MHS & MOD

M SERIES METAL MEMBRANE

Fitting, Operation & Maintenance Instructions

Description

The ranges of John Crane's Metastream couplings covered by this data sheet are designed to transmit torque between the rotating shafts of a driving and driven machine, while accommodating the inevitable lateral, angular and axial misalignment, which will exist between two coupled machines.

The coupling will generally be supplied in one of the following configurations:

Non-spacer couplings (designated MHSO or MODO)

- Factory-assembled membrane unit (3A). The MHSO membrane unit includes an adapter plate (3C)
- Driving and driven hubs (1 and 2 respectively) as required
- All the necessary fasteners

Spacer couplings (designated MHSS or MODS)

- Transmission unit (3T), comprising two factory assembled membrane units (3A) and spacer (3B)
- Driver and driven hubs (1 and 2 respectively) as required
- All the necessary fasteners

NOTE: *The replacement MOSO membrane units now comprise a MHSO membrane pack/adapter plate assembly and are shipped with metric fasteners. Such units are completely interchangeable with original MOSO membrane units. Metric threaded bolts are standard with MHSS couplings.*
MOD Series couplings incorporate imperial 'UNF' threads throughout the range with the exception of the 0800 size, which utilizes 'BSF' threadform.

Spares

When requesting spares, always quote the full designation of the coupling.

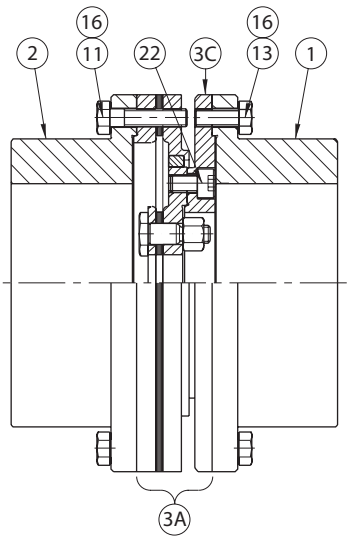
The following spares can be purchased from John Crane:

- Set of hub bolts (11)
- Set of spacer bolts (12)
- Hubs, bored to your requirement or unbored (1, 2)
- Complete transmission unit, balanced or unbalanced (3T)
- Membrane unit (3A)
- Spacer (3B)

Drawings

These instructions are written for standard catalog products, generally designed in accordance with the following outline drawings:

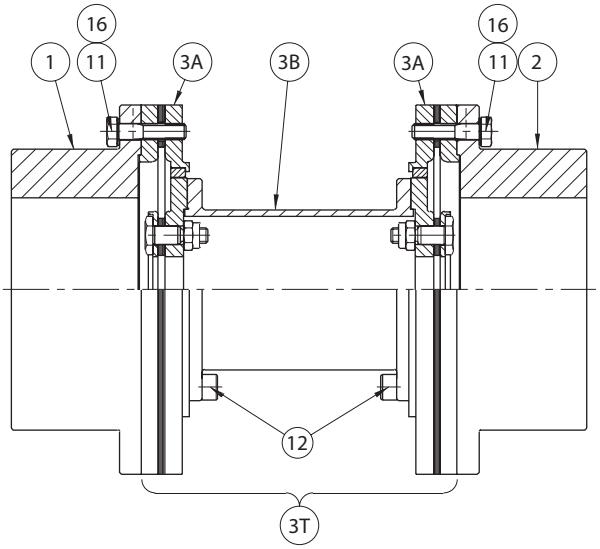
FIGURE 1A. MHSO



Membrane unit

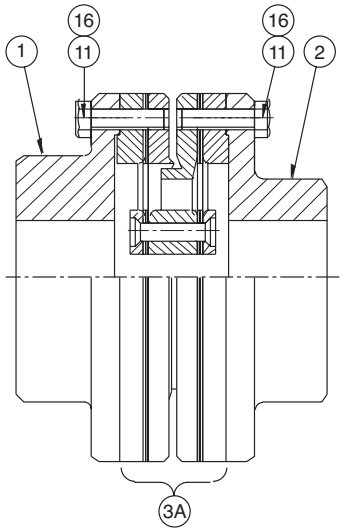
1, 2 – Hub
3A – Membrane unit
3B – Spacer
3C – Adaptor plate
3T – Transmission unit
11, 13 – Hub bolt
16 – Lock washer
22 – Adaptor cap screw

FIGURE 1B. MHSS Designs



Transmission unit

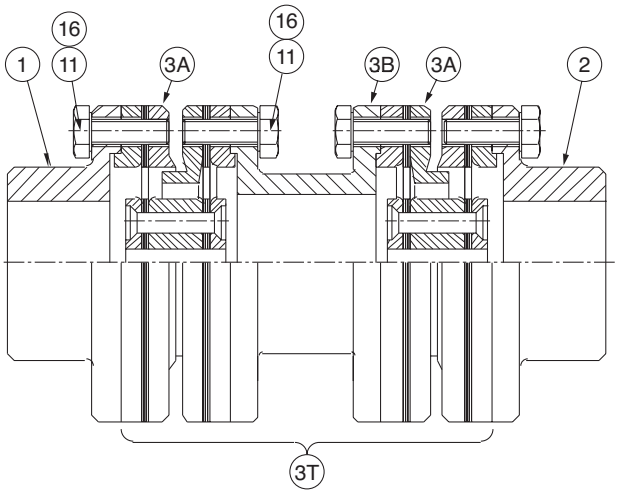
FIGURE 2A. MODO



Membrane unit

1, 2 – Hub
3A – Membrane unit
3B – Spacer
3C – Adaptor plate
3T – Transmission unit
11, 13 – Hub bolt
16 – Lock washer
22 – Adaptor cap screw

FIGURE 2B. MODS Designs



Transmission unit

IMPORTANT These instructions should be read in conjunction with any application-specific general arrangement drawing, which may be supplied with the coupling.

Selection Verification

Although a coupling may be correctly specified at the time of placing an order, 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, then we would decline responsibility for any consequent damage and the user would assume all risks.

Unpacking and Storage

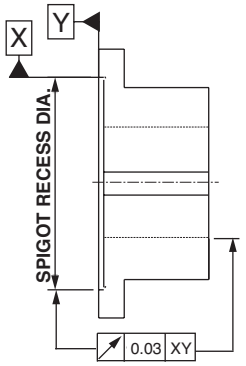
- The coupling should be unpacked and examined for any signs of transit damage. Particular attention should be paid to screw threads, hub bores and spigot/recess location diameters.
- If the coupling is not to be used immediately, it should be repacked in the original packaging, with any transit gags in place and stored in a dry building away from direct heat.
- The coupling and components should be stored horizontally and should not be kept standing on end for long periods.
- Documentation supplied with the coupling should be retained for future reference.

Installation Procedure

Prior to installing the coupling, ensure that the machinery is made safe.

- Remove the coupling from its packaging and carefully inspect for signs of damage. Particular attention should be paid to screw threads, the hub bores and the spigot/recess location features, which should be free from burrs and other damage.
- The coupling hubs may have been supplied unbored or pilot bored. In this case, it is important that the setting up for boring is referred to the correct datum. The bore must be concentric with the location spigot recess on the flange face and perpendicular to the flange face 'Y' (see Figure 3).

FIGURE 3



Installation of hubs

Fit the driver (1) and driven (2) hubs to the corresponding machine shafts.

Parallel bore with keyed drive

1. Ensure the hub bore and mating shaft are clean.
2. The hub is usually installed with the hub face and shaft end flush although, ±1-2 mm overhang is acceptable to correct for errors in setting distance between shaft ends (DBSE).
3. Measure the shaft diameter and hub bore to confirm the correct fit.
4. For clearance fits, install the key(s) into the shaft keyway and, with a little lubrication on the shaft, slide the hub onto the shaft. The key should be a tight sliding fit in the keyway with a small clearance at the top of the key. Secure the hub to the shaft in the correct axial position with one or more grub screws.
5. John Crane recommends a light interference fit for most applications, and it may be necessary to apply heat to assist fitting of such hubs. A warm oil bath 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.
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, remeasure 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.
   NOTE: *The hub face may not be flush with the shaft end when taper bores are used.*

Hubs mounted by FB taper bushes

To mount hubs supplied with taper bushes, refer to the FB Taper Bushes Fitting & Maintenance Instructions, I-FB BUSH.

Adapters

For machines with a flanged shaft end, the flange may be designed to bolt directly to the coupling transmission unit or the coupling may be supplied with a custom bolted flange adapter. Refer to the specific general arrangement drawing for location and mounting details.

ATTENTION Hubs must be positively secured to the shaft to ensure that, in the event of element failure, the coupling anti-fly feature can not disengage.

Hubs must be adequately supported during installation to avoid accidental damage should they slip.

Installation Procedure (continued)

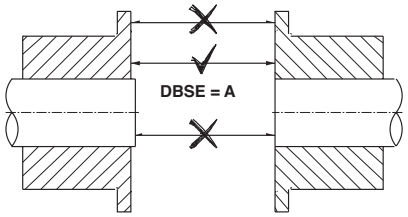
Shaft alignment

Align the center lines of the driving and driven machine shafts as follows:

1. With one machine firmly bolted down, set the DBSE according to drawing or catalog dimension 'A'.

IMPORTANT DBSE is usually measured between the inner face of the hubs and should not be taken as the length of the transmission unit at its maximum diameter (see Figure 4).

FIGURE 4



2. Align the shaft center lines both horizontally and vertically by aligning the hub flanges. John Crane recommends the reverse-periphery method for accurate alignment. This can be done using dial gauges or with a laser shaft alignment kit. Further details are available from John Crane on request.

IMPORTANT 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 installed misalignment is no more than 10% of the maximum allowable misalignment with allowance being made for any anticipated movements, which will occur during operation (e.g., thermal movements on hot pumps).

Installation of the transmission unit/membrane units

1. Check spigot and recess locations on the hubs and transmission unit for burrs or other signs of damage. Remove any transit gags (painted red) from the membrane units and fit the membrane unit (3A) or assembled transmission unit (3T) between the hubs.

⚠ **The transmission unit must be adequately supported during installation to avoid accidental damage should it slip.**

2. It may be necessary to compress the transmission unit while sliding it between the hubs, and facilities are provided to make this easier:
   - On smaller units, lever slots are provided in the hub flanges.
   - For spacer couplings, MHSS sizes 200 kw/1,000 rpm and above, membrane unit compression may be eased by the use of compression plates and bolts (see Figure 5 and 6 and Table 2 and 3). Although these are not supplied by John Crane, a supplement describing suitable fixtures is available.
   - For MODS spacer coupling sizes above 125 kw/1,000 rpm where membrane unit compression is difficult, installation plates and bolts may be used (see Figure 5 and 6 and Table 2 and 3).
3. Maximum compression should not exceed 0.8 times the coupling maximum axial misalignment value per membrane unit, unless indicated otherwise on the general arrangement drawing.

IMPORTANT Always remove the compression bolts as soon as the transmission unit is in position and before fully tightening the hub bolts.

4. Fit the hub bolts (11, 13) and locking washers (16) if supplied, and tighten these evenly to locate the transmission unit, ensuring that the spigots enter their recesses squarely. Bolts should be tightened in a "diametrically opposite" sequence to the values quoted in Table 1.
   Non-spacer couplings, type MHSO, use the shorter stripper bolt (13) on the adapter side. The longer stripper bolt (11) passes through the membrane bank. If a general arrangement drawing is supplied with the coupling, then torque values quoted on that drawing take precedence.

   NOTE: *The MHSO non-spacer unit includes an adapter plate (3C), which is fastened to the membrane assembly with metric screws (22).*

5. If possible, rotate the machinery two or three times slowly to ensure it moves freely. The coupling is now ready for continuous and trouble-free service.

Installation Procedure (continued)

TABLE 1. Standard coupling bolt tightening torques*

TABLE 1A

Coupling Types	Size														
MHSO & MHSS	0003	0006	0015	0030 0060	(0075) 0100	0200	0450 0600	0900	1200	1500	2000	3000	4500	6800	9010
MOSO & MOSS	0002	0005	0010	0020 0055	0065	0125	0300	0600	0800	1000	1400	2000	3000	4500	6500
Stripper Bolt (11 & 13) [Nm]	5	5	12	12	12	12	37	63	95	134	185	185	460	644	1100
Spacer Bolt (12) [Nm]	4	5	5	12	12	21	37	37	63	95	95	185	185	314	460

TABLE 1B (rev. 1)

Coupling Types	Size											
MODO & MODS	0002 0005	0010 0020	0040 0055 0065	0125	0300 0400	0600	0800	1000	1400 2000	3000	4500	6500
Stripper & spacer bolts (11 & 13) UNF thread size [inch]	1/4 BSF	5/16	3/8	3/8	1/2	5/8	11/16	3/4	7/8	1-1/8	1-1/4	1-1/2
Tightening torque [lb/ft]	1.66	3.3	6	15	40	78	108	140	219	475	661	1157
Tightening torque [Nm]	2.25	4.5	8	21	54	106	146	190	297	644	896	1568

* For threads lubricated with light oil.

[Data given on general arrangement drawings takes precedence]

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, John Crane's Metastream flexible diaphragm couplings will give long and trouble-free service. Routine examination should include a periodic check on the tightness of fasteners and visual inspection of transmission components for signs of fatigue or wear.

If the coupled machinery is disturbed at any time, then 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.

Inspection and Maintenance

Maintenance work must only be carried out by suitably qualified personnel when the equipment is stationary and has been made safe.

John Crane's Metastream flexible power transmission couplings are designed to give long and trouble-free service if operated within the conditions for which they were specified. Failures are rare and can generally be attributed to:

- Excessive misalignment
- Severe torsional overload

In all cases of coupling failure, the cause should be identified and corrected before replacing the coupling.

The usual mode of failure of flexible diaphragm couplings is rupture of the flexing membranes. In such circumstances, it is possible to repair the coupling by fitting a replacement membrane unit.

Inspection and Maintenance (continued)

ATTENTION When repairing John Crane's Metastream flexible diaphragm couplings, only John Crane-approved parts should be used.

- To replace a transmission unit (3T) or non spacer unit (3A), first remove the hub bolts (11, 13) and then compress the membrane unit or transmission unit using the lever slots in the hub flanges or compression fixtures and lift out the unit.

The transmission unit must be adequately supported during removal to avoid accidental damage should it slip.

- For MHSS, MODS and updated MOSS spacer couplings, remove the spacer bolts (12) and separate the membrane units from the spacer (3B).
- For MHSO membrane units, no further dismantling of the membrane unit assembly is required. Replacement MHSO units (Figure 1A) include the adapter (3C).
- Old style MOSS spacer transmission units are no longer supplied. Should a replacement be required, then two options are available:
  - i. A complete interchangeable MHSS transmission unit (Figure 1b, 3T)
  - ii. Two MHSO non-spacer units (Figure 1A) can be assembled directly to the existing MOSS large-diameter spacer

Both options are supplied with a set of metric fasteners, which must be used to replace the original imperial fasteners.

- For MHSS couplings, bolt the replacement membrane units onto the spacer to rebuild the transmission unit. If refurbishing an old style MOSS using option (ii), then bolt the adapter plate of the membrane units to the large spacer flanges using the shorter set of spacer bolts.
- Having rebuilt the transmission unit, it is recommended that the shaft alignment be checked prior to reinstallation.
- The refurbished transmission unit should be installed in accordance with the instructions for fitting a new coupling.

IMPORTANT All disturbed fasteners should be replaced with new every time the coupling is refurbished.

Warning

All reasonable care has been taken in the design and manufacture of this coupling to ensure that it will be safe when properly used. However, these instructions are of a general nature, and it is assumed that the user is aware of the statutory requirements of his or her plant.

John Crane will provide advice on the use of this coupling, but the following matters are the sole responsibility of the user:

- Compliance with statutory plant requirements
- Compliance with other relevant safety requirements
- Final coupling selection for a particular duty
- Operation in aggressive atmospheres: The anti-fly bearing comprises non-metallic materials, including thermoset resins. Ensure suitable protection is provided if the coupling is to operate in an aggressive atmosphere

Safety Instructions

These instructions should be available to everybody who has need of them at the place where the coupling is used.

In accordance with European agreement, certain words or symbols have particular meanings when used within these Territories or when applied to actual coupling parts. They are used as follows:

IMPORTANT used for items of particular concern when using the coupling.

ATTENTION where there is an obligation or prohibition concerning the avoidance of risk.

where there is an obligation or prohibition concerning harm to people or damage to the equipment.

Fitting Transmission Units with Compression Fixtures

For the larger coupling sizes (0200 and above) the membrane axial stiffness may be quite large. In the event that there is insufficient space to safely use levers to compress the membranes, the following alternative method is given using compression fixtures.

Select four spacer bolts (12) that line up either side of hub bolt holes in the membrane unit (3A) and remove from the spacer flange (3B) as shown in Figure 5.

Fit two of the fixtures as shown in Figure 6. Note that the spacer bolts (12) that were removed are replaced by the caphead screws (C), which now secure the two bottom corners of the plate (A) to the inner guard ring through the spacer flange (3B). A hub bolt (11) is used to secure the top of the plate, through the collar (B) to the outer guard ring (3A).

Using the hub bolts (11), tighten the plates (A) onto the collars (B). Repeat for the opposite membrane unit. The transmission unit is now compressed to its correct distance to allow insertion between the hubs.

When the transmission unit is correctly located between the hubs, remove the fixtures and replace the spacer bolts (12).

Suitable fixtures can be made to the details listed in Table 2, or may be purchased from John Crane.

FIGURE 5

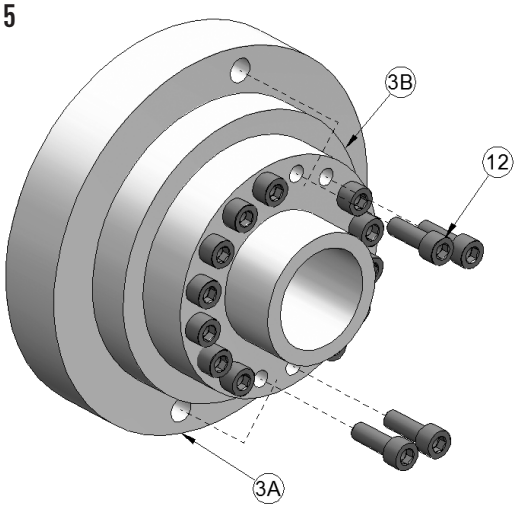


FIGURE 6

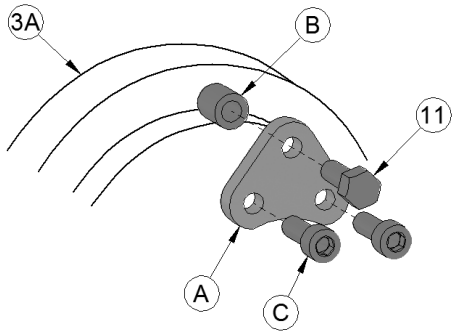
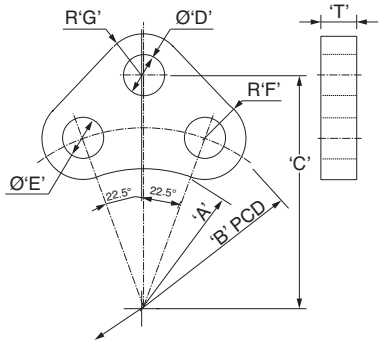
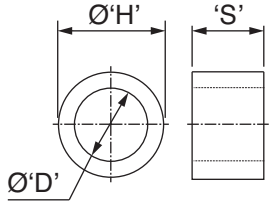
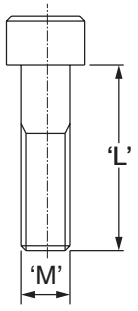


TABLE 2. Fixtures for MHSS Membrane Compression

Ref.	A	B	C
Part	Plate Drg.Ref. HC8059	Collar Drg.Ref. HC8059	Caphead Screw
Quantity	4	4	8
Sketch			

Gag Set Drg.Ref. HC7024

TABLE 3. DIMENSIONS (mm)

MHSS Size	*Min DBSE	'A' Radius	'B' PCD	'D' DIA.	'C' Radius	'E' DIA.	'F' Radius	'G' Radius	'H' DIA.	'S'	'T'	'M'	'L'
0200	70	56	130	8.5	94.45	10.5	10	12	18	9	10	M10	30
0450	75	73	167	12.5	114.35	12.5	12	15	22	13.5	10	M12	35
0600	75	78	178	12.5	122.24	12.5	12	15	22	13.5	10	M12	35
0900	80	86	190	14.5	129.43	12.5	12	15	24	15	10	M12	35
1200	95	89	200	16.5	138.11	15	15	15	28	19	15	M14	45
1500	110	95	216	19	153.99	17	17	17	30	17	15	M16	45
2000	135	105	240	21	171.45	17	17	17	34	13	20	M16	50
3000	140	114	263	21	190.5	21	21	21	34	21	20	M20	60
4500	150	147	325	28	234.95	21	21	21	45	20	20	M20	60
6800	160	162	375	31	269.9	25	25	25	50	26	23	M24	70
9010	185	179	400	37	292.1	28	28	28	58	26	28	M27	80

*For couplings with shorter DBSE there is insufficient space to use these fixtures. Refer to John Crane.

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 (40ºC max)

CE Ex I $M2_C$ Ex II $2GD_C$ T6 (T85°C) john crane 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 4, and in all other respects complies with the type certificates.

TABLE 4

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 < 150ºC) OR ambient temperature is unspecified, the equipment is not suitable for mining applications, Group I, Category 2.

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

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

When the ambient temp. is specified, 'T3' is replaced by the following 'T' mark (**) according to Table 4.

CE Ex I $M2_C$ Ex II $2GD_C$ ** john crane 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 4 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**.

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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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