



NATIONAL COUPLING

General Design Requirements for the Use of Hydraulic Couplings

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INTRODUCTION

The following general design requirements should be considered “best practice” for most applications. These design requirements are intended to serve as basic guidelines for performance optimization of pin and box type hydraulic couplings and apply to a broad spectrum of applications. As a general rule, all mounting configurations must allow the male and female couplings to freely center and align themselves. Failure to do this will likely cause damage to the coupling sealing surfaces and result in hydraulic system leakage.

Mounting requirements of the couplings may vary according to specific applications such as subsea production control modules, junction plate assemblies, tubing hanger penetrators, flying lead connectors, tree-to-tree cap hydraulic connections, etc. Additional factors that may impact the general design requirements include whether the couplings are plate mounted or thread mounted, whether they have rigid tubing or flexible hose connections and whether or not the couplings are free to float. Each of these factors should be evaluated on a case-by-case basis.

Please contact National Coupling Company, Inc. (NCC) in the event that an application requires a design beyond the limitations of these general design requirements. NCC has provided hydraulic coupling designs for applications requiring mating and de-mating under severe misalignment conditions (both axial and radial) that have performed very reliably. NCC welcomes the opportunity to develop special design solutions as required.

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GENERAL DESIGN REQUIREMENTS:

1. The coupling mounting hole diameter should be sized as specified on the NCC drawing.

The coupling mounting hole diameter specified on the NCC drawing is sized in accordance with the customer specified mounting plate thickness. The combination of the coupling tail dimensions, mounting hole diameter and mounting plate thickness determine the amount of radial float and angular adjustment available to the couplings.

In general, a mounting hole diameter larger than recommended will allow more misalignment between the couplings than allowed by the coupling design. Excessive misalignment may damage the coupling seals and/or seal surfaces.

A mounting hole diameter smaller than recommended reduces the allowable radial float and is acceptable as long as tighter tolerances are held between the mating coupling mounting holes.

2. An orientation mechanism should be used for coupling alignment.

The orientation of coupling mounting surfaces shall be controlled by a mechanism other than the couplings themselves. All guide pins, concentric cylinders, keyways, etc. shall achieve fine alignment of the mating couplings and parallelism of the mounting surfaces prior to the engagement of the male and female couplings.

Mounting hole concentricity must allow the couplings to freely center and align themselves within .001" while being mated or de-mated.

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3. Positive stops should be incorporated into the design to prevent shoulder-to-shoulder contact between couplings.

Couplings should be able to freely float when fully mated to optimize seal performance. Shoulder-to-shoulder contact may restrict the radial, axial and angular float of the couplings. Fully mated couplings should maintain a shoulder to shoulder gap between .001” and the maximum allowable value specified on the coupling drawing.

4. The male and female coupling mounting surfaces must be parallel prior to mating and de-mating the couplings.

Combined with coupling floating requirements, this condition must be met to maintain axial alignment of the couplings and optimize seal performance.

5. Couplings should be perpendicular to mounting surfaces.

The design must allow the couplings to rest in a natural position perpendicular to the mounting surfaces. Angular deviation from perpendicular may restrict the coupling from floating freely over the full range of motion in the radial and axial directions.

Couplings should be axially aligned within 1 degree when mating and when fully mated. This includes parallelism between mounting plates and perpendicularity between the couplings and their respective mounting plates.

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6. The coupling mounting surfaces should be flat, clean and smooth.

The flatness, cleanliness and finish of the coupling mounting surface affect the ability of the coupling to float freely over its full range of motion.

7. All thrust washers or mounting hardware for the coupling should be sized in accordance with NCC specifications.

Proper sizing of the thrust washer or other mounting hardware will allow the couplings to freely align with each other during mating and de-mating. Sizing the outer diameter, inner diameter and thickness of the thrust washer in accordance with the recommended dimensions optimizes the axial, radial and angular float of the coupling.

8. Tubing or hose connections should not induce axial or side loads that restrict the float of the coupling.

Tubing or hose connections must allow the couplings to rest in a natural position perpendicular to the mounting surface and freely float within the mounting hole. Tubing and hoses should be secured such that they do not apply an axial or radial load to the coupling. Radial and axial loads on the coupling will reduce the ability of the coupling to freely float and align with its mate, and may damage coupling seals and sealing surfaces.

Tubing and hoses should extend coaxially with the coupling in its free floating position. Any angular deviation or radial offset caused by the tubing or hoses may induce side loading on the coupling. A bore liner is recommended to protect the male probe sealing surfaces in applications where coupling side loads may exceed 7 lbs. NCC recommends that all tubing and hoses extend as far from the couplings as the design allows before they are secured.

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9. Coupling guide sleeve should be used if applicable to the coupling design.

The purpose of the coupling guide sleeve is to protect the male sealing surface, assist in the rough alignment of the couplings and aide in the flushing of debris from the upper shoulder of the male. As a general rule, the guide sleeve is not intended to resolve misalignment issues outside of the design requirements listed above.

10. Coupling seals should be periodically inspected and replaced.

Seal life will vary depending on the service conditions they are exposed to. Seals that experience large side loads or severe chemical exposure will need to be replaced more frequently than seals in well aligned couplings using mild fluids. Seals should be replaced after 20 mates and demates, or sooner if service conditions warrant.

SUMMARY

Hydraulic couplings are critical components of any subsea hydraulic system. Like other components in the hydraulic system, couplings must be used within the scope of their intended design parameters. Improper coupling use could jeopardize the integrity of the entire hydraulic system. Adhering to these coupling mounting recommendations will optimize coupling performance and extend coupling service life in a wide range of applications.

NCC has provided successful coupling solutions for design cases where both couplings float, cases where one coupling is free to float and cases where both couplings are rigidly mounted, as well as other special cases outside of these general design requirements. Each design case must be evaluated individually to insure optimum coupling performance and reliability. NCC personnel are available to assist our

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customers and operators in the engineering and design of couplings for special applications.

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