Welcome to the HBK webinar:

WHAT TO CONSIDER WHEN INSTALLING A TORQUE TRANSDUCER TO ACHIEVE BEST MEASUREMENT RESULTS

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Organizational Information

1. The webinar session will be **recorded** for **internal training** purposes.

2. All attendees **microphones** are **muted** during the presentation.

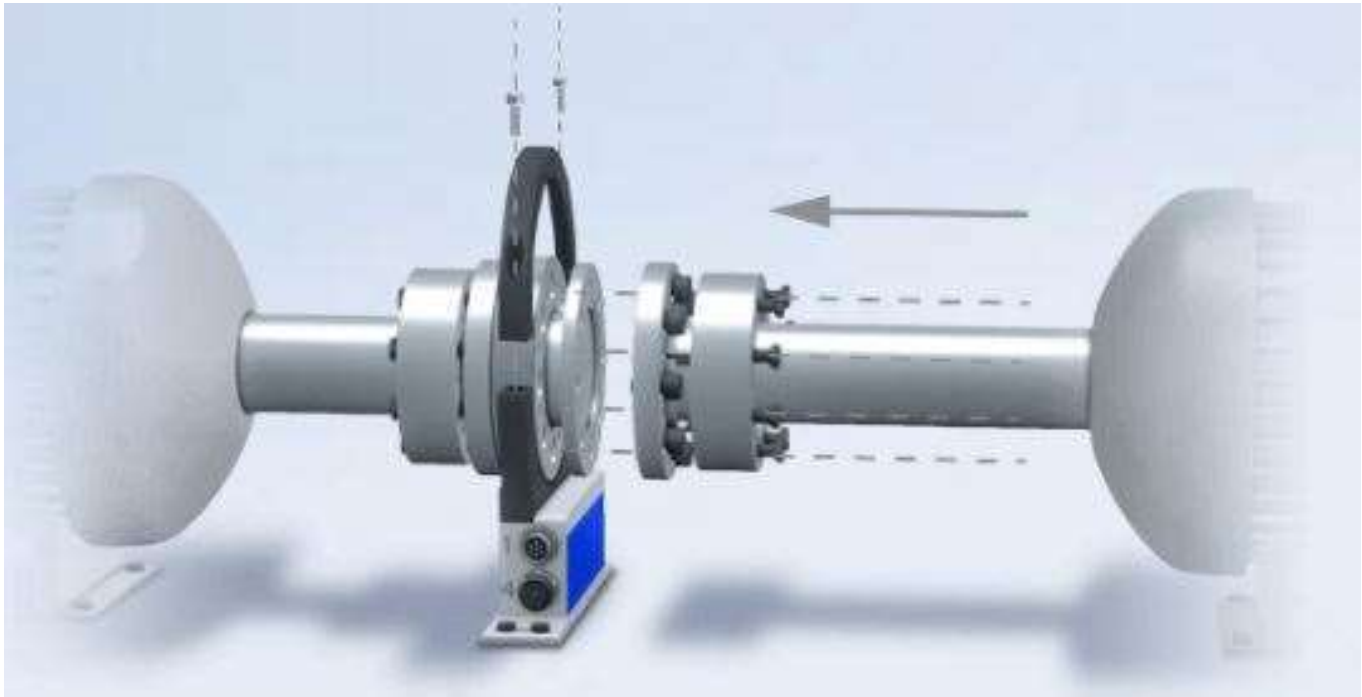
3. If you have questions, please send it via the **chat function**. Questions will be answered at the end of the presentation.

4. Please feel free to **enable your microphone** and **camera** after the presentation **for discussion**.

Agenda

1. Introduction
2. Preparation of transducer
3. Screw selection
4. Material condition and adaption design considerations
5. Design influences
6. Compensation of misalignment
7. Summary

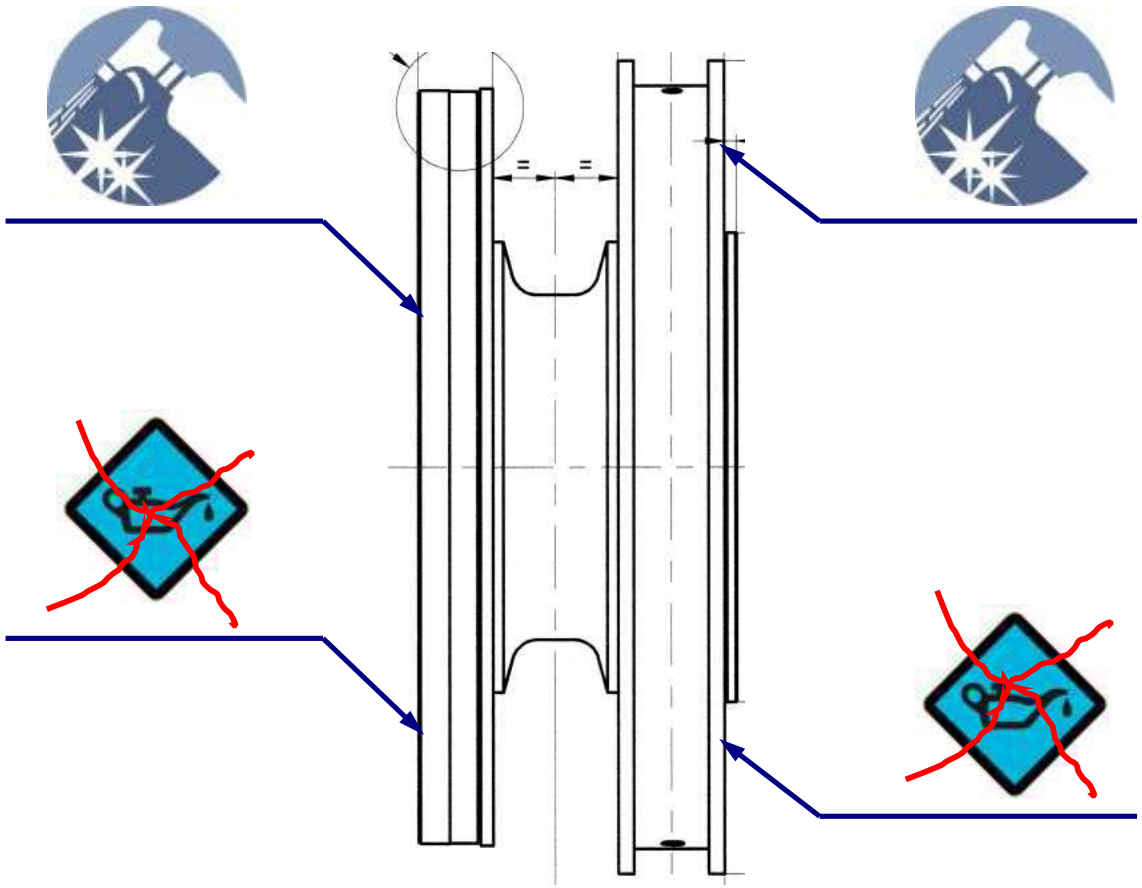
Introduction



Preparation & screw selection

How to handle the transducer

- Clean surface of transducer and mounting parts
  - Remove oil, grease etc.



Screw selection

- Hexagon socket head screws according to DIN EN ISO 4762 are best suited for mounting flange type torque transducers
- Use only screws of strength class specified
  - Lower class may not able to achieve the needed preload
  - Higher class may have an impact on fatigue strength

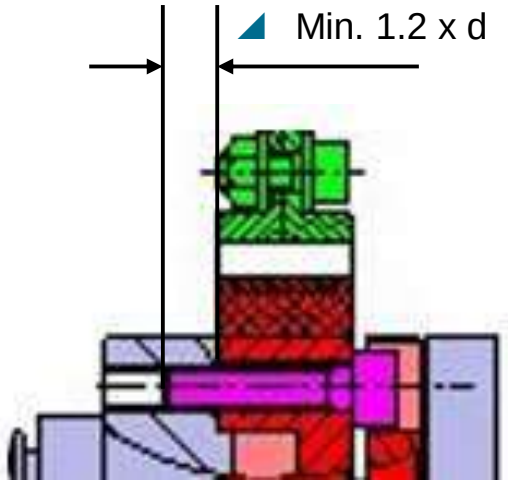
Measuring range	Fastening screws		Prescribed tightening moment
N·m	Z [1]	Property class	N·m
50	M8	10.9	34
100	M8	10.9	34
200	M8	10.9	34
500	M10	10.9	67
1 k	M10	10.9	67
2 k	M12	10.9	115
3 k	M12	12.9	135
5 k	M14	12.9	220
10 k	M16	12.9	340

1) DIN EN ISO 4762; black/oiled/μ_{tot} = 0.125

Screw selection

- Consider tightening moment
- Consider min. screw depth

Screw depth



Measuring range	Fastening screws		Prescribed tightening moment	Minimum thread reach
N·m	Z [1]	Property class	N·m	mm
50	M8	10.9	34	1.2 x d[2]
100	M8	10.9	34	
200	M8	10.9	34	
500	M10	10.9	67	
1 k	M10	10.9	67	
2 k	M12	10.9	115	
3 k	M12	12.9	135	
5 k	M14	12.9	220	
10 k	M16	12.9	340	

1) DIN EN ISO 4762; black/oiled/μ_{tot} = 0.125
2) d = screw diameter in mm

Mounting

Mounting

- Screw and screw head free of impurities?
- Use all numbers of screws
- Proposal for tightening bolts in flanged joint
  - Sequence

Summary:

- Tightening all screws by hand
- Tighten the screws crosswise
- Torque controlled / Yield strength controlled
  e.g. 80% / 20% step
- After reaching the desired tightening torque, check all screws again in turn.

Mounting

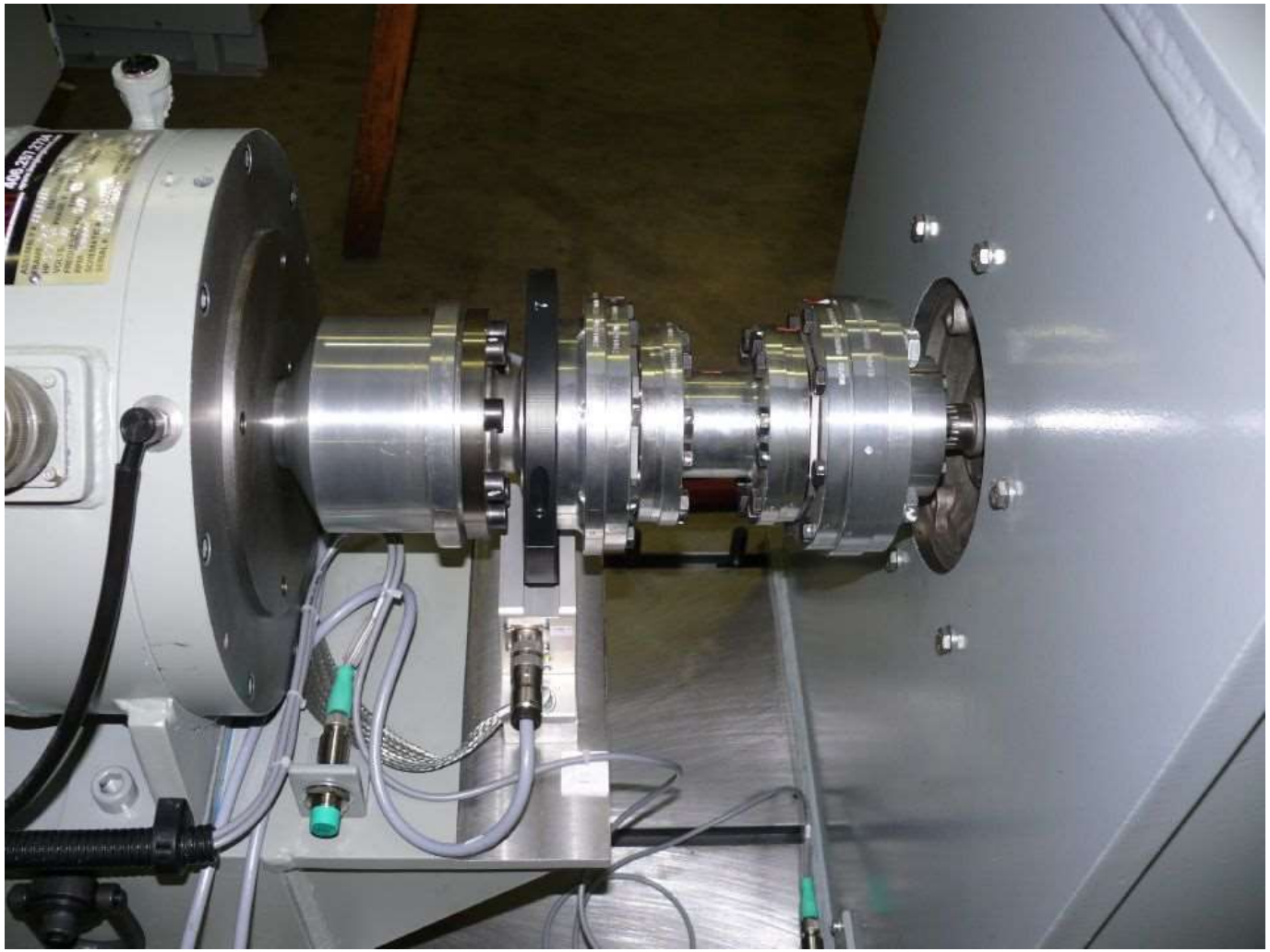
- Be careful using washers!
- If washers are used they should have at least the same quality as the screws

Washer considerations:

1. Polished surface
2. Quality like screws specified
3. Diameter like screw head diameter of screws specified

Material condition and adaption design considerations

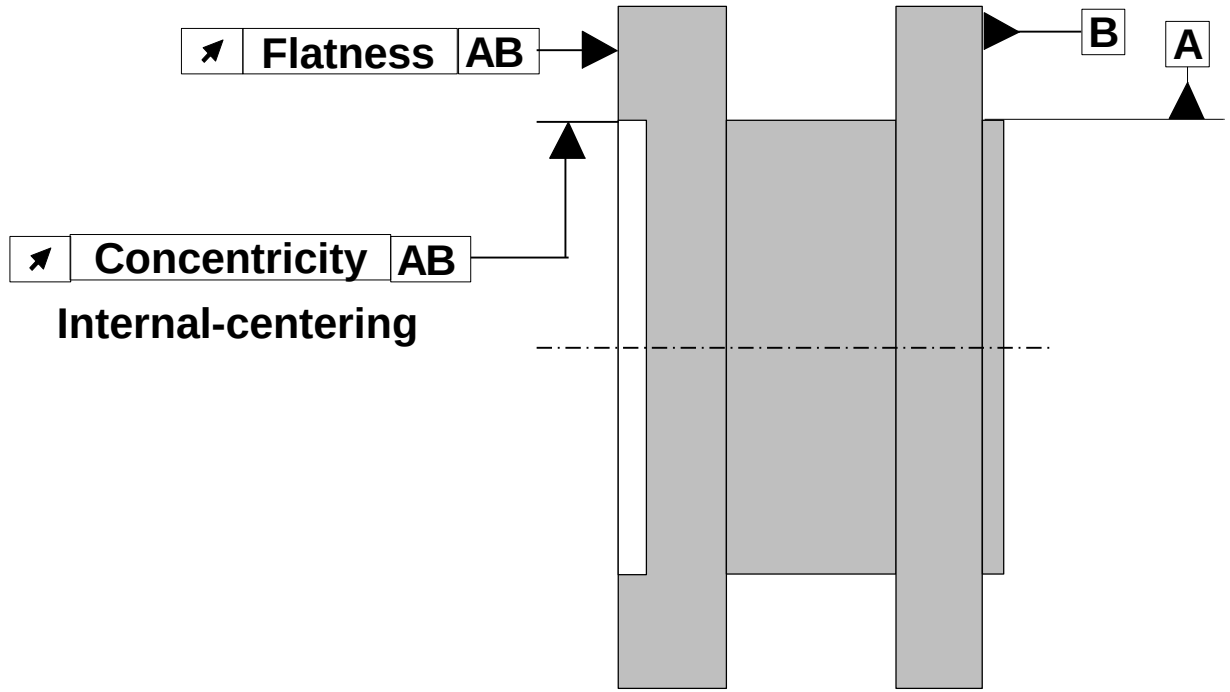
Material condition and adaption design considerations



Source: Anderson Electric Controls

Material condition and adaption design considerations

- Installation conditions

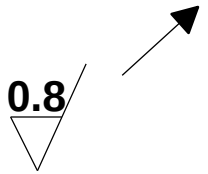


Measuring range (N·m)	Axial run-out tolerance (mm)	Radial run-out tolerance (mm)
50	0.01	0.01
100	0.01	0.01
200	0.01	0.01
500	0.01	0.01
1 k	0.01	0.01
2 k	0.02	0.02
3 k	0.02	0.02
5 k	0.02	0.02
10 k	0.02	0.02

- Rough grinding!

Hardness 46 ... 51 HRC

Surface quality of flatness and concentric surfaces (A, B and AB)



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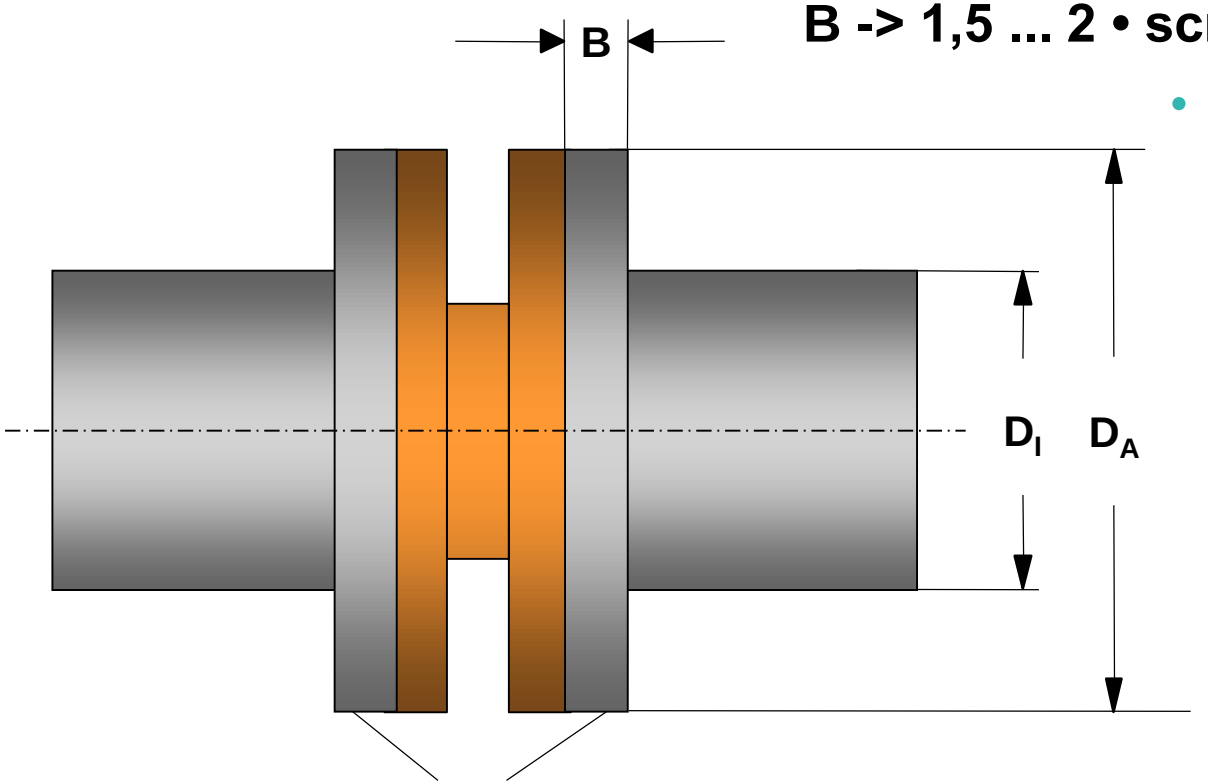
Material condition and adaption design considerations



B -> 1,5 ... 2 • screw diameter

- Avoid deflection

$D_I / D_A \leq 0,6$

- Fir highest performance in torque measurement apply the desing rules, if possible, as defined in the reference torque world!

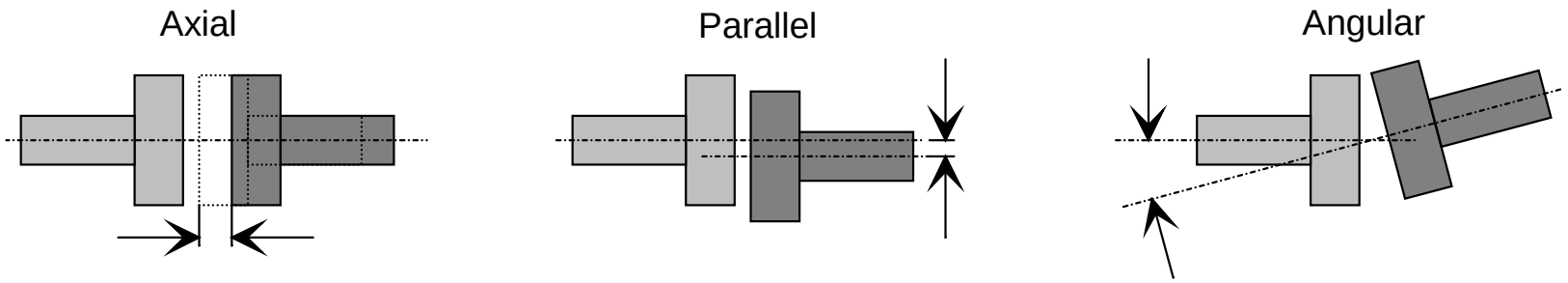
Design influences

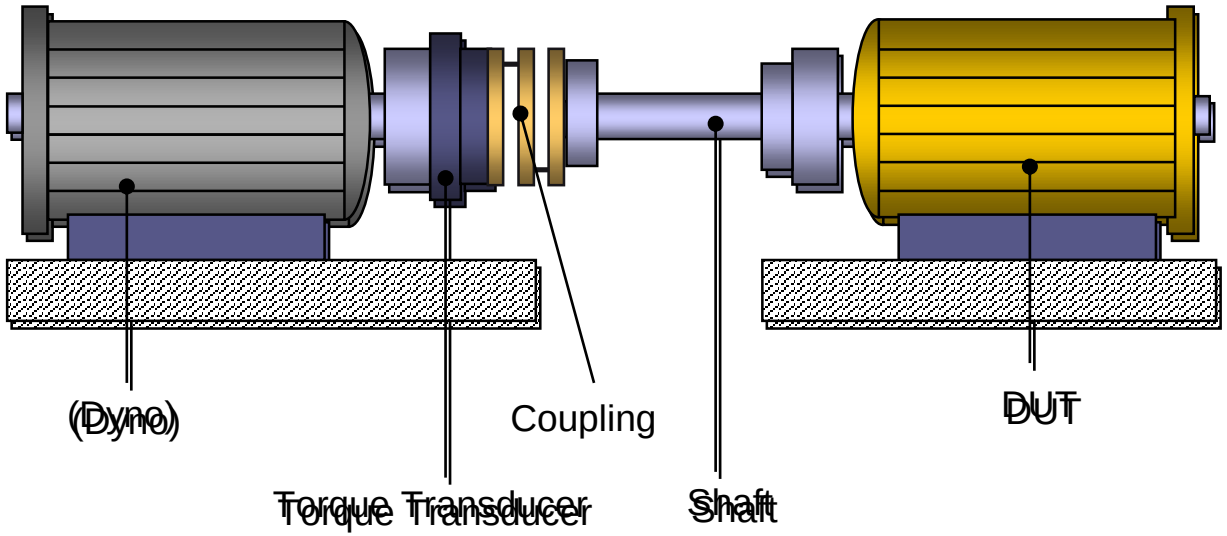
- Axial and radial run-out tolerances like torque transducers
  - **Leads to fit clearance**
  - **Run-out tolerances can add up => unbalance => bending moment!**
- Axial run-out tolerances
  - **If the axial run-out tolerances deviate too much from each other, in case of turning the transducer will be virtually deflected! => bending moment!**
- Surface quality (Ra < 0.8µm)
  - **High surface quality prevents settlement => Influence on zero point**
- Min. tensile strength ≥ 900 N/mm², >30HRC
  - **If the tensile strength of the adapter flange is too low, there is a risk that the thread may tear out and too soft adapters may have an influence on zero point**
- Number of screws and tightening torque according to specification
  - **Ensure proper torque transmission thru friction and maintain measurement performance**

Compensation of misalignment

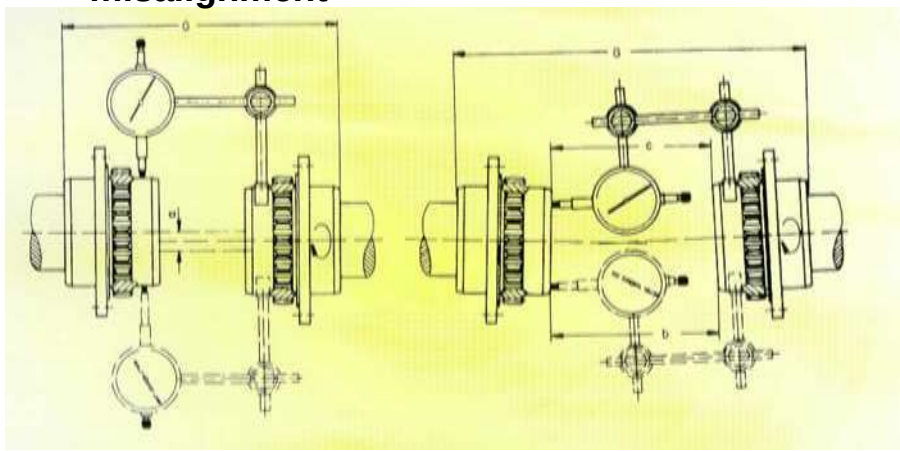
Misalignment

- Alignment of the complete shaft as good as possible
- Uncompensated misalignment results in forced deformation



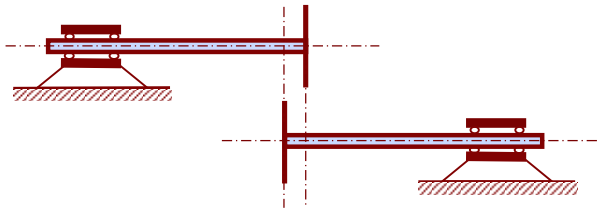


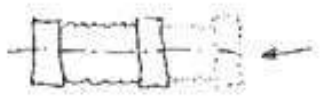
Parallel misalignment



Misalignment

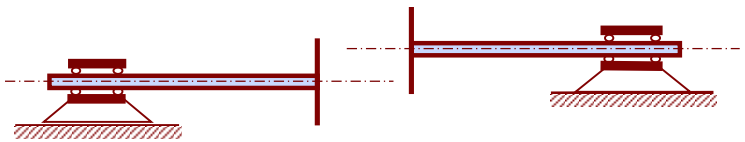
Axial

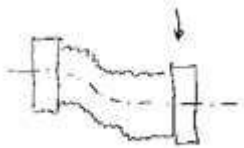




- Axial force
- Bending moment

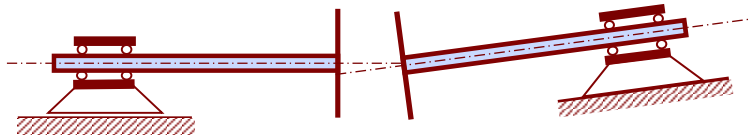
Parallel

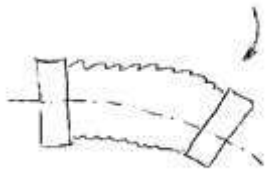




- Radial force
- Bending moment

Angular





- Bending moment

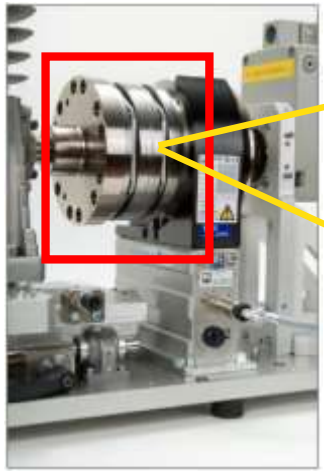
Misalignment

- Compensation

Universal joint

- Joint shaft
  (with bigger misalignment)

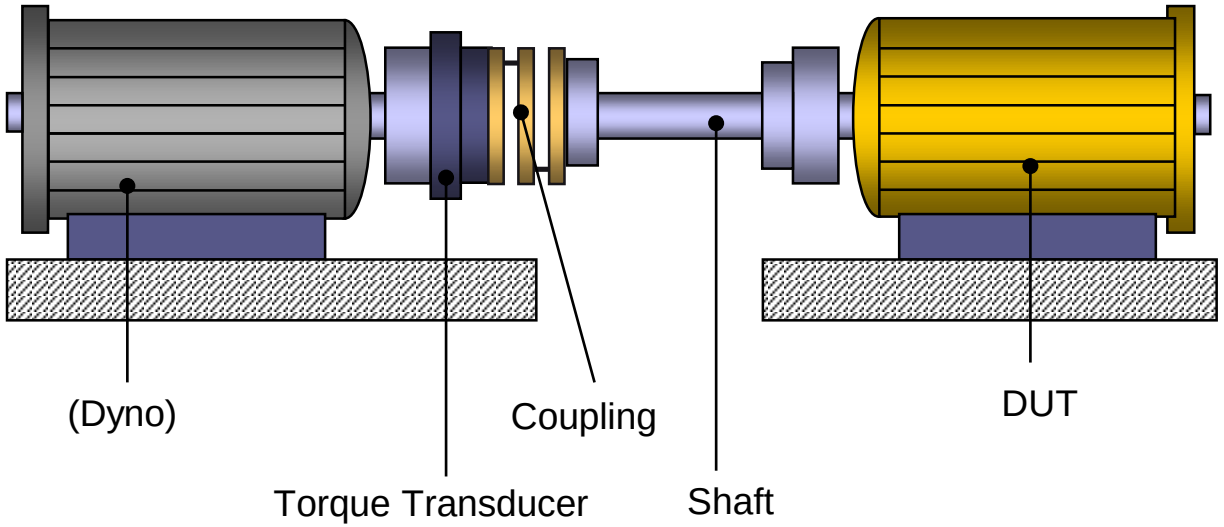
Full coupling



- Bending elastic coupling
  -full or double joint coupling-
  (with small misalignment)

Misalignment

- Compensation
- Precise torque transmission
- High torsional stiffness
- Compensation of all three types of offsets
- Small restore forces



- High alignment quality keeps restore forces small!

Summary

Summary

- Use always the specified number and quality of screws
- Concentricity and eccentricity tolerances should match those of the transducer
- Ground surface ($R_a < 0.8$)
- Minimum material strength >900 N/mm^2, hardness >30 HRC
- Surface flatness $\leq$0.01 mm
- Observe the prescribed torque when tightening the connection bolts
- Compensation of misalignment

Thank You

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