cleaning of external and internal thread connections from compound and contaminations (ref. para. 5.4);
- Visual inspection of thread and thread shoulders surfaces of pins and coupling (ref. para.5.5). In case of any damages detection, perform repair as per Table 1 or reject the pipes and couplings;
- Cleaning of thread protectors from previously applied compound and contaminations (ref. para. 5.8);
- Application of preservation compound (like "Kendex OCTG" or equivalent) or preservation thread compound on pin and coupling thread connections and installation of thread protectors.

## **7 Manufacturer's warranty**

Provided that the present recommendations are met, TMK UP MAGNA 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 MAGNA 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 vertical axis and number of turns along 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, make-up diagram shall have the following characteristics:

- Sufficient resolution (at least 800 × 600 pixels) for precise curve display. Display shall be at least 9.8425 inches 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 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.

Displayed make-up results shall not be sufficient for acceptance or rejection of make-up operations. 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!***