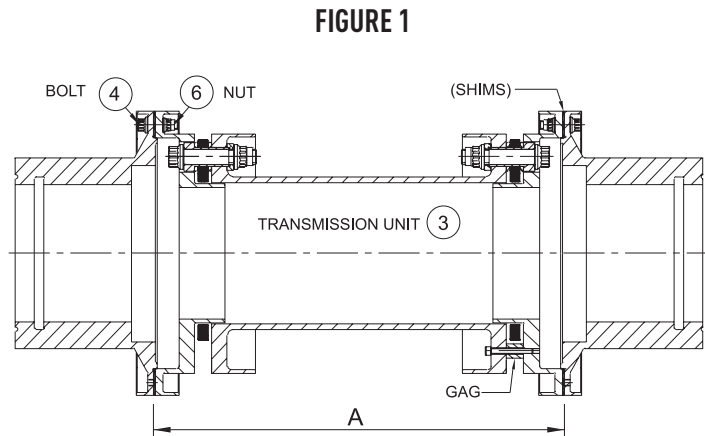


General Specification

John Crane's torsionally rigid HSFE/HLFE/HTFE flexible coupling is a high-performance, dynamically balanced, coupling typically for use on mechanical drives with integral flanges (turbines, pumps, compressors). Additionally, it is designed to maintain the drive until the machinery can be safely brought to rest in the event of failure of the flexing elements.

A general arrangement (GA) drawing is always supplied for high performance couplings. These instructions are to be read in conjunction with the GA and any specific information on the drawing takes precedence over the general information included herein.

NOTE: Throughout these instructions, the generic high performance coupling code H_FE indicates HSFE, HLFE and HTFE.



Extent of Supply

The coupling will generally be supplied in the following configuration:

- Factory-assembled transmission unit, which will have been dynamically balanced for high-speed applications. The transmission unit will be supplied with transit gags (painted red) fitted to give protection during transportation and to aid installation of the coupling. These must be removed before running the coupling.
- Depending on the associated machinery, the coupling may be supplied with hubs or adapters, or designed for direct mounting onto machine flanges. These instructions are written for the general case where couplings have been designed and supplied with two hubs, suitably machined to fit the driver and driven shafts. Where transmission units are directly mounted to flanged machine shaft ends or adapters, reference to the specific GA drawing will give sufficient information for the correct installation of the coupling.
- When indicated on the GA drawings, adjustment shims are supplied. These allow the coupling length to be adjusted on site to suit the specific application. Refer to the specific GA drawing for details of the use of these shims.

NOTE: Components with match markings must be assembled together with their corresponding marks aligned. Match-marked stripper bolts and nuts must be paired.

Selection Verification

Although a coupling may be correctly specified at the time of order placement, the duty conditions can sometimes change prior to the coupling being put into service. Information is available from John Crane to advise on the selection and limitations of their power transmission products, but the user is ultimately responsible for verifying the suitability of the selection for the actual service conditions.

The coupling and its manner of use must conform to any legal or licensing requirements and, where appropriate, meet local health and safety requirements.

IMPORTANT If the conditions of operation are changed without approval from John Crane, the user will be responsible for any consequent damage and assume all risks.

Handling and Storage

- Couplings and components should be stored in a dry building away from direct heat.
- For maximum protection, the coupling and components should be stored in the original packaging. If any packaging has been removed or damaged in transit, it should be restored to a secure, safely-packaged condition.
- The coupling should be stored horizontally and should not be stood on end for long periods. Avoid shock during handling and protect against corrosion.
- Always examine parts thoroughly when taking them from storage for signs of damage or deterioration.
- During transport, handling and storage, the transit gags (painted red for identification) should be in position.

HIGH PERFORMANCE COUPLINGS

Installation, Operation & Maintenance Instructions

Handling and Storage (continued)

- Following installation of the coupling, all transit gags and bolts should be tagged with the plant/coupling ID and stored, ready for subsequent reuse on coupling removal, as should ancillary items such as spare shims.
- Documentation supplied with the coupling should be retained for future reference.

Installation of Coupling

Refer to the assembly drawing for all dimensions.

Inspect the coupling to ensure that it is undamaged, paying particular attention to hub bores and spigot (pilot) recess locations. Note any match marks that must be aligned when the coupling is installed.

Fit the hub(s) to the shaft(s).

Installation of Hubs

Prior to installing the coupling, ensure that the machinery is made safe. Hubs must be adequately supported during installation to avoid accidental damage should they slip.

IMPORTANT Refer to the coupling assembly drawing for all dimensions.

Parallel bore with keyed drive

1. Ensure the hub bore and mating shaft are clean and free from burrs.
2. The hub is usually installed with the hub face flush to the shaft end.
3. Measure the shaft diameter and hub bore to confirm the correct fit.
4. John Crane recommends a light interference fit for most applications and it may be necessary to apply heat to assist fitting of such hubs. An oven or induction type heater will usually be adequate. DO NOT spot heat or exceed 175°C as this may cause distortion. A thermal heat stick can be used to estimate the temperature before quickly sliding the hub onto the shaft. A suitable stop will ensure the correct axial position is located.

Taper bore with keyed drive

1. Thoroughly clean all contact surfaces and smear the tapered surfaces with oil.
2. Fit the hub onto the shaft without the key(s). Lightly hammer the hub with a soft faced mallet to ensure metal to metal contact takes place. Taper surface contact should be checked for compliance with applicable standards.
3. Measure the distance from the end of the shaft to the face of the hub using a depth micrometer (record this measurement).
4. Securely mount a dial gauge onto the inboard hub flange and set to zero.
5. Remove the hub and fit the key(s) which should be a tight sliding fit in the keyway with a small clearance at the top of the key.
6. Refit the hub and draw up the shaft to the correct axial position indicated by the dial gauge. *[If an interference fit is required the hub may have to be heated (this is rare however)].*
7. When the hub has cooled re-measure the distance from the end of the shaft to the face of the hub to confirm the correct axial position.
8. Fit the shaft-end retaining nut if applicable to ensure the hub is locked in position axially. Ensure the nut is seated against the hub recess face.
NOTE: *The hub face may not be flush with the shaft end when taper bores are used.*

Taper hubs mounted by oil injection

1. Ensure that fillets and corner radii of mating surfaces, oil distribution and drainage grooves are well rounded and free from burrs and contamination. Taper surface contact should be checked for compliance with applicable standards.
2. Thoroughly clean all contact surfaces and smear the tapered surfaces with oil.
3. Remove O-rings if fitted.
4. Fit the hub onto the shaft. Lightly hammer the hub with a soft faced mallet to ensure metal to metal contact takes place.
5. Measure the distance from the end of the shaft to the face of the hub using a depth micrometer (record this measurement).
NOTE: *Where O-rings are used this measurement should be taken with the O-rings removed.*

Installation of Hubs (continued)

6. Position a dial gauge against the hub flange face to measure axial movement and set to zero.
NOTE: Dial gauge should be zeroed with O-rings removed.
7. If O-rings are used remove hub and refit the O-rings before continuing.
8. Fit the oil injection equipment, axial stop and mounting tools. Consult the arrangement drawing and the oil injection system suppliers' instructions.



Fit and secure the axial ram or hydraulic nut BEFORE injecting oil between the components.

9. Inject oil between the component interface until the required mounting pressure is reached, or it leaks out at the ends of the mating surfaces.
10. By means of the mounting tools, draw the hub up the shaft to the correct axial position, injecting oil during this operation.
NOTE: The correct pull-up distance should be shown on the GA drawing along with max. permissible installation pressure.
11. Release the interface oil pressure and leave equipment fitted for one hour to allow for oil to drain from mating surfaces.
12. Remove the mounting tool and oil injection equipment.
13. Re-measure the distance from the end of the shaft to the face of the hub to confirm the correct pull-up.
14. Fit the locking washer and shaft-end retaining nut if applicable.



WAIT for 3-4 hours before applying torque.

Adapters

For machines having an integral flanged shaft, the flange may be machined to suit the bolting configuration of the coupling transmission unit. Alternatively, the coupling may be supplied with a customised flange adapter. Refer to the specific general arrangement drawing for location and mounting details.

Installation of Coupling (continued)**The shafts should then be aligned**

With one machine firmly bolted down, set the reference length (usually the distance between flange faces, DBFF) according to drawing dimension (A), taking into account any axial movements and thermal expansion which may occur in operation. The normal service operating distance must be as close as possible to that shown on the arrangement drawing.

Align shaft center lines horizontally and vertically.

NOTE: The misalignment tolerances quoted in literature and on drawings allow for dynamic conditions and variations. For the best service from the coupling, John Crane recommends that installation misalignment is no more than 10% of the maximum allowable misalignment. Allowance should be made for any anticipated movement which will occur during operation (i.e. thermal movements on hot pumps).

Check the distance between flange faces of the hubs, taking into account where applicable any axial movement that may occur in operation.

Shim setting procedure (if supplied)

Shims are supplied to compensate for minor variations in the axial setting of taper bored hubs. The assembly is supplied with one set of shims fitted and a separate set for installation. If necessary, the distance between transmission unit flange faces can be increased or decreased by adding or removing shims as required.

Required shim thickness can be found from:

$$S = A - CSL \quad \text{Where } S = \text{Shim thickness}$$

$$A = \text{Measured distance between flange faces (DBFF)}$$

$$CSL = \text{Cold setting length} = L + \Delta + \zeta$$

$$L = \text{Transmission unit length}$$

$$\Delta = \text{Thermal growth to normal operating temperature (where appropriate)}$$

$$\zeta = \text{Compensation for transient thermal growth (where appropriate)}$$

IMPORTANT Total shim set thickness must not exceed the value stated on the assembly drawing.

Check spigot and recess locations on the hubs and transmission unit for burrs or other signs of damage.

Installation of Coupling (continued)

FIGURE 2. Gagging arrangement

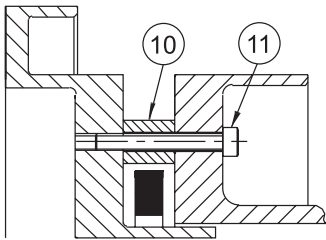


FIGURE 3. Membrane cap compression

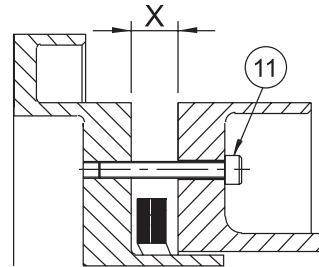


TABLE 1. Minimum Membrane Gap 'X' at Maximum Permissible Compression

HSFE	0074	0096	0115	0139	0159	0179	0200	0220	0240	0262	0283	0320	0357	0409	0449	0485
Gap 'X' mm	5.8	6.8	8.3	8.8	10.9	12.3	13	14.4	15.7	17.5	19.0	20.5	24.3	28.0	30.0	34.0
HLFE			0115	0139	0159	0179	0200	0220	0240	0262	0283	0320	0357	0409	0449	0485
Gap 'X' mm			9.0	9.7	12.2	13.8	14.4	16.0	17.6	19.2	20.7	22.0	26.2	30.1	32.3	35.5
HTFE						0179	0200	0220	0240	0262	0283	0320	0357	0409	0449	0485
Gap 'X' mm						14.5	15.3	17.0	18.7	20.3	22.1	23.5	28.0	32.2	34.5	37.9

TABLE 2. Tightening Torque — Spacer Bolts

Type HSFE sizes	0074 to 0139	0159 to 0200	0220 to 0320	0357 to 0485	0357 to 0485
Type HLFE sizes	0115 to 0139	0159 to 0200	0220 to 0320	0357 to 0485	0357 to 0485
Type HTFE sizes	-	0179 to 0200	0220 to 0320	0357 to 0485	0357 to 0485
Stripper bolt nut (6) Nm	10	25	80	205	270

Membrane unit compression

Before the spacer can be fitted between the membrane units it is necessary to compress the membranes. The following instructions detail each membrane unit compression:

- Remove the gagging sleeves (10) and refit gagging screws (11).
- Evenly tighten the gagging screws to compress the membrane units enough to clear the spigot location. Do not over compress the membrane units — Table 1 specifies the minimum gap 'X' at permissible compression.

Fitting the transmission unit

- Carefully supporting the weight of the transmission unit (3), position it between the hubs and align any match marks.
- Fit the matched pairs of stripper bolt (4) and nut (6) loosely to hold the transmission unit. Remove the gagging screws and store these safely with the sleeves for future use.

IMPORTANT Do not tighten stripper bolts with gagging bolts installed.

- Bolts should be tightened in a "diametrically opposite" sequence to the torque values quoted in Table 2. Always check the general arrangement drawing for confirmation, tightening torque values on the drawing take precedence.
- With the coupling in position, check that the 'as fitted' concentricity's correspond closely with those quoted on the balancing certificate. If this document is not available, ensure that all flanges are set up as concentric as possible. A figure of 0.075 mm TIR should not generally be exceeded.
- If possible, slowly rotate the machinery two or three times to ensure it moves freely.

WARNING Transit gags (red in color) must be removed before running the coupling.

Operation

ATTENTION Before starting the machinery, ensure that all necessary safety procedures are being observed.

When operated within the duty conditions for which they were designed, HSFE/HLFE/HTFE couplings will give long and trouble-free service. It is recommended that the tightness of fasteners (4 and 6) are checked periodically.

If the coupled machinery is disturbed at any time, the shaft alignment should be rechecked as a matter of routine. Alignment checking is also recommended if a deterioration of installation alignment during service is suspected.

In the event of failure, it is essential that the true cause of failure is found and corrected before a new unit is put into service. The most likely faults will either be excessive misalignment, extreme overload or a combination of both.

The stripper bolts use prevailing torque locknuts; it is recommended that all the nuts are used no more than five times, or until the prevailing friction torque is lost.

Removal of Coupling

DANGER Ensure coupling is stationary and has been made safe prior to commencing removal.

- Support the transmission unit (3) to ensure the weight is never imposed on one end only. Slacken off the stripper bolts 4 and 6.
- Fit the gagging bolts and compress the membrane units evenly until there is sufficient gap to permit removal of the transmission unit (refer to Table 1 and Figure 2).

IMPORTANT Do not over compress either assembly as this may damage the flexing elements.

- Remove the stripper bolts (4) and nuts (6), and lift out the transmission unit.
- Tapped holes are provided in flanges to assist in breaking the spigot/recess fit.

The following instructions detail the gagging of each membrane unit:

- Remove the red painted gagging bolts (11) used to compress the membrane. Then refit the gagging sleeves (10) and bolts and tighten. The membrane unit is now gagged. Repeat for the other membrane unit.

IMPORTANT NOTE: *The gagging method described above is only intended for transportation and fitting.*

IMPORTANT Do not dismantle the membrane assemblies as this will invalidate the dynamic balance.

Hub Removal

1. Keyed hubs

- Puller holes are provided as an aid to hub removal. They are not intended for 'cold' removal of the hub.
- Insert screwed rods and position a puller plate or bar over the rods, bridging a packer bearing on the shaft end.
- Tension the rods up to the safe tightening torque.
- Taking due safety precautions, preferably using an induction heater or heating tape, heat the hub quickly and evenly until it moves and draw off.
- DO NOT use spot heat or exceed 175°C as this may cause distortion.
- If the hub must be removed 'cold' then use a heavy duty puller bearing on the back of the hub boss. Avoid contact and load transfer between the puller and the flange as this may cause distortion.

2. Hubs mounted by oil injection

DANGER A suitable stop to control axial movement of the hub/membrane unit must be fitted before oil injection begins.

- For reasons of safety — and to prevent damage to mating surfaces — use the mounting tools to restrict the movement of the hub from the shaft, which may suddenly separate with considerable force.
- Assemble the oil injection equipment. Consult the oil injection system suppliers' instructions.
- Inject oil between the components until the required pressure is reached, or it leaks out at the ends of the mating surfaces.
- Gradually release the mounting tool so that the hub/membrane unit slides off smoothly.

Hub Removal (continued)**3. Adapters**

- Refer to the specific GA drawing for location and mounting details.
- Note position on shaft flange and any match markings.
- Support the weight of the adapter.
- Remove the adapter stripper bolts.
- Tapped holes are provided in flanges to assist in breaking the spigot/recess fit.

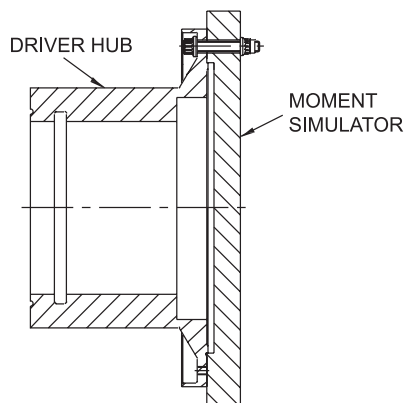
Caution

All necessary steps have been taken to ensure, as far as is reasonably practical, that couplings are designed and manufactured to be safe when properly used. These instructions are, however, general and it is important that users observe all statutory plant and other safety requirements.

While power transmission couplings are simple in concept, it is assumed that they will be used by appropriately qualified, experienced and competent people, for whom these instructions have been written.

Solo Running using a Moment Simulator

Where the driving machine is required to be run uncoupled a moment simulator may be provided. The moment simulator is designed to simulate the half-weight and center of gravity of the coupling when bolted to the hub face.



HIGH PERFORMANCE COUPLINGS




Installation, Operation & Maintenance Instructions

This section refers to couplings that bear the CE and ATEX required markings:

CE / ATEX Marking

All couplings that comply with CE and ATEX legislation will be marked as shown. This will be etched on the spacer element of the transmission unit if enough room is available.

A) Ambient temperature is standard (40°C max)



CE  I M2_C  II 2GD_C T6 (T85°C)  SL1 4LU, UK. XX

Where John Crane's Metastream metal membrane couplings are required for use in higher ambient temperatures, John Crane UK Ltd certifies that the equipment complies with the temperature classification range listed below in Table 3, and in all other respects complies with the type certificates.

TABLE 3

Ambient Range Marking		Group II, Category 2 GD **	Group I, Category 2 M2	Marking Option
Min.	Max.			
Unknown		T3 (T200°C)	Not Applicable	B
-55°C <	Ta < 150°C	T3 (T200°C)	Not Applicable	B
-55°C <	Ta < 90°C	T4 (T135°C)	150°C	C
-55°C <	Ta < 55°C	T5 (T100°C)	150°C	C
-55°C <	Ta < 40°C	T6 (T85°C)	150°C	A

B) Ambient temperature is (-55°C < Ta < 150°C) OR ambient temperature is unspecified, the equipment is not suitable for mining applications, Group I, Category 2.

CE  II 2GD_C T3 (T200°C)  SL1 4LU, UK. XX

C) Ambient temperature is (-55°C < Ta < 90°C)

When the ambient temp. is specified, 'T3' is replaced by the following 'T' mark (**) according to Table 3.

CE  I M2_C  II 2GD_C **  SL1 4LU, UK. XX

NOTE:

'XX' is the year of manufacture and will change. For example, for year 2016; XX = 16.

CE and EX marks must meet requirements of Annex II in Reg. (EC) No. 765/2008 and Annex II in Dir. 84/47/EEC respectively.

Operation in aggressive atmospheres

The following components contain non-metallic materials. Confirm compatibility or provide suitable protection if the coupling is to operate in an aggressive atmosphere.

- The hub electrical insulation (if supplied option) – reinforced thermosetting plastic
- Limited end float bearings (if supplied option) – PTFE based plastic

Temperature classification of John Crane's Metastream couplings

John Crane's Metastream metal membrane couplings, supplied in conformance with Directive 2014/34/EU, have to meet the classifications specified in Table 3 when used in accordance with instructions and information supplied.

T, L and H series couplings, using the disk type flexible elements, are covered by type examination certificate **Sira 02ATEX9403**.

M series couplings, using the diaphragm type flexible elements, are covered by type examination certificate **Sira 02ATEX9404**.

**John Crane UK Ltd**

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Declaration of Conformity

EEC Directive 2014/34/EU of 26.02.2014
and resultant legislation and standards

We, the manufacturers – John Crane UK Ltd, – confirm that the explosion prevention requirements have been implemented for

Metastream® metal-membrane couplings

Equipment complies with the requirements of directive 2014/34/EU. It is in accordance with article 1 3. (a) of the directive and the fundamental Health and Safety requirements of Annex II, are fulfilled.

The current Type Examination Certificates for the couplings are:-

'T', 'L' & 'H' Series -	Sira 02ATEX9403
'M' Series -	Sira 02ATEX9404

The technical documentation is deposited with the designated notified body in accordance with article 13 (b) (ii) of the Directive 2014/34/EU.

SIRA Certification Services
Unit 6, Hawarden Industrial Park
Hawarden, Chester, CH5 3US
United Kingdom

Signed:

Date: 20th July 2016

S. Pennington
(Engineering Manager - Couplings)

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Declaration of Incorporation**E.C. Machinery Directive (2006/42/EC)**

Section 1.0 - Machinery Description:
Flexible Power Transmission Ring and Diaphragm Form Membrane Couplings
Types:

'H', 'T', 'L' & 'M' Series

Section 2.0 - Applicable Harmonised Standards
ISO13709 (API 610) for centrifugal pumps
ISO14691 couplings for - General-purpose applications
ISO10441 (API 671) (opt) couplings for - Special-purpose applications

Section 3.0 - Declaration:
We, John Crane declare that under our sole responsibility for the supply of the machinery defined in Section 1.0 above, the said machinery parts are intended to be incorporated into other machinery or assembled with other machinery to constitute machinery as covered by this Directive.

The machinery parts, covered by this declaration must not be put into service until the machinery into which it is to be incorporated has been declared in conformity with the provisions of the Directive.

Signed:

Date: 20th July 2016

S. Pennington
(Engineering Manager - Couplings)



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If the products featured will be used in a potentially dangerous and/or hazardous process, your John Crane representative should be consulted prior to their selection and use. In the interest of continuous development, John Crane Companies reserve the right to alter designs and specifications without prior notice. It is dangerous to smoke while handling products made from PTFE. Old and new PTFE products must not be incinerated. ISO 9001 and ISO14001 Certified, details available on request.