

## For the attention of external product suppliers:

### Specification for the assembly and inspection of Threaded Connections

#### 1. Purpose

To ensure the long-term reliability and safety of a threaded connection, the following specifications must be observed by all assembly departments, as well as our service organization when carrying out corresponding tasks. Essentially, it is important to make sure that all components of a threaded connection correspond to each other in terms of strength. It is particularly important to note the correct tightening torque of highly loaded threaded connections.

#### 2. Scope

This specification must be used by all suppliers who supply the ZwickRoell Group with components with high-strength screw/bolt connections.

#### 3. Responsibilities

All contractors are responsible for implementing this specification for the components manufactured for the ZwickRoell Group.

#### 4. Description

##### 4.1. Permissible surface coating for high-strength bolts/screws (10.9 and 12.9)

Zinc flake coating to ISO 10683 **flZn/nc/TL/x/480h/C 0.09-0.14**

In exceptional cases (when fasteners according to the above-mentioned specifications are not available) screws/bolts without post-treatment (black screws) are permissible.

A mix of fasteners with different surface coating is not permitted.

Also refer to sections 4.3 and 4.8.2.

##### 4.2. Fasteners without tightening torque specification included in the drawing

For static machines/applications, the following applies:

Threaded connections without tightening torque specifications included in the drawings, operating manual or inspection checklists are tightened manually. Manual tightening or tightening by hand means tightening with a common tool appropriate for the connection, without requiring a significant amount of force.

Common and appropriate means that a tool fits directly without reducers (adapters) and that no extensions are used to increase the torque.

Without requiring a significant amount of force in this context means application of the tightening torque by hand, without applying body weight or using support, and without abrupt tightening movements. The force required must be reduced or adjusted for connections with light metal, plastics, etc.

Here, the experience of the assembly personnel and service technicians comes into play.

Note: For orientation on fasteners without tightening torque specifications in the drawing (no high-strength fasteners), a selection of common tightening torques can be found in the annex.

For availability purposes, higher strength fasteners can also be used (adhere to the same instructions).

Required safety instructions (Loctite, locking washers, etc.) are noted in the drawing, the operating manual, or the inspection checklist. If a threaded connection proves to be at risk of becoming loose during operation, it must be secured with Loctite 243 and the responsible design engineer must be informed (addendum in the drawing).

If necessary, fasteners are lubricated with “ZwickRoell-Fett” (low-viscosity grease).

For dynamic machines/applications the requirements are different:

Screws/bolts are tightened in a dry state and must always be secured with Loctite 243.

#### **4.3. Fasteners with tightening torque specification included in the drawing (8.8; 10.9; 12.9)**

are tightened correctly according to torque without thread locking (Loctite)

- Fasteners with zinc flake coating are mounted dry (without additional lubrication); the lubrication is integrated in the coating.
- Black screws/bolts (used in exceptional cases) are lubricated with “ZwickRoell-Fett” on the threads and under the screw/bolt head. Fasteners coated in a preservative oil are considered lubricated.  
Oil (hydraulic oil, gear oil, MoS<sub>2</sub>, WD40, ...) may not be used.

#### **4.4. Surfaces of threaded connections**

- Flange surfaces of any kind must always be free of paint/lacquer.
- For threaded connections with defined torque values, the surface under the screw head must also be free of paint/lacquer.
- Threads must be clean (free of chips, particles, rust, sand, ...).

#### **4.5. Working with screw/bolt patterns (e.g., pitch circle)**

If not otherwise specified in the drawing, operating manual or inspection checklist, these screws/bolts are tightened in at least two torque level steps (50% / 100%) crosswise or from the inside out.

#### **4.6. Changing screws/bolts**

In general, screws of the same strength class as specified in the drawing must be used.

- If screws/bolts were overstressed during operation, or if one or more screws/bolts have failed or been overstressed at one of the connection points, all screws/bolts must be replaced.
- If high-strength screws/bolts (10.9, 12.9) become loose during maintenance work, all screws/bolts that are part of that connection must be replaced.  
If no torque is specified in the drawing for 10.9 or 12.9 threaded connections, please contact the responsible design department.

#### **4.7. Repair/assembly**

Threads must be cleaned with cold cleaner and additional blowing out of lubricants, especially hydraulic oil.

Threads must be clean and turn smoothly (free of chips, particles, rust, sand, ...).

Note: Hydraulic oil can get into threaded holes in defective, leaking hydraulic cylinders. Hydraulic oil significantly reduces the friction value. For tightening torque values at the permissible limit, this can lead to an overload condition on the threaded connections.

## 4.8. Checking/inspecting the threaded connection

Inspections only apply to function and safety related threaded connections, which can be determined from the drawing, from the instruction manual, or for the technician, from the inspection checklist.

The inspection of a threaded connection on a loose/not tightened screw/bolt connection is to be carried out using 50% of the indicated torque value.

### 4.8.1 Final assembly (before delivery)

If the screw/bolt moves, the threaded connection must be tightened with the correct torque. This may only be done once and must be identified by a marker.

### 4.8.2 At the customer site

If the screw/bolt moves when the previously described inspection torque is applied, the threaded connection must be opened and all screws/bolts that are part of the connection must be replaced by new screws/bolts and tightened with the correct torque. If during initial commissioning, loose screw/bolt connections are detected, the screws/bolts in question can be tightened once, using the correct torque.

#### Note:

Under no circumstance should the screws/bolts be re-tightened since it cannot be ruled out that the screws/bolts may have already expanded and are therefore pre-damaged!

## Annex

Tightening torque values for orientation of static machines / applications in steel components without explicit specifications in the drawing:

Screw/bolt quality	M4	M5	M6	M8	M10	M12	M16
Class 8.8	2Nm	4Nm	7Nm	16Nm	32Nm	55Nm	135Nm
Stainless steel A2-70	1.5Nm	2.7Nm	4.7Nm	11.5Nm	23Nm	40Nm	95Nm

Values correspond to approximately 70% of the literature table values for tightening torques at friction values of  $\mu=0.12$  (lubricated).