PREMIUM SERVICE

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Guidelines
For Use of Casing
with TMK UP FMC Thread Connection

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Revision 5

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2018

Contents

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 FMC Thread Connection

Effective date is May 06.2018

With an option of early introduction

1 Scope

The present guidelines contain recommendations for maintenance and use of casing with TMK UP FMC 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:

– 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;

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

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

– TU 0254-062-46977243-2008 RUSMA-1i Inhibited Thread Compound;

– 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 19.20.29-186-46977243-2016 RUSMA R-24Cu Arctic 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 **metal-to-metal seal:** Seal or sealing system, that relies on intimate and usually high contact stress of a metal surface to achieve a seal.

3.2 **rotation on shoulder:** Excessive turns after shoulder to ensure thread connection tightness.

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

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

3.5 **thread seals:** Box seal and pin seal.

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

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

3.8 **box shoulder:** Internal barrier which serves as an arrester during make-up.

3.9 **pin seal:** Area of the pin external surface which provides for tightness of the thread connection during make-up.

3.10 **box seal:** Area of the box internal surface which provides for tightness of the thread connection 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, 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 pipe bundles to loading platform or deck from chromium and corrosion-resistant steels 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 a forklift, gripping forks, frames and clamps with non-metallic 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 external and internal 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 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!

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

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 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 or for more than 12 months if stored with RUSMA-SP compound, the compound under safety parts shall be renewed.

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 install 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 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 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 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 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'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

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 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 seals 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, RUSMA-1(3), RUSMA-1i, RUSMA-SP, etc. thread compounds under thread protectors, the compound removal is not required. At that 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 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, thread seals and 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 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.

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

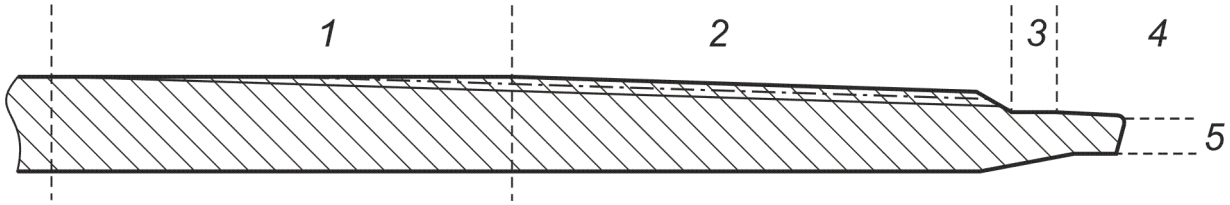
– A mould taken from a detected defect using a special tape (X Coarse material of Testex company for defects up to 0.0039 inch deep, for deeper defects: X-Coarse Plus or equivalent one). Mould height shall be measured with a thickness gage, measurement accuracy shall be at least 0.0004 inch (PEACOCK G2-127 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 (PEACOCK T-4 gage or equivalent one).

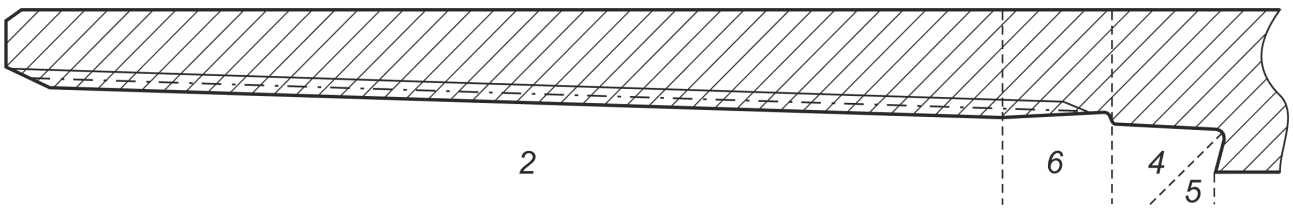
If any unacceptable damages are detected on pipes, such pipes shall be rejected then and reported accordingly specifying pipes serial numbers, describing defects found with photos attached.

Table 1 – Types of damages and methods of repair

Surface area (Figure 1)	Type of damage	Damage repair method
1, 2, 5	Pit corrosion less than 0.0039 inch 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 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, 6	Pit corrosion less than 0.0118 inch deep or insignificant surface rust	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
	Insignificant surface rust	Buffing
	Burrs, tears and scratches	Not to be repaired
	Nicks	Not to be repaired
	Small grooves	Buffing



a) **–** Surface of external thread connection



b) **–** Surface of internal thread connection

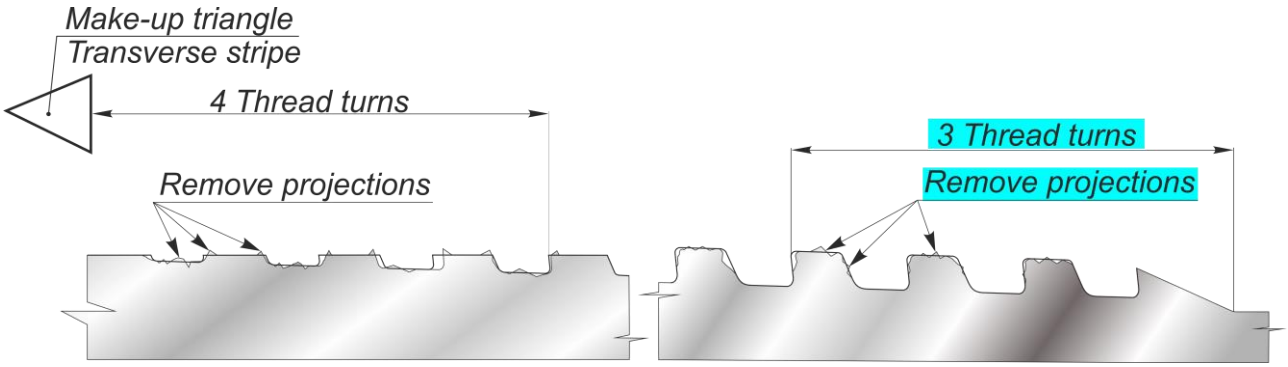
1 – imperfect profile thread; 2 – perfect profile thread; 3 – cylinder groove; 4 – tapered thread seal; 5 – thread shoulder 6 – tapered bore;

Figure 1 – Surfaces of external and internal thread connections

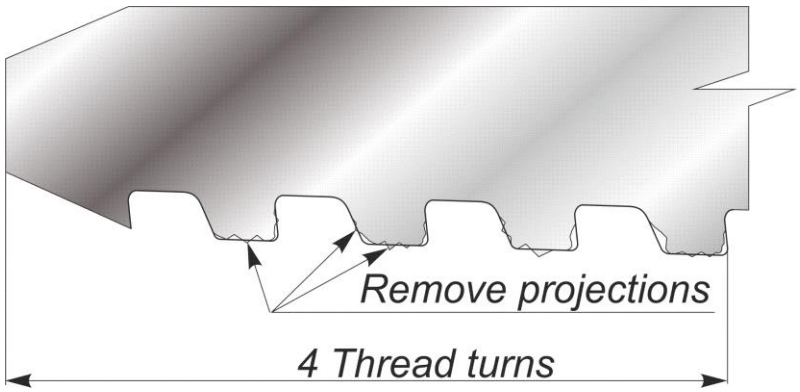
Possible types of damages of thread, thread seals and thread shoulders surfaces of pins and couplings during make-up, as well as repair methods are specified in Table 2.

Table 2 – Types of damages and methods of repair

Surface area	Type of damage	Method of repair	Maximum time allowed for repair
4,5 Figure 1	Any damages	Not to be repaired	n/a
1,2,3,5 Figure 1	Severe damages	Not to be repaired	n/a
1,2,3, 6 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 4 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 – Surface of external and internal thread connections

5.6 Drifting

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.

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 3. 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 inch in any of the three planes, such a drift shall be rejected.

The mandrel 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 3 – 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
up to 8 5/8 incl.	5.9843	d – 0.1252
over 9 5/8 to 13 3/8 incl.	12.0079	d – 0.1563
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 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.

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

$$L = \sum L_{ф} - n\,\Delta L \qquad (1)$$

where L – the total length of the string;

$\sum L_{ф}$ – the overall length of 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 (ref. 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
4 1/2	4.2559
5	4.2795
5 1/2	4.3425
5 3/4	4.3622
6 5/8	4.5275
7	4.7480
7 5/8	4.9370
8 5/8	5.0591
9 5/8	5.1220
9 7/8	5.1220
10 3/4	5.1220
12 3/4	5.1850
13 3/8	5.1850

5.8 Thread protectors installation

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

Removed thread protectors can be re-used provided 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 seals from direct environmental impact.

Cleaning of protectors from conservation compound shall comply with the requirements for cleaning of external and internal 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, thread seals 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, RUSMA-1(3);
- RUSMA-1i;
- RUSMA R-4, RUSMA R-4(3);
- RUSMA SP;
- Bestolife API Modified;
- JET-LUBE API Modified.

While making-up pipes of chromium steels it is recommended to use RUSMA R-14 , RUSMA R–14 (3) thread compounds, and RUSMA R-24Cu Arctic thread compound in high north areas.

Upon coordination with the connection designer, other than mentioned thread compounds may be applied; if they comply with API 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 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.

6.1.3 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 (as per para. 5.4) surface of thread connection.

Never use metal brushes for compound application!

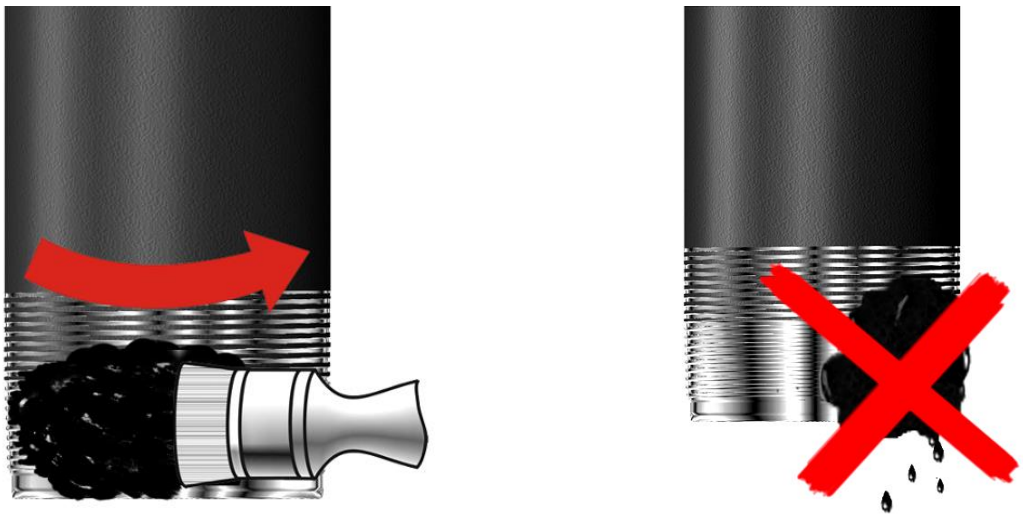


Figure 3 – Proper and improper application of thread compound

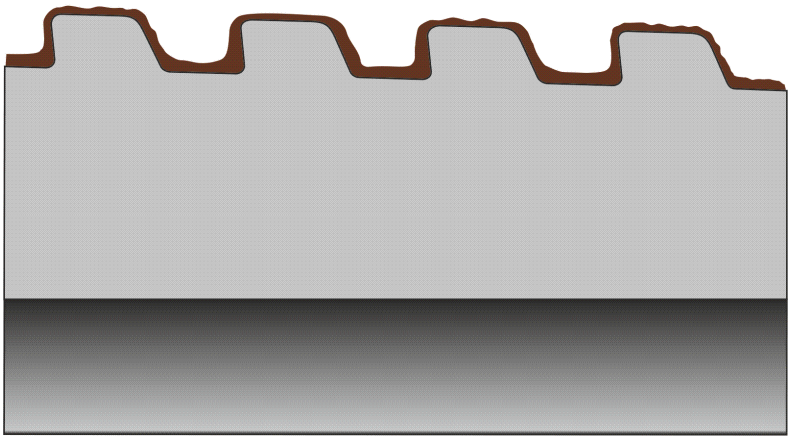


Figure 4 – Proper distribution of thread compound over thread profile

6.1.4 Required amount of thread compound shall be distributed between coupling and pin end 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} and m_{max} in gr for make-up of one thread connection shall be calculated as follows:

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

$$m_{max} = 0.3 \times D \quad (3)$$

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 nominal outside diameter of pipes, in mm, rounded to an integral value.

Example – The minimum quantity of thread compound required for make-up of one thread connection of pipes with an outside diameter of 114.30 mm (4 1/2 inch):

$$m_{min} = 0.25 \times 114 = 28.5 \approx 30,0$$

at that at least 20 gr shall be applied on coupling end and at least 10 gr 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 shall be in compliance with the tong manufacturer recommendations);

– Make-up triangle (cross stripe) and make-up marks.

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 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, 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 a string of chrome steel pipes it is recommended to use an elevator and 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. Clamps diameter shall be 1 % greater than pipe nominal 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-metallic or non-injurious tong dies.

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

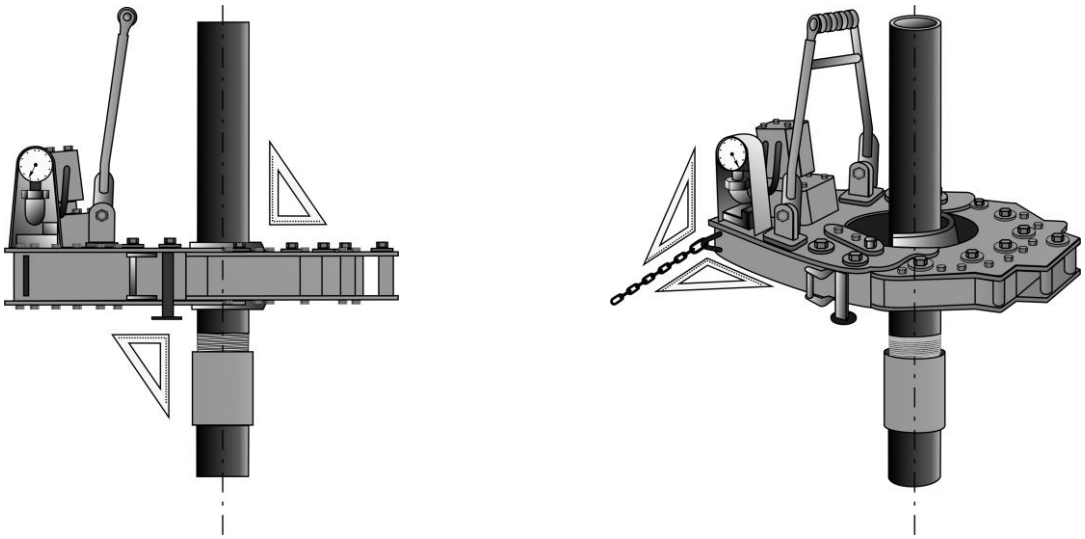


Figure 6 – Rotary tongs positioning before make-up

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

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 seals and thread shoulders of the free pin for any mechanical damage, check for alignment of the assembled pipes (Figures 7 and 8).

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.)

Maximum misalignment of connected pipes shall not exceed 0.7874 inch.

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.

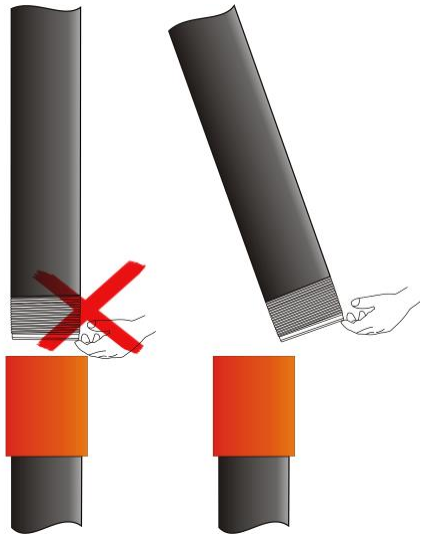


Figure 7 – Mechanical damages inspection

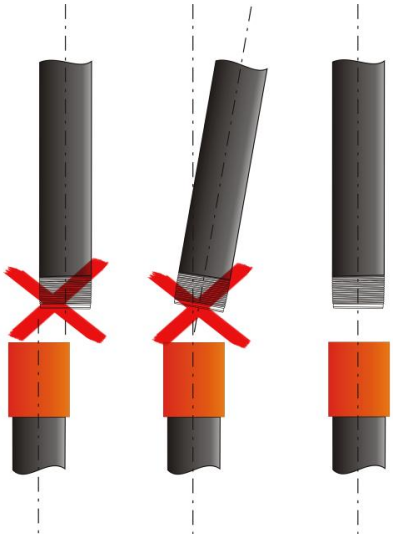


Figure 8 – Alignment inspection

6.3.4 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.

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

N o t e. 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} can be corrected but not more than by ±10 %. At that the values of M_{min} and M_{max} shall be corrected but not more than by ±10 % of corrected M_{opt}.

Break-out may require higher torque than make-up.

Reduce of thread connection break-out torque by 25% relative to the recommended optimum make-up torque M_{opt} is allowed.

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 make-up triangle and 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 Annex A.

Make-up without registering equipment shall be performed based on make-up torques and make-up marks on pin and coupling, applied by the manufacturer (in light paint) and the make-up triangle on the pin (Figure 9) or based on make-up marks on pin and coupling and the make-up triangle on the pin (Figure 9), applied by the manufacturer (in light paint). 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.

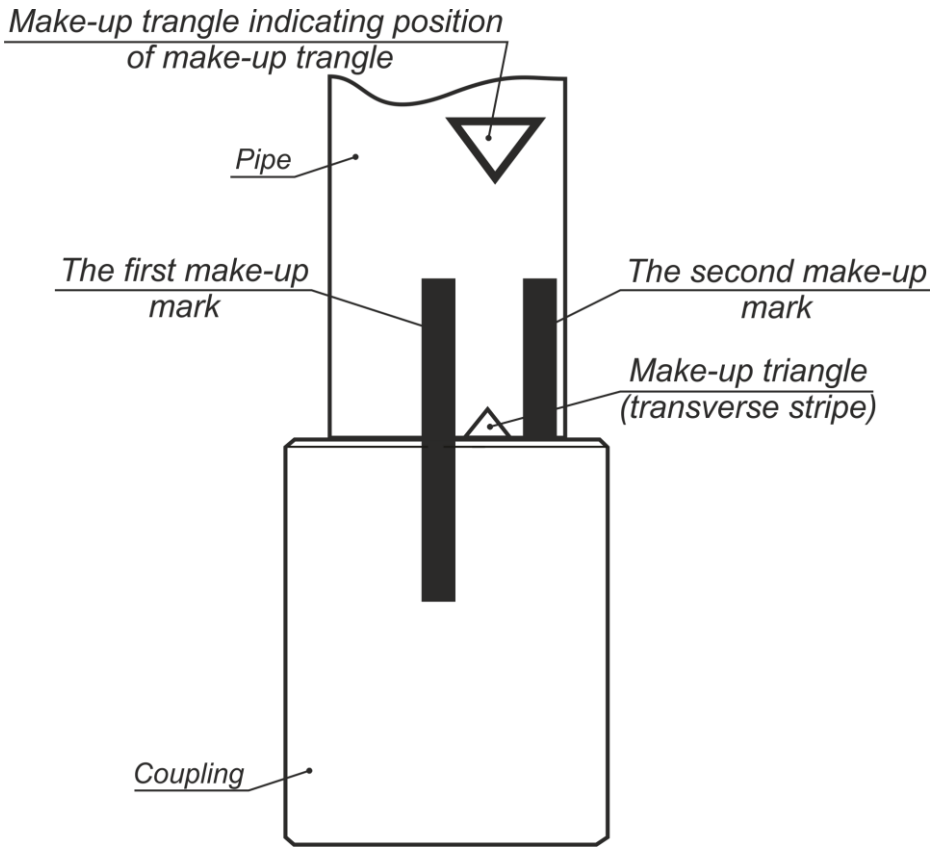


Figure 9 – Make-up with make-up marks and make-up triangle

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			Q125			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}	M_{min}	M_{opt}	M_{max}
4 1/2	0.2500	2700	3000	3300	3500	3800	4200	3800	4300	4700	4100	4500	4900	4500	5000	5500	4900	5400	5900	5000	5600	6200	5400	6000	6600	5600	6200	6800
	0.2902	3100	3500	3800	4000	4400	4900	4400	4900	5500	4600	5200	5700	5200	5800	6400	5600	6200	6800	5800	6500	7200	6200	6900	7500	6400	7200	7900
	0.3370	3700	4100	4500	4600	5200	5700	5200	5800	6300	5500	6000	6600	6100	6800	7400	6500	7200	8000	6900	7600	8300	7200	8000	8800	7500	8300	9100
	0.4016	4400	4800	5300	5500	6100	6700	6100	6800	7400	6400	7200	7900	7200	8000	8800	7700	8600	9400	8100	9000	9900	8600	9500	10500	8900	9900	10800
5	0.2961	3400	3800	4100	4400	4800	5300	4800	5300	5800	5000	5600	6200	5700	6300	6900	6000	6700	7400	6300	7100	7800	6700	7400	8200	7000	7700	8600
	0.3618	4100	4600	5000	5200	5800	6400	5800	6500	7200	6100	6800	7400	6900	7600	8300	7400	8200	9000	7700	8600	9400	8100	9000	9900	8400	9400	10300
	0.4213	4800	5300	5800	6100	6800	7400	6800	7500	8300	7200	8000	8800	8000	8900	9800	8600	9500	10500	9000	10000	11000	9500	10500	11600	9800	10900	12000
5 1/2	0.2748	3700	4100	4600	4800	5300	5800	5300	5900	6500	5600	6200	6800	6300	6900	7600	6700	7400	8200	7000	7800	8600	7400	8300	9100	7700	8600	9400
	0.3039	4100	4600	5000	5300	5900	6500	5900	6600	7200	6300	6900	7600	7000	7700	8600	7400	8300	9100	7800	8700	9600	8300	9100	10000	8600	9500	10500
	0.3610	4900	5500	6000	6300	7000	7700	7000	7700	8600	7400	8200	9000	8300	9100	10000	8800	9800	10800	9300	10300	11400	9700	10800	11900	10200	11300	12400
	0.4150	5800	6400	7100	7200	8000	8800	8000	8900	9800	8000	8800	9700	8600	9600	10500	9100	10200	11200	10600	11800	13000	11200	12500	13700	11700	12900	14200
5 3/4	0.2756	4400	4900	5500	5700	6300	7000	6000	6600	7300	6300	6900	7600	6600	7400	8100	7600	8400	9200	7900	8800	9700	8000	8900	9800	8300	9200	10200
	0.3031	4800	5300	5800	6100	6800	7400	6400	7200	7900	6600	7400	8100	7100	7900	8700	8100	9000	9900	8400	9400	10300	8600	9600	10500	8800	9800	10800
	0.3346	5000	5600	6200	6500	7200	8000	6900	7600	8300	7100	7900	8700	7600	8400	9200	8600	9600	10500	9000	10000	11000	9100	10200	11200	9400	10500	11500
	0.3740	5500	6100	6700	7000	7800	8600	7400	8200	9000	7700	8600	9400	8200	9100	10000	9400	10400	11400	9700	10800	11900	9900	11000	12100	10300	11400	12500
	0.4213	6000	6600	7300	7700	8600	9400	8100	9000	9900	8300	9300	10300	9000	10000	11000	10300	11400	12500	10600	11800	13000	10900	12100	13300	11100	12400	13600
6 5/8	0.2882	4500	5000	5500	5800	6400	7100	6400	7200	7900	6300	7000	7700	6700	7400	8200	7700	8600	9400	8400	9400	10300	8200	9100	10000	8300	9300	10300
	0.3520	5800	6400	7100	7400	8300	9100	7800	8700	9600	8100	9000	9900	8600	9600	10500	9900	11000	12100	10300	11400	12600	10500	11700	12800	10800	11900	13100
	0.4169	7100	7900	8700	9100	10100	11100	9600	10600	11700	9900	11000	12100	10500	11700	12900	12100	13400	14700	12500	13900	15300	12800	14200	15600	13200	14700	16200
	0.4748	8300	9200	10200	10600	11800	13000	11100	12400	13600	11600	12800	14100	12300	13700	15100	14200	15700	17300	14700	16300	17900	15000	16700	18400	15400	17100	18800
7	0.3169	6100	6800	7400	7900	8800	9700	8300	9200	10200	8600	9600	10500	9100	10200	11200	10600	11800	13000	10900	12100	13300	11100	12400	13600	11500	12800	14000
	0.3618	7000	7700	8600	8900	9900	10800	9400	10400	11400	9700	10800	11900	10300	11400	12600	11800	13100	14500	12300	13600	15000	12500	13900	15300	12900	14300	15700
	0.4079	7700	8600	9400	9900	11000	12100	10300	11500	12700	10800	11900	13100	11500	12800	14000	13100	14600	16100	13600	15200	16700	13900	15500	17000	14300	15900	17600
	0.4531	8500	9400	10400	10900	12100	13300	11400	12700	13900	11700	13100	14400	12600	14000	15400	14500	16100	17700	15000	16700	18400	15300	17000	18700	15800	17600	19300
	0.4980	9300	10300	11400	11900	13200	14500	12500	13900	15300	13000	14400	15900	13800	15300	16900	15800	17600	19300	16400	18200	20100	16700	18600	20400	17300	19200	21100
	0.5402	10000	11100	12200	12800	14200	15600	13500	15000	16400	13900	15500	17000	14900	16500	18100	17000	19000	20900	17600	19600	21600	18100	20100	22100	18600	20600	22700
	0.5906	10800	12000	13200	13900	15400	17000	14500	16200	17800	15100	16800	18500	16100	17800	19600	18400	20500	22600	19100	21200	23400	19600	21800	24000	20100	22300	24600
7 5/8	0.3748	9100	10100	11100	11700	13000	14300	13000	14400	15900	13600	15200	16700	15300	17000	18700	16300	18100	20000	17200	19100	21000	18100	20100	22100	18800	20900	22900
	0.4299	10400	11600	12800	13300	14800	16300	14800	16400	18100	15600	17300	19100	17500	19400	21300	18700	20700	22800	19600	21800	24000	20700	23000	25300	21500	23900	26300
	0.5000	12200	13500	14800	15600	17300	19100	17300	19200	21200	18300	20300	22300	20400	22700	25000	21800	24300	26700	22900	25400	28000	24200	26800	29500	25100	27900	30700
	0.5949	14500	16100	17700	18500	20600	22600	20600	22900	25100	21600	24000	26500	24300	26900	29600	26000	28800	31700	27200	30200	33300	28700	31900	35000	29800	33100	36400

End of Table 5

D, Inch	*S*, Inch	Torque, ft lb for steel grades																										
		J55, K55			N80, L80			C90			R95, C95,T95			C110, P110			Q125			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}	M_{min}	M_{opt}	M_{max}
8 5/8	0.3520	11200	12500	13700	14400	16000	17600	16000	17800	19500	16900	18700	20600	18900	20900	23000	20200	22400	24600	21200	23500	25900	22300	24800	27300	23200	25700	28300
	0.4000	12800	14200	15600	16300	18100	20000	18100	20100	22100	19100	21200	23400	21400	23700	26100	22900	25400	27900	24000	26700	29400	25300	28100	30900	26300	29200	32200
	0.4500	14300	15900	17600	18400	20400	22500	20400	22600	24900	21500	23900	26300	24100	26800	29400	25700	28600	31500	27000	30000	33000	28500	31600	34800	29600	32900	36200
	0.5000	15900	17700	19500	20400	22700	25000	22700	25200	27700	23900	26500	29200	26800	29700	32700	28600	31800	35000	29900	33200	36500	29900	33200	36500	29900	33200	36500
	0.5571	17700	19700	21700	22700	25200	27700	25200	28000	30800	26500	29500	32400	29700	33000	36400	29900	33200	36500	29900	33200	36500	29900	33200	36500	29900	33200	36500
9 5/8	0.3520	13400	14900	16400	17200	19100	21000	19000	21200	23300	20100	22300	24600	22500	25000	27500	24100	26800	29400	25300	28100	30900	26600	29600	32500	27700	30800	33800
	0.3949	15000	16700	18400	19300	21500	23600	21500	23800	26200	22600	25100	27600	25300	28100	30900	27000	30000	33000	28400	31600	34700	29900	33200	36500	29900	33200	36500
	0.4350	16600	18400	20300	21300	23700	26000	23600	26300	28900	24900	27700	30500	27900	31000	34100	29800	33100	36400	29900	33200	36500	29900	33200	36500	29900	33200	36500
	0.4720	18000	20000	22000	23000	25600	28200	25600	28400	31300	26900	29900	33000	29900	33200	36500	29900	33200	36500	29900	33200	36500	29900	33200	36500	29900	33200	36500
	0.5449	20800	23100	25400	26600	29600	32500	29600	32800	36100	29900	33200	36500	29900	33200	36500	29900	33200	36500	29900	33200	36500	29900	33200	36500	29900	33200	36500
	0.5949	22600	25100	27600	29200	32400	35700	29900	33200	36500	29900	33200	36500	29900	33200	36500	29900	33200	36500	29900	33200	36500	29900	33200	36500	29900	33200	36500
	0.6260	23900	26500	29200	29900	33200	36500	29900	33200	36500	29900	33200	36500	29900	33200	36500	29900	33200	36500	29900	33200	36500	29900	33200	36500	29900	33200	36500
9 7/8	0.6252	22100	24500	26900	28200	31300	34500	29900	33200	36500	29900	33200	36500	29900	33200	36500	29900	33200	36500	29900	33200	36500	29900	33200	36500	29900	33200	36500
	0.6610	23300	25900	28500	29800	33100	36400	29900	33200	36500	29900	33200	36500	29900	33200	36500	29900	33200	36500	29900	33200	36500	29900	33200	36500	29900	33200	36500
	0.7201	25400	28200	31000	29900	33200	36500	29900	33200	36500	29900	33200	36500	29900	33200	36500	29900	33200	36500	29900	33200	36500	29900	33200	36500	29900	33200	36500
10 3/4	0.3500	20100	22300	24500	20700	23000	25300	20900	23300	25700	21100	23500	25800	21500	23900	26300	21900	24300	26800	22200	24600	27100	22300	24800	27300	22600	25100	27600
	0.4000	21800	24200	26600	22400	24900	27400	22700	25200	27700	22900	25400	27900	23200	25800	28400	23600	26300	28900	23900	26500	29200	24000	26700	29400	24300	27000	29700
	0.4500	23600	26200	28800	24200	26800	29500	24400	27100	29900	24600	27300	30000	24900	27700	30500	25400	28200	31000	25600	28500	31300	25700	28600	31500	26000	28900	31800
	0.4949	25100	27900	30700	25700	28600	31500	26000	28900	31800	26200	29100	31900	26500	29500	32400	26900	29900	33000	27200	30200	33300	27400	30400	33400	27600	30600	33700
	0.5449	26900	29900	32900	27500	30500	33600	27700	30800	33900	27900	31000	34100	28200	31400	34600	28700	31900	35000	28900	32200	35400	29100	32300	35500	29300	32500	35800
	0.5949	28600	31800	35000	29300	32500	35800	29600	32800	36100	29600	33000	36300	29900	33200	36500	29900	33200	36500	29900	33200	36500	29900	33200	36500	29900	33200	36500
	0.6720	29900	33200	36500	29900	33200	36500	29900	33200	36500	29900	33200	36500	29900	33200	36500	29900	33200	36500	29900	33200	36500	29900	33200	36500	29900	33200	36500
12 3/4	0.3740	22600	25100	27700	29000	32200	35500	29900	33200	36500	29900	33200	36500	29900	33200	36500	29900	33200	36500	29900	33200	36500	29900	33200	36500	29900	33200	36500
	0.4331	26300	29100	32100	29900	33200	36500	29900	33200	36500	29900	33200	36500	29900	33200	36500	29900	33200	36500	29900	33200	36500	29900	33200	36500	29900	33200	36500
	0.4882	29600	32800	36100	29900	33200	36500	29900	33200	36500	29900	33200	36500	29900	33200	36500	29900	33200	36500	29900	33200	36500	29900	33200	36500	29900	33200	36500
	0.5512	29900	33200	36500	29900	33200	36500	29900	33200	36500	29900	33200	36500	29900	33200	36500	29900	33200	36500	29900	33200	36500	29900	33200	36500	29900	33200	36500
13 3/8	0.3799	25200	28000	30800	29900	33200	36500	29900	33200	36500	29900	33200	36500	29900	33200	36500	29900	33200	36500	29900	33200	36500	29900	33200	36500	29900	33200	36500
	0.4299	28500	31700	34900	29900	33200	36500	29900	33200	36500	29900	33200	36500	29900	33200	36500	29900	33200	36500	29900	33200	36500	29900	33200	36500	29900	33200	36500
	0.4799	29900	33200	36500	29900	33200	36500	29900	33200	36500	29900	33200	36500	29900	33200	36500	29900	33200	36500	29900	33200	36500	29900	33200	36500	29900	33200	36500
	0.5142	29900	33200	36500	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 ones.

6.3.10 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 – 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 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 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 122 ^{0}F 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% 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.

6.3.14 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.

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

During the first rotations (better manually, using chain tongs), back app shall be opened, and make-up shall be performed without make-up torque increase. At that it is possible to make horizontal movements of hydrotongs (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 app 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

6.4.1 Make-up inspection by 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 upon thread surfaces mating (area I), and the further mating of thread seals and thread shoulders (area II and area III), as shown in the Figure 11 below.

6.4.1.2 The rotary torque increase on the first revolutions, corresponding to the initial mating of thread surfaces shall be smooth and even. Further on with mating of thread surfaces and thread seals, acceleration of rotary torque shall increase till shouldering of the connection which shall be accompanied with the sharp increase in torque. Value of torque increase from the moment of the connection shouldering shall be at least 1000 Nm per 0.015 of rotation.

6.4.1.3 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 do not exceed the shoulder torque M_{sh} value, and it is possible to track areas of mating of thread surfaces, seals and shoulders on the diagram.

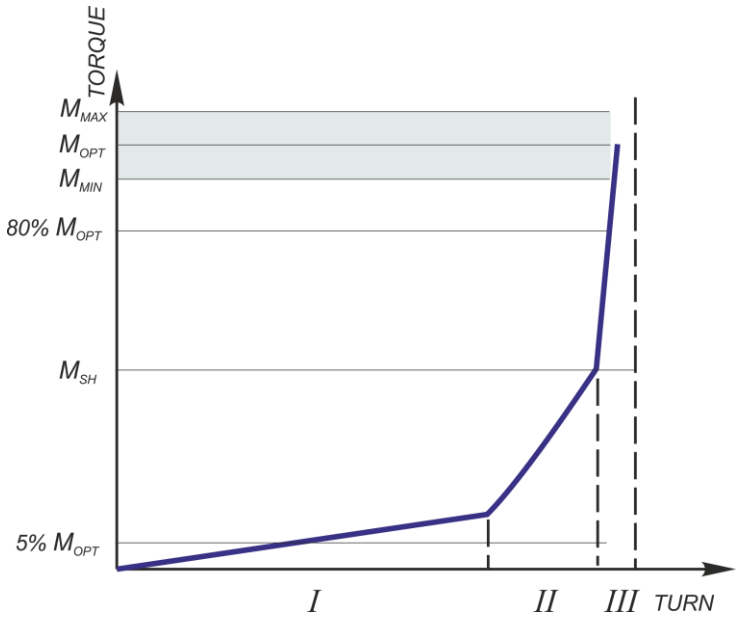


Figure 11 – Thread connection make-up diagram

6.4.2 Within the same purchase order the make-up diagrams for each pin and coupling shall be as close as possible by shape.

6.4.3 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}.

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

6.4.5 Typical cases of make-up diagram shape non-compliance are shown in Figures 11 – 16.

6.4.6 If the torque make-up 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.

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 (Table 2), are observed, re-assembly of the connection can be performed upon elimination of all the damages.

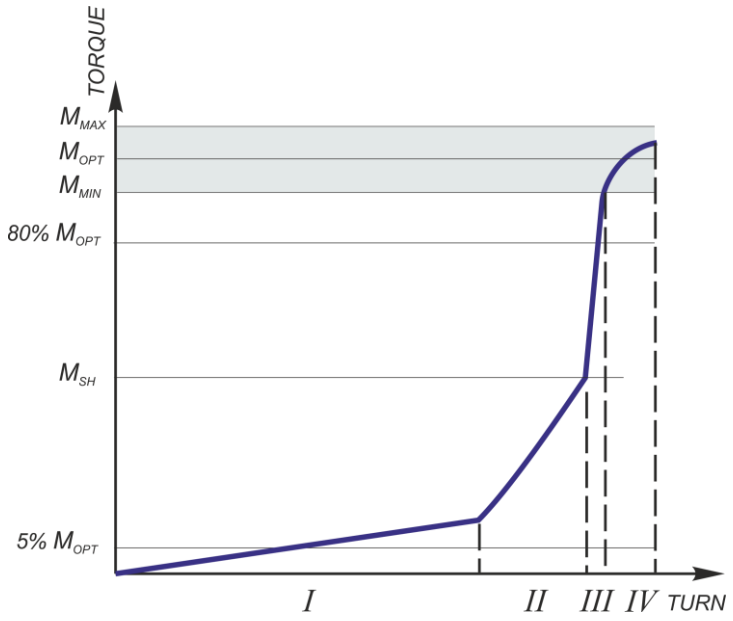


Figure 12 – Make-up diagram. Torque increase stopped

6.4.7 Too low value of shoulder torque M_{sh} (below 5% of M_{opt}) on the make-up diagram (Figure 13) may result from:

– Unfavorable combination of technological parameters of mating connection;

– Application of wrong type of compound,

– Compound contamination or its poor storage conditions.

6.4.7.1 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.

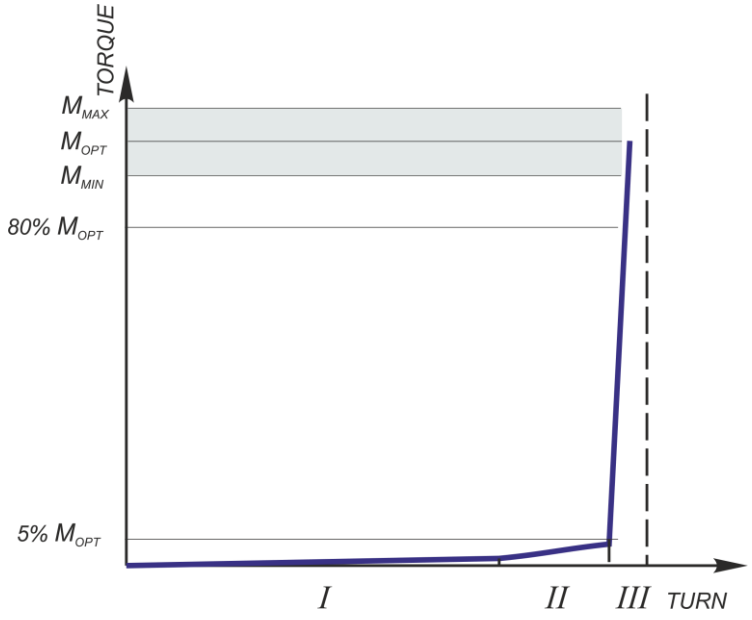


Figure 13 – Make-up diagram. Low value of shoulder torque of thread shoulders

6.4.8 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;

– High density of thread compound (e.g. at low temperatures);

– Unfavorable combination of technological parameters of the connection.

6.4.8.1 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.

6.4.8.2 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 (Table 2). 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.

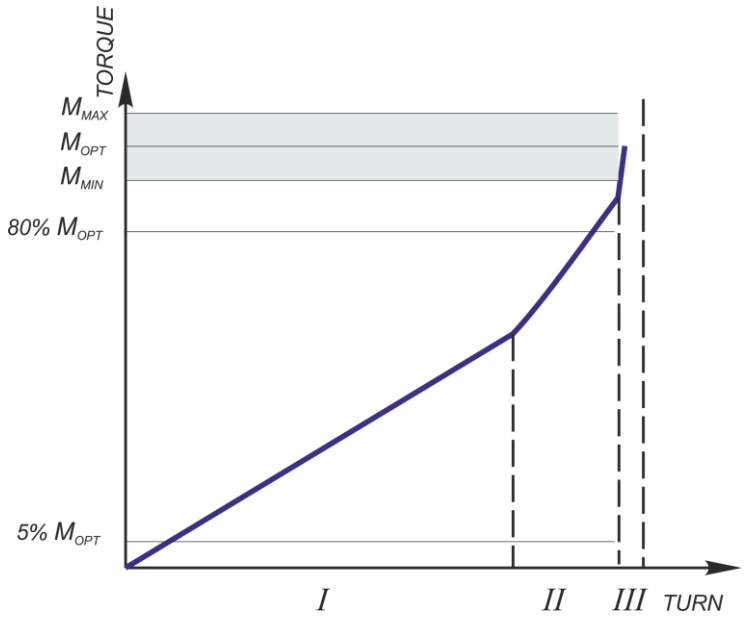


Figure 14 – Make-up diagram. High value of shoulder torque of thread shoulders

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

– Uneven application of thread compound and improper cleaning from preservation compound;

– Rotary tong jam;

– Uneven force of rotation on shoulder.

6.4.9.1 Such a diagram is considered good and may be accepted provided that requirements specified in para. 6.4.1.3 are met.

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 tong placement, alignment of made-up pipes, make sure there is no slippage of clamp jaws and make-up the connection again.

6.4.9.2 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 (Table 2). 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.

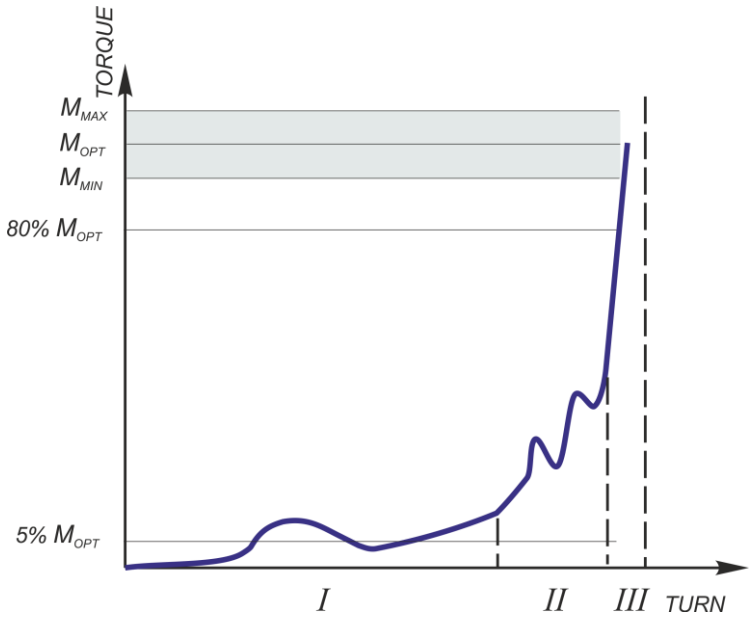


Figure 15 – Make-up diagram. Torque leaps

6.4.10 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.

6.4.10.1 Such a diagram is considered good and may be accepted provided that requirements specified in para. 6.4.1.3 are met, 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.

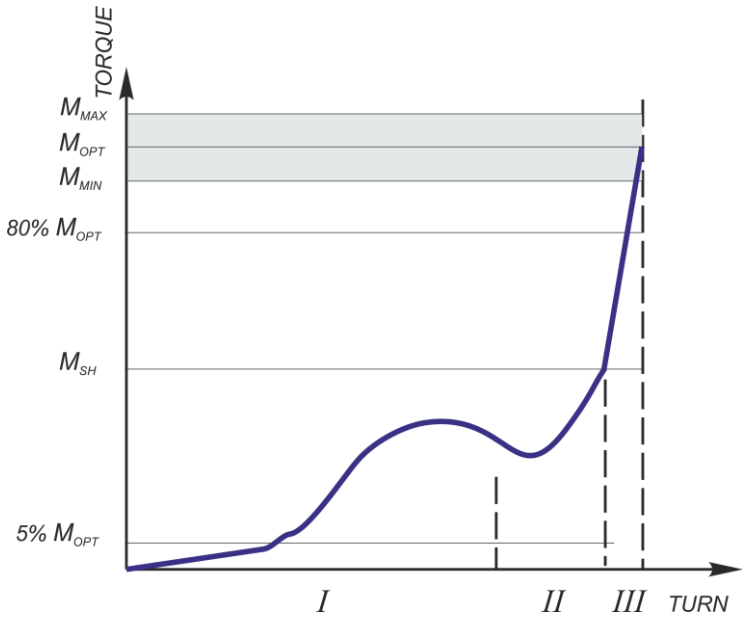


Figure 16– Make-up diagram. Wave-like effect

6.4.11 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 external and internal thread connections and inspect them. If during visual inspection damages were not found or damages can be repaired (Table 2), reapply thread compound of the appropriate type and quality onto the connection, check the 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 marks

6.4.2.1 When making-up thread connection by make-up marks, superimposition of the mark on the coupling with the first mark on the pin in the direction of make-up, corresponds to shoulder of pin and box shoulders.

6.4.2.2 When make-up torque value is reached, a make-up mark on the coupling shall coincide with the second mark on the pin in the direction of make-up or be positioned between the first and the second marks that corresponds to rotation on shoulder of thread connection intended to reach given diametrical interferences in thread and seal as well as to engage thread shoulders in seal process (Figure 19).

Rotation on shoulder is accompanied by significant torque increase; herewith it shall be minimum 90 % and maximum 110 % of optimum make-up torque value.

6.4.2.3 When make-up torque value is reached, coupling end face shall align with the base of make-up triangle (transverse stripe) on the pin with allowable deviation ±0.0394 inch.

6.4.2.4 Various locations of make-up marks after thread connection make-up with optimum torque and corresponding to such make-up mating of thread shoulder surfaces are possible (Figure 17).

Figure 17, a) – the connection is under-torqued. The mark on coupling does not run up to the first mark on pin in the direction of make-up. It means that there is a gap between the mating surfaces of pin and coupling. Make-up is allowed to be continued till the mark on coupling aligns with the first or the second mark on pin in the direction of make-up [Figure 17 b), c), d)]. The make-up torque should not exceed its maximum value.

If the make-up torque exceeds its maximum value, and the mark on coupling doesn't reach the first mark on pin in the direction of make-up, the connection shall be broken-out, cleaned from compound, surfaces of pin and coupling connections shall be visually inspected.

If any unrepairable damages are detected (Table 2), the connection shall be rejected.

If no visible damages are observed on the thread connection or the damages can be re-paired (Table 2), upon elimination of damages the connection can be made-up again, herewith the total number of make-ups shall be not more than three times.

When performing remake-up, the mark on coupling shall stay between the first and the second marks on pin or it may align with the second mark on pin [Figure 17 c), d)]. The torque shall be within the range from the optimum to the maximum value.

When make-up is complete, inspection of make-up correctness shall be performed according to the position of make-up triangle.

Figure 17, b), c), d) – the connection is correctly made-up with the minimum rotation on shoulder [Figure 17 b)], with the optimum rotation on shoulder [Figure 19, c)], with the maximum rotation on shoulder [Figure 17, d)].

Inspection of make-up correctness shall be performed according to the position of make-up triangle.

Figure 17, e) – the connection is over-torqued. The mark on coupling is located behind the second mark on pin, that means possible deformation of mating pin and coupling seal surfaces.

In this case the coupling location shall be inspected relative to make-up triangle.

If the coupling end face aligns with the make-up triangle base and the mark on coupling is located behind the second mark on pin at the distance of not more than 0.4724 inch [Figure 17 e)], the connection can be accepted.

If the coupling end face aligns with the make-up triangle base but the mark on coupling is located behind the second mark on pin at the distance of more than 0.4724 inch [Figure 17 e)], the connection shall be broken-out and inspected. The thread connection shall be rejected if deformation of pin and coupling seal surfaces is observed and shall be remade-up with optimum torque if no deformation is observed.

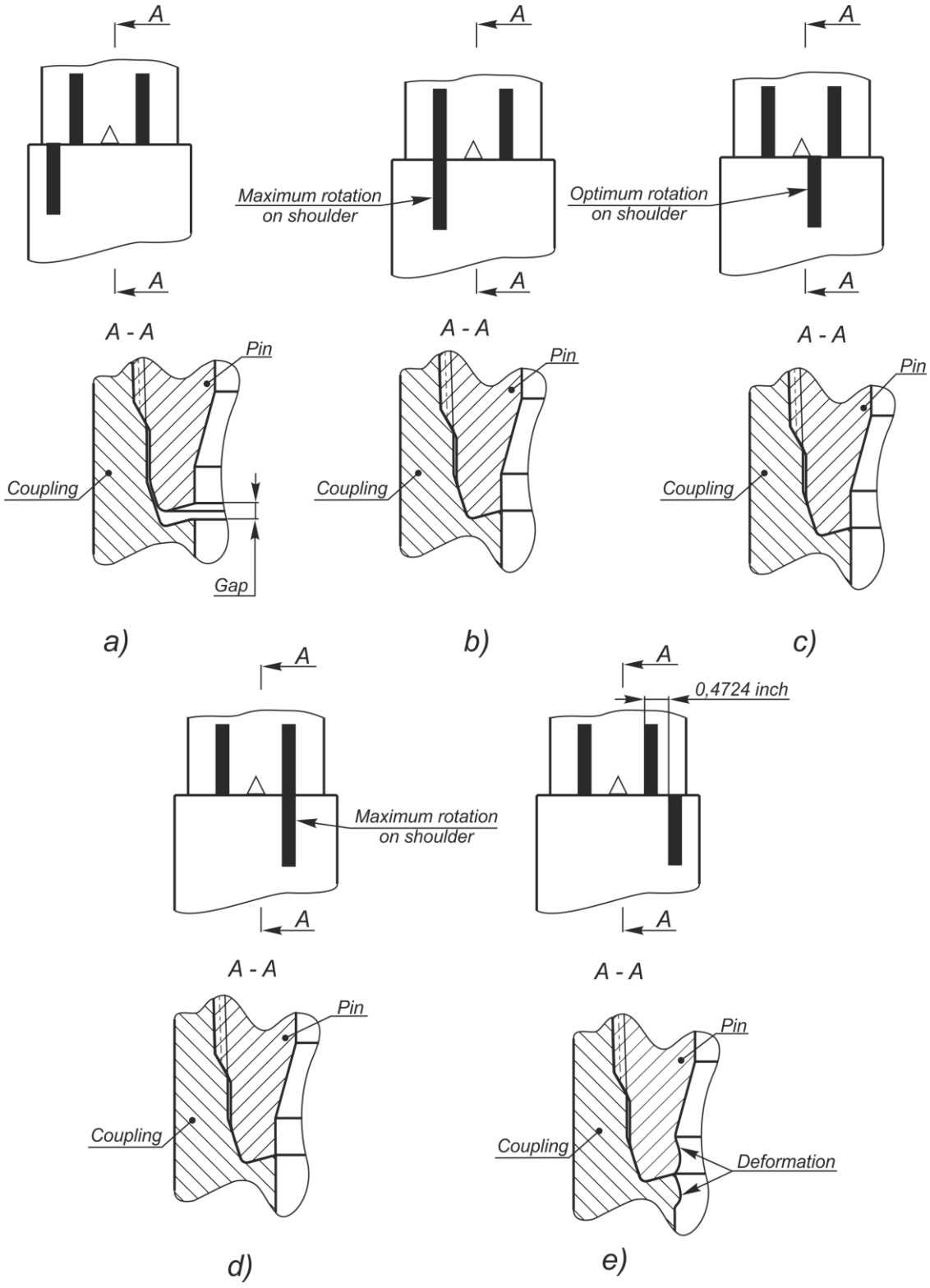


Figure 17 – Locations of make-up marks and mating surfaces of thread shoulders

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 220.462÷330.693 lb, 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.

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

Table 7 – 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, 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 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, thread protective elements shall be installed on pin and coupling ends immediately after break-out.

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. 5.5);

– Visual inspection of pipes and couplings for significant mechanical damages (like galling, jamming etc.) (ref. para. 5.5);

– Cleaning of external and internal thread connections from compound and contaminations (ref. para. 5.4);

– Visual inspection of thread, thread seals 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 one) or preservation thread compound on external and internal thread connections and installation of thread protectors.

7 Manufacturer's warranty

Provided that the present recommendations are met, TMK UP FMC 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 FMC 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 9.8425 inch 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!