Single (½) high Torque Flexible Disc Coupling for free flowing installation

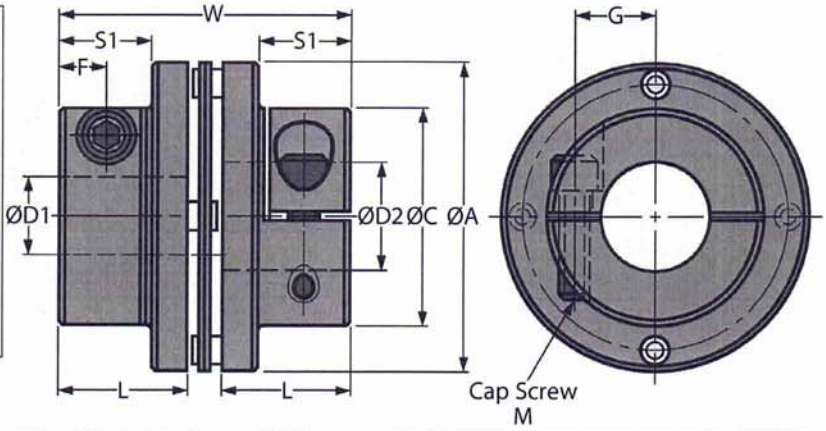
NORDIC TRANSDUCER

COUPLINGS

MHS-C

Flexible Single Disc Coupling

High Torque Backlash Free, Clamp Fixing : 2 - 20Nm : 6 - 25mm Bores



Part Number	Min. Bores ØD1 ØD2	Max. Bores ØD1 ØD2	ØA	L	W	ØC	S1	F	G	M	Mass g
MHS-32C	6	10	32	13.7	32	22	9	4	8.00	M3	38
MHS-40C	8	14	40	16.5	38	28	12	6	10.50	M4	66
MHS-50C	12	20	50	19.4	44	39	15	7	14.75	M5	120
MHS-63C	15	25	63	22.3	50	45	18	8	17.00	M6	190

Part Number	Wrench Torque Nm	Rated Torque* Nm	Max. Torque* Nm	Max. Rpm	Moment of Inertia** kg•m2	Static Torsional Stiffness Nm/rad	Errors of Angularity	Max. Axial Play
MHS-32C	1.5	2.0	4	19,000	4.5×10^{-6}	1,300	1°	±0.2
MHS-40C	2.5	4.0	8	15,000	1.2×10^{-5}	2,800	1°	±0.2
MHS-50C	7.0	7.5	15	12,000	3.7×10^{-5}	3,700	1°	±0.2
MHS-63C	12.0	10.0	20	10,000	8.4×10^{-5}	5,000	1°	±0.2

* Adjustment of rated and maximum torque specifications for load fluctuations is not required.
** Based on maximum shaft bores.

Material

Hub: Aluminium A2017 with anodised coating.
Disc: 301 Stainless Steel.
Pin: 303 Stainless Steel.
Collar: 303 Stainless Steel.
Cap Screw: SCM435, black oxide coating.

Maximum Operating Temperature: +100°C (Approx.).

Ordering

Add bore size required to end of part number eg.
MHS-32C-8X10 (bored Ø8mm & Ø10mm).

MHS-32C- 8 – 10

Type
ØD1
ØD2

Extras

Boring Out, Pin Holes, Tapped Holes.
Keyways available subject to a minimum order quantity of 5 pieces P.O.A. due to being pre-formed prior to assembly.
Keyways may be slotted after assembly but Ondrives do not offer this service.
Pin holes and tapped holes also available. Keyways not available on blind hubs.

Features

- For use with stepper motors.
- Zero backlash.
- Very good high torsional stiffness and torque properties.
- Identical clockwise & anti-clockwise rotational characteristics.
- Double stainless discs absorb angular misalignment and shaft end play.
- Parallel misalignment not absorbed.
- Maintenance free, excellent resistance to oil and chemicals.
- Capscrews supplied.
- Recommended tolerances on shaft diameters is h6 and h7.
- Minimal effect on response in static torsional stiffness caused by temperature, though operating at high temperatures may lead to misalignment due to shaft distortion or elongation from thermal expansion.
- Stock cap screws may be replaced with Stainless Steel screws.

Many types of Miniature Metal Bellows Couplings can also be used

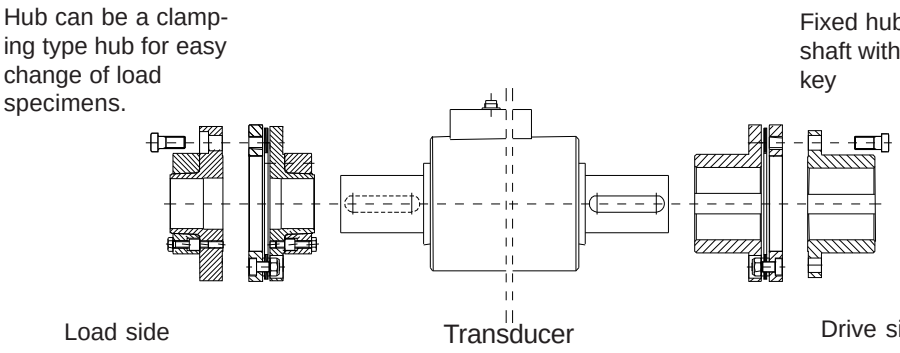
NORDIC TRANSDUCER ALS ODDE DENMARK
www.torquesensor.eu ntt@ntt.dk Phone: +45 98581444

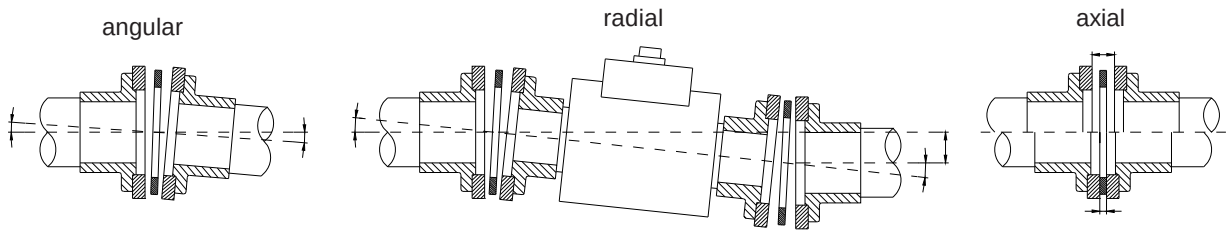
Flexible disc couplings based on sheet metal plates is shown here .

In rotating torque installations, the type of couplings used is very important.
The installation of couplings should be such that no radial forces other than the coupling weight are present.
The couplings must have a flexing part which can accommodate minor angular, radial and axial misalignment, but at the same time have the stiffness to transmit the given torque force without any vibration or slip in the force transmitted, which can spoil the correct picture of torque, or in worst case can spoil the transducer.
Many different types of couplings are present on the marked to day, but it must be taken into count that a torque transducer is a high precision measuring device and should not be employed as a simple mechanical transmission device.

Single flexible, shaft couplings **for free floating transducer only to be used on TorqueSensors >50Nm with a speed < 500 RPM**

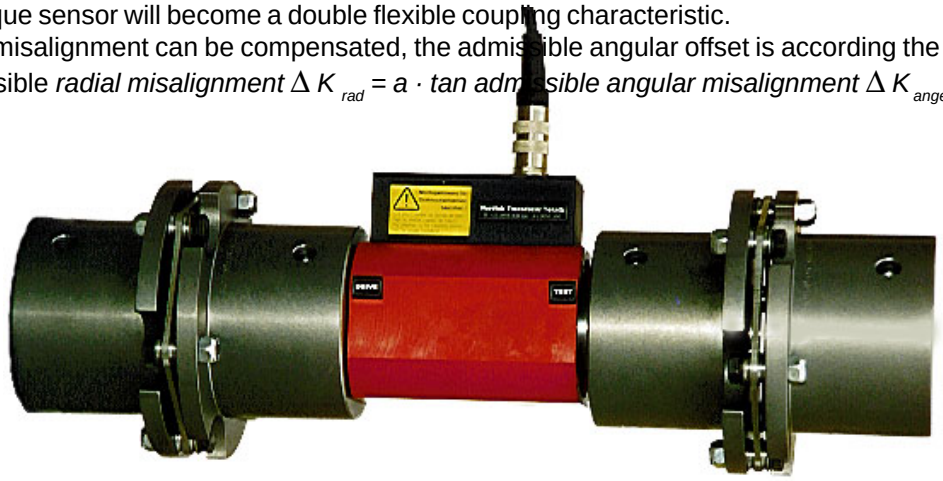
Torsional stiff and flexible coupling compensate axial and angular misalignment in the shaft arrangement.





Above drawings show the principle arrangement of single flexible coupling and the shaft offset. In general the three shown types of shaft offset occur simultaneously in operation. They superimpose to a total misalignment which has to be compensated by the coupling.
Where as a single flexible element only permits angular and axial misalignment, two of these elements together with the torque sensor will become a double flexible coupling characteristic.
In this case angular misalignment can be compensated, the admissible angular offset is according the formula:

admissible *radial misalignment* $\Delta K_{rad} = a \cdot \tan$ *admissible angular misalignment* ΔK_{angel}



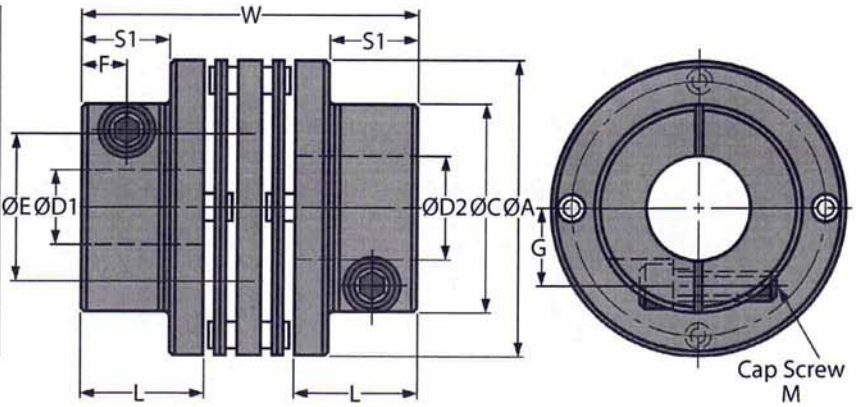
500Nm model Torque transducer shown with 2 single flexible couplings

COUPLINGS

MHW-C

Flexible Double Disc Coupling

High Torque Backlash Free, Clamp Fixing : 2 - 20Nm : 6 - 25mm Bores



Part Number	Min. Bores ØD1 ØD2	Max. Bores ØD1 ØD2	ØA	L	W	ØC	S1	F	G	M	ØE	Mass g
MHW-32C	6	10	32	13.7	40	22	9	4	8.00	M3	15	48
MHW-40C	8	14	40	16.5	46	28	12	6	10.50	M4	25	81
MHW-50C	12	20	50	19.4	52	39	15	7	14.75	M5	25	150
MHW-63C	15	25	63	22.3	58	45	18	8	17.00	M6	32	230

Part Number	Wrench Torque Nm	Rated Torque* Nm	Max. Torque* Nm	Max. Rpm	Moment of Inertia** kg•m2	Static Torsional Stiffness Nm/rad	Errors of Eccentricity	Errors of Angularity	Max. Axial Play
MHW-32C	1.5	2.0	4	19,000	6.2×10^{-6}	1,000	0.15	2°	±0.4
MHW-40C	2.5	4.0	8	15,000	1.6×10^{-5}	1,500	0.20	2°	±0.5
MHW-50C	7.0	7.5	15	12,000	4.6×10^{-5}	2,000	0.20	2°	±0.6
MHW-63C	12.0	10.0	20	10,000	1.1×10^{-4}	2,500	0.30	2°	±0.8

* Adjustment of rated and maximum torque specifications for load fluctuations is not required.
** Based on maximum shaft bores.

Material

Hub: Aluminium A2017 with anodised coating.
Disc: 301 Stainless Steel.
Pin: 303 Stainless Steel.
Collar: 303 Stainless Steel.
Cap Screw: SCM435, black oxide coating.

Maximum Operating Temperature: +100°C (Approx.).

Ordering

Add bore size required to end of part number eg.
MHW-32C-8X10 (bored Ø8mm & Ø10mm).

MHW-32C- 8 – 10

Type
ØD1
ØD2

Extras

Boring Out, Pin Holes, Tapped Holes.
Keyways available subject to a minimum order quantity of 5 pieces P.O.A. due to being pre-formed prior to assembly.
Keyways may be slotted after assembly but Ondrives do not offer this service.
Pin holes and tapped holes also available. Keyways not available on blind hubs.

Features

- For use with stepper motors.
- Zero backlash.
- Very good high torsional stiffness, torque and misalignment absorption properties.
- Identical clockwise & anti-clockwise rotational characteristics.
- Double stainless discs absorb angular misalignment and shaft end play.
- Parallel misalignment not absorbed.
- Maintenance free, excellent resistance to oil and chemicals.
- Capscrews supplied.
- Recommended tolerances on shaft diameters is h6 and h7.
- Minimal effect on response in static torsional stiffness caused by temperature, though operating at high temperatures may lead to misalignment due to shaft distortion or elongation from thermal expansion.
- Stock cap screws may be replaced with Stainless Steel screws.

Double (Full) Spiral Beam in Alumnium for smaler capacities as this 10Nm Torque can also be used as Coupling for Table stand installation.

Miniature Aluminiun or Metal Bellows Couplings can also be used on small forces typical up to 10-15Nm

Application

Two double-flexible bellows couplings provide compensation, when torque sensors with fixed housing are required.

Compensation of misalignment is always needed to avoid measurement error and damage to the sensor.

Installation of sensors with fixed housing or mounting support requires double flexible couplings on both sides of the sensor. Each coupling is mounted via clamping hubs on both sides.

The frictional clamped connection guarantees absolutely backlash-free installation.

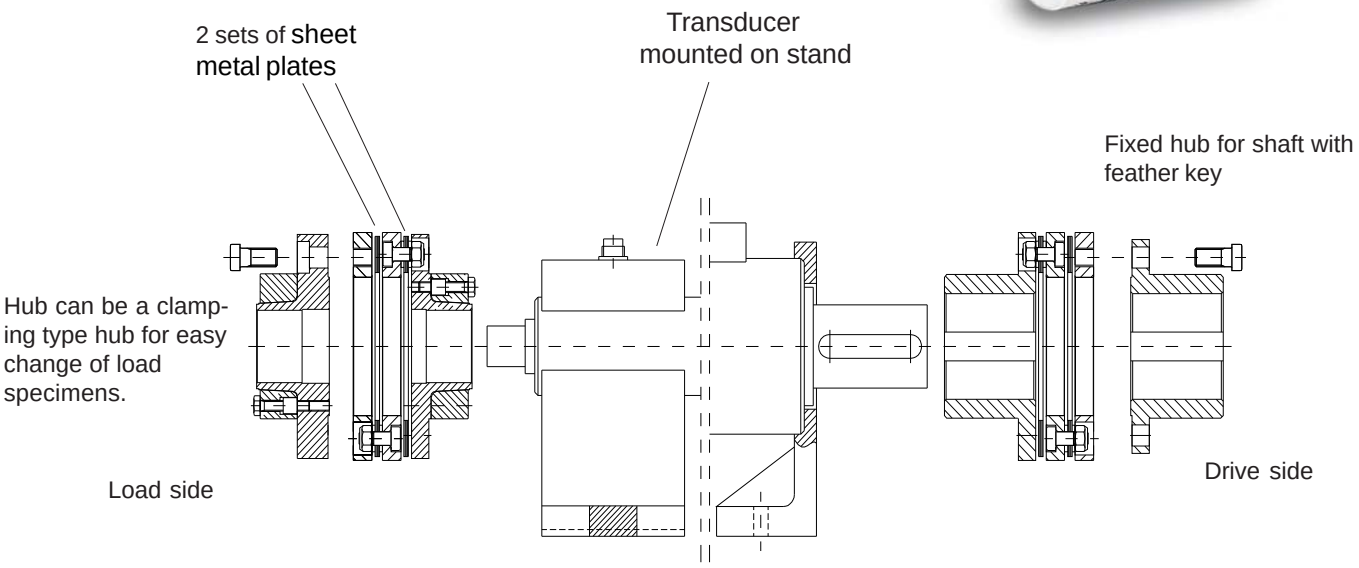
Inside diameters (.d1 and .d2) of the clamping hubs can be configured individually.

This allows integration to the torque sensor into nearly any type of application.

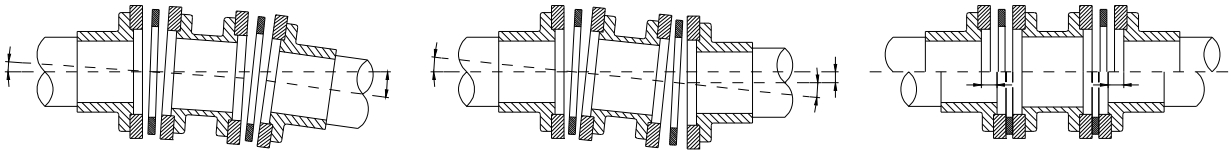
The Force sensors with a fixed housing, here a double flexible coupling must be fitted on both sides.
Clamping hubs are used for the mounting on both sides. The frictional connections make sures that installation is absolutly free of any play.

Double flexible, shaft couplings for foot mounted transducer typical over 50Nm capacity

Torsional stiff and flexible steel shaft coupling with two flexible disc pack compensate axial, angular and even radial misalignment on shaft connection. At small capacities use Bellow Clamping Hubs



Behaviour of one double coupling shown here !



angular radial axial

The drawings above show the general design of double-flexing couplings and their characteristics during shaft offset. In general the three shown types of shaft offset occur simultaneously in operation. They superimpose a total misalignment which has to be compensated by the coupling. Whereas a single-flexing element only permits angular and axial misalignment, the parallel offset capacity of double-flexing couplings is a function of the admissible angular offset and the distance between the two packs according to the formula:

admissible *radial misalignment :* $\Delta K_{rad} = a \cdot \tan$ *admissible angular misalignment* ΔK_{angel}

Nordisk Transducer Teknik

Als Odde, DK-9560 Hadsund Denmark
Tel.: +45 98581444
E-mail: ntt@ntt.dk WEB: www.torquesensor.eu

For small Multi-Beam couplings

The choice of couplings available to today's engineers can be daunting, but follow our guidelines and you will arrive at the optimum coupling for your particular application.

Does the coupling provide adequate misalignment protection?
Can it transmit the load torque?
Do I need axial motion or axial stiffness?
Can it sustain the required speed of rotation?
Will it fit within the available space envelope?
Can it operate at the designated ambient temperature?
Does it provide torsional stiffness required for positional accuracy?
Does it provide electrical isolation between the shafts?
Will it have the required life expectancy?

MISALIGNMENT COMPENSATION AND AXIAL MOTION

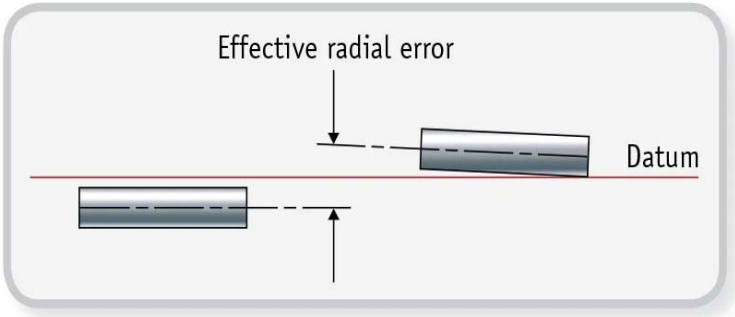


Fig. 15 *Effective radial error.*

Figure 15 - Effective Radial Error The ability to deal with misalignment and axial motion differentiates a flexible coupling from a simple rigid-type coupling.The particular mechanism used — bellows, membrane, flexible beam or sliding disc — determines the performance characteristic of the coupling, including its tolerance of misalignment or axial motion.

For instance, sliding disc and universal/lateral couplings can tolerate large misalignments, but at the cost of having their backlash-free life reduced. Bellows-type couplings, can absorb a high degree of axial motion but with a possible reduction in misalignment capacity. Membrane couplings, however, can be damaged beyond repair if axial motion exceeds the coupling's specification. That said, they can withstand large misalignments with little or no reduction in life expectancy.

Where misalignment is incidental, in other words caused simply by manufacturing tolerances, a more realistic measure is the effective radial error. This is the radial distance between the shafts' axes measured midway along the length of the coupling. Sometimes called the composite error, this can be crucial when determining a value for the maximum permissible misalignment.

Axial motion is often created as a result of axial clearances in the shaft bearings, or through thermal expansion. While it is usual to absorb this with a suitable coupling, it may, in some cases, be more beneficial to resist the motion, particularly if it has a positioning function. Couplings such as the universal/lateral type can be useful in such circumstances.

Flexible couplings are designed to protect shaft support bearings from destructive radial and thrust loads arising from misalignment and axial motion. In effect, all couplings resist these properties; therefore, the conclusion is that those with least resistance will better protect the bearings. Figure 16 compares the radial bearing loads of some of the most popular couplings based on a nominal outside diameter of 25 mm, with the exception of the jaw coupling where a 30 mm diameter has been used.

FLEXIBLE SHAFT COUPLINGS

Flexible shaft-type couplings compensate for radial and angular misalignment though the flexure of a varying number of compliant elements. This type of coupling includes the multi-stage bellows, helical beam and radial slit concepts.

Points to bear in mind:

The greater the number of elements, the greater the angular and radial misalignment capacity and the lower the torsional stiffness.
The forces required to effect compliance are broadly proportional to the torsional stiffness. The stiffer the coupling in torsion, the higher the resulting bearing loads.

MEMBRANE (HUCO FLEX-DISC) COUPLINGS

Thin pressed spring steel membranes act as the pivotal media in disc couplings. These are attached alternately to the drive and driven members, and provide flex to compensate for misalignment. Any torque is resolved to simple tensile stresses in the opposing segments of the membranes, which are free of residual stresses as no secondary forming operations are involved in their manufacture. Another advantage of this type of coupling is their near-infinite life and dynamically balanced construction, making them suitable for applications where high rotational speed and high-level motion integrity are required. Typical applications include closed loop servo systems in machine tools, robots, scanners, centrifuges, turbines and dynamometers. When selecting a disc coupling, the user can specify modified spring rates, longer/shorter intermediate members and either keywayed or ‘D’ bore

Flex disc, bellows or multi beam couplings should be considered when:

Torsional stiffness is a critical parameter
The backlash-free life requirement is beyond the capacity of the Oldham or Uni-Lat
Speeds are typically higher than 3000 revs/min
Rotation is continuous or the duty-cycle exceeds 50%
A coupling with axial compliance is required to protect fragile bearings from thrust load
There is little risk of the alignment errors exceeding prescribed limits during initial installation or on subsequent replacement of the motor, encoder, etc.
The environmental conditions favour an all metal coupling

FLEX BELLOWS/BEAM

The characteristics of the bellows coupling can be modified by varying the number and/or the wall thickness of the convolutions of the bellows. This type of coupling generally has high torsional stiffness and may be used in any drive system where high levels of motion integrity are essential. Typical applications include encoder drives in closed-loop servo systems. Coupling options include modified spring rates, along with keywayed and ‘D’ bores.

Huco Multi Beam couplings 3 stage or 6 stage

Although the life expectancy of the Huco-Flex bellows coupling is not as high as the comparable Huco-Flex disc coupling, size for size it offers the highest torsional stiffness ratio and provides a high level of translation accuracy. This makes the bellows-type coupling ideally suited to intermittent applications.

Huco-Flex disc couplings have a greater reliability and near infinite life when used within their torque and misalignment ratings. They also provide a high level of translational accuracy and their spring rates can be modified through varying the number and thickness of the stainless steel membranes. However users must be aware that couplings designed around a flexural system can fail with little or no warning, causing immediate loss of drive. The cause of these failures is due mainly to metal fatigue caused by sustained flexure above the coupling's recommended torque and compliance factors.

Failure in mechanical couplings is more subjective and useful life can vary depending on individual applications. For instance, in zero backlash applications the coupling is deemed to have failed as soon as backlash is in evidence. In other applications the failure threshold may be 2 degrees of backlash.

Huco Multi Beam couplings are zero backlash single-piece couplings and are available in single stage (3-beam) or two stage (6-beam). Multi beam couplings also have material options available for moisture and corrosion resistance.

Huco's Single Beam couplings provide zero backlash and are single-piece couplings that are more flexible than Multi-Beam but less torsionally rigid.

Huco single Beam couplings

NORDIC TRANSDUCER

LOAD TORQUE, INERTIA AND TORSIONAL STIFFNESS for small Multi-Beam couplings

Figure 16 - LoadIn applications where couplings are used to drive frictional loads, for example, pumps, shutter doors and machinery, etc., the coupling's torsional stiffness is not a major factor as the angular synchronisation of the shafts is not an issue. However, when resonance is a problem, it is possible to reduce the coupling's torsional stiffness and so avoid conflict with the natural resonance of the machine.

This does not apply when the loads are inertial; typically position and velocity control systems where registration of input and output shafts is critical throughout the opera ting cycle. In these applications the three elements of motor, coupling and load combine to create a resonant system. The frequency of this system is controlled by the load inertia and the coupling's torsional stiffness. Increasing the inertia, or lowering the torsional stiffness, results in a lower resonant frequency.

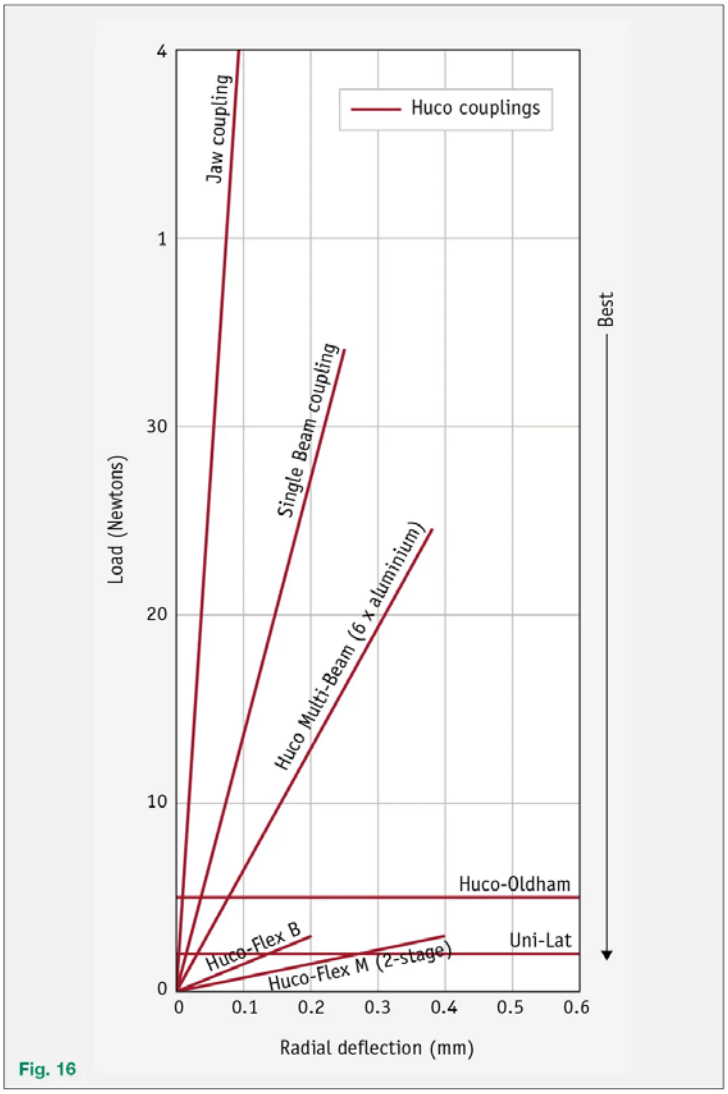


Fig. 16

In order to control a resonant system you must work well below its resonant frequency. For example, imagine supporting a weight on an elastic band. You can control the weight's vertical movement if you move your hand slowly. Increase the speed and the weight barely moves.

Therefore, to improve responsiveness you require less elasticity or you need to reduce the weight. If you now substitute the elastic band with a coupling and the weight with an inertial load, you have an analogy of an inertial system.

To summarise, when the emphasis is on performance, you require a stiffer coupling in order to reduce settling times, improve positional accuracy and raise the upper limit of dynamic performance.

Torsional deflection (the inverse of torsional stiffness) for a number of the most popular couplings, based on a nominal outside diameter of 25 mm, with the exception of the jaw coupling where a 30 mm diameter has been used.