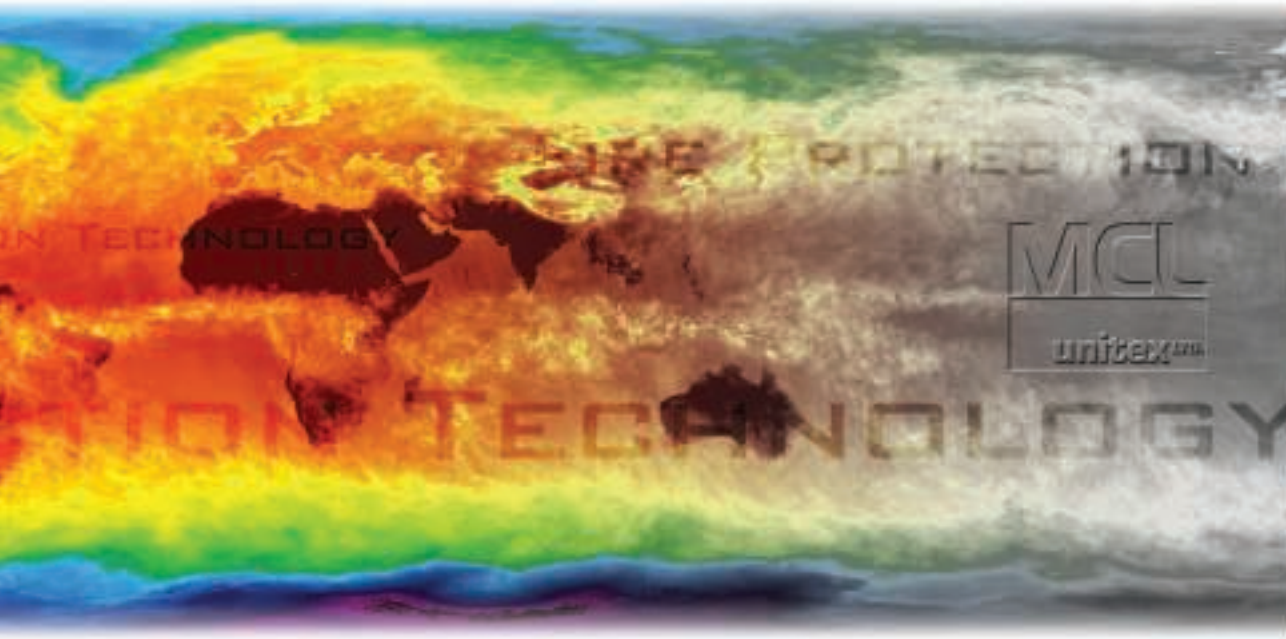


Fire Protection Technology

A Guide to Fire Sealing

CONTENTS

Hazard Definitions

Before a Firetex seal selection is made, the hazard must be defined together with the location of the anticipated hazard. MCL's flexible seal systems are designed to address relative movements between pipe and sleeve, hydrocarbon and cellulosic fires, blast overpressure and the most onerous hazard of all, jet fire.

Blast Overpressure

The incidence of fire on hydrocarbon installations is often preceded by explosion or pressure vessel fracture. Such scenarios can create a blast overpressure which may damage sealing systems prior to their exposure to resulting fires.

The Firetex seal has been blast tested up to 1.35 bar g and has been proven to maintain its integrity.

'A' Rated Divisions

The letter 'A' in the classification denotes the temperature rating of the division.
'A' refers to a maximum cellulosic fire temperature of 950°C.
(The time/temperature curve is defined in BS 476 Part 20.)

Within the classification of 'A' rating, the system must maintain its integrity and insulation criteria after a given time. Regardless of the insulation requirement, integrity must be maintained for 60 minutes, that is, the seal must not allow the passage of flame or smoke.

The number after the letter 'A', (0 to 60), defines the time during which the unexposed face (cold face) must not exceed a temperature of 180°C. This is the insulation criteria.

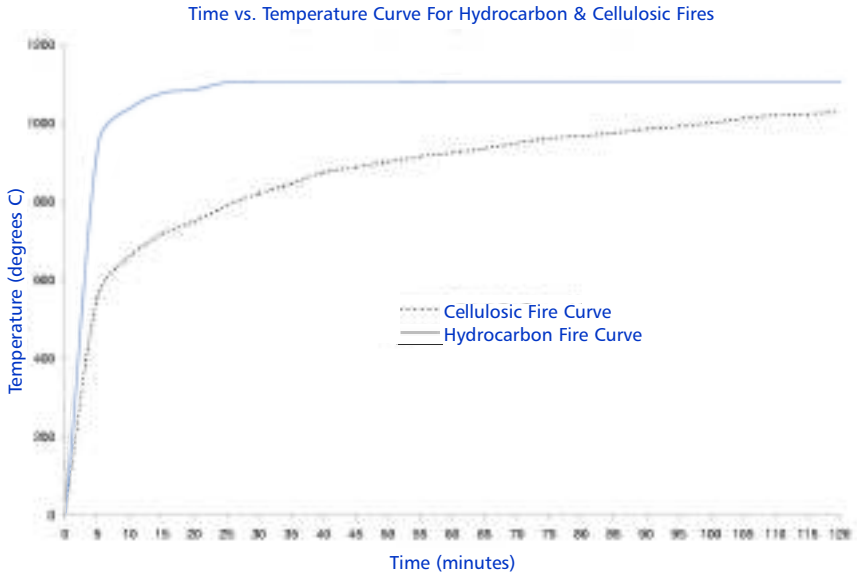
For example:

A0: An 'A0' division must maintain its integrity for a period of 60 minutes, however because it is '0' rated, the cold face temperature, (the insulation criteria) can rise above 180° C.

A60: An 'A60' division must maintain both its integrity for 60 minutes and insulation criteria for a period of 60 minutes.

'H' Rated Divisions

The letter 'H' in the classification denotes the temperature rating of the division. 'H' refers to a maximum hydrocarbon fire temperature of 1150°C as specified in the hydrocarbon fire standard which sites the industry accepted Mobil High Rise Time vs. Temperature Curve. (In North America, the same curve is defined in UL1709)



Within the 'H' classification the seal system must maintain its integrity for 120 minutes.

The number after the letter 'H' (0, 60, 120) defines the time during which the cold face must not exceed a temperature of 180°C. This is the insulation criteria.

For example:

H0: The seal must maintain its integrity for 120 minutes. The '0' means that there is no insulation requirement, i.e. the cold face may rise above 180°C.

H60: The seal system must maintain its integrity for 120 minutes. The '60' means that the cold face temperature must not rise above 180°C during the first 60 minutes.

H120: The seal system must maintain its integrity for 120 minutes. The '120' means that the cold face temperature must not rise above 180°C for 120 minutes.

'J' Rated Divisions

The letter 'J' in the classification denotes jet fire.

Unlike 'A' and 'H' classifications, the number following relates to integrity and not insulation. Jet fire testing is clearly defined within the HSE specification OTI 634 95.

For example:

J60: The seal system must maintain its integrity for 60 minutes.

J120: The seal system must maintain its integrity for 120 minutes.

Standard Pipe/Sleeve Size Ratios

As a result of successful, extensive fire testing, MCL are able to offer any pipe/sleeve size ratio from ½" to 42" diameter. However, the most common and standard ratios are listed in the following table. These have been 'industry standards' for many years and are based on allowing the pipe to move approximately +/-25mm laterally within its sleeve in addition to movements in the other planes.

Table of Seal Standards

Pipe nb (ins)	Pipe od (mm)	Sleeve nb (ins)	Sleeve od (mm)	Seal Length (mm)	MCL Seal Reference
½	21.33	1½	48.26	150	4-3
¾	26.67	2	60.30	150	5-5
1	33.27	2	60.30	150	5-9
1	33.27	3	88.90	150	7-7
1½	48.26	3	88.90	150	8-6
2	60.30	4	114.30	150	11-0
3	88.90	6	168.10	150	16-2
4	114.30	6	168.10	200	17-8
6	168.10	8	218.90	200	24-4
8	218.90	10	273.00	200	31-0
8	218.90	12	323.80	200	34-2
10	273.00	12	323.80	200	37-6
12	323.80	14	355.60	250	42-8
14	355.60	16	406.40	250	48-0
14	355.60	18	457.20	250	51-2
16	406.40	20	508.00	250	57-6
18	457.20	20	508.00	250	60-8
20	508.00	24	609.60	250	70-4
24	609.60	30	762.00	250	86-4
30	762.00	36	914.40	250	105-6
32	813.00	36	914.40	250	108-8
36	914.40	40	1016.00	250	121-6

Design Movements

These standard seals will accommodate +/-25mm movement in all three planes. It is important that the installer acquaints themself with the direction and magnitude of pipe work design movements. Typically relative movement between pipe and sleeve are only nominal but where such movements are significant, it is important that the installer applies suitable compression/extension of the seal to ensure that these movements may be accepted by the system.

For movements in excess of +/-25mm, seal length design is increased accordingly. Should movements be considered by our engineering department to be beyond practical seal length extension, a multi-leaf system may be offered. For this and other seal variations, please refer to the 'Special Seal' section of this guide.

Seal Fixing

Fixing Bands/Clips, Clipping Lengths and Cuffs

Each standard Firetex pipe penetration seal is supplied with two grade 316 stainless steel 'worm drive' clips to secure the seal at both the pipe and at the sleeve. Where the sleeve is of 14" diameter and above, a further clip is supplied for added security. Each seal is designed to have a cuff (sometimes referred to as the clipping length) of suitable length to accommodate the clips at each end. For single clips, the cuff would typically be 30mm long and for larger sleeves where double clipping is required, the cuff length is extended to 70mm. For larger diameters, each clip may be made up from a number of single clips arranged in tandem. This clip configuration provides for multi-point tensioning and thus a more secure installation.

For very large diameter pipes/ducts, the double clipping may be replaced by special purpose made 'tension bands', 25mm wide 316 grade stainless steel bands with a number of tension drive locations to ensure equal and secure fixing.

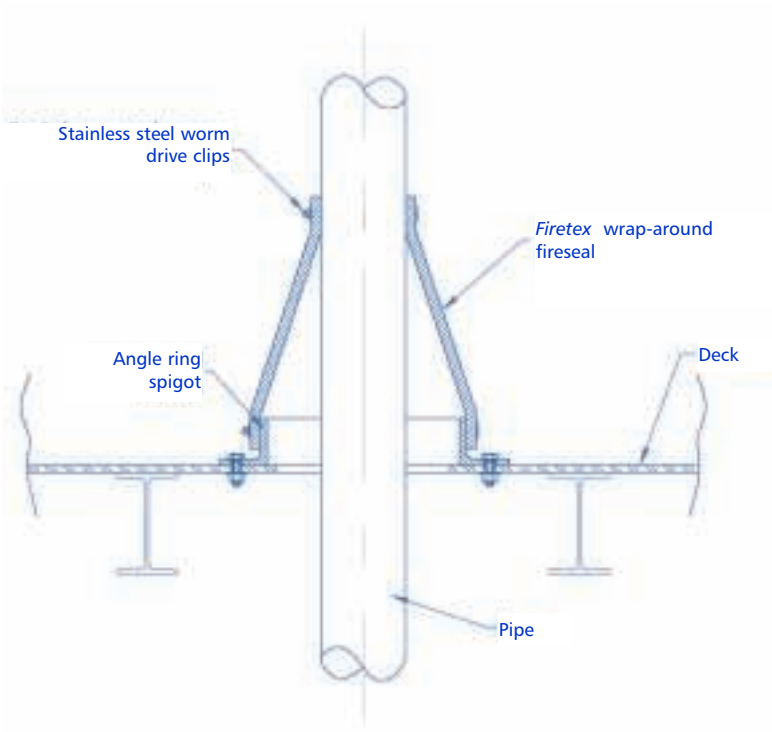
The same principle is employed in the design of MCL's Jettex overseals.

Special Seal Systems

Spigot Plates, Angle Rings and Flanged Seals

In situations where pipe penetrations are designed without sleeves, or where these have been overlooked, MCL offer the following solutions:

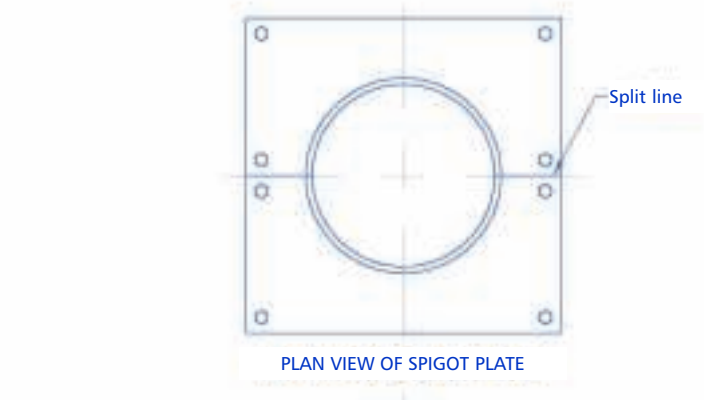
1. For a single sided seal arrangement MCL offer the angle ring sleeve. The ring may be bolted/welded to the deck/bulkhead and thus allow the fitting of a standard Firetex seal.



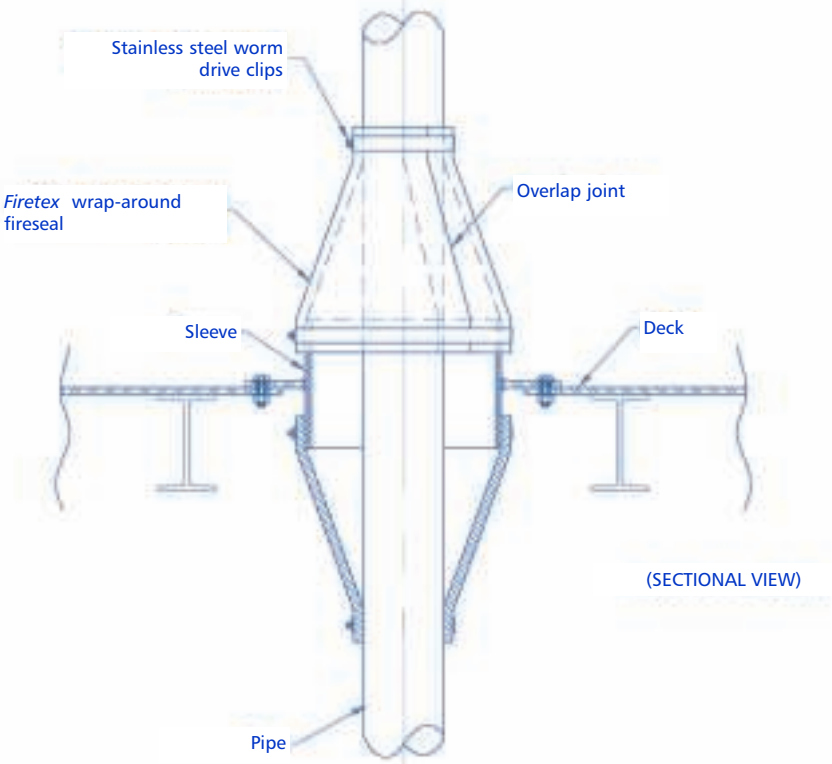
Ask our engineering department for data sheet PPS-0260.

Ask our engineering department for data sheet PPS-0250.

2. Where a double sided seal arrangement is required, the spigot plate may be more appropriate. This provides a ‘sleeve’ on both sides of the barrier allowing the fitting of two standard seals.

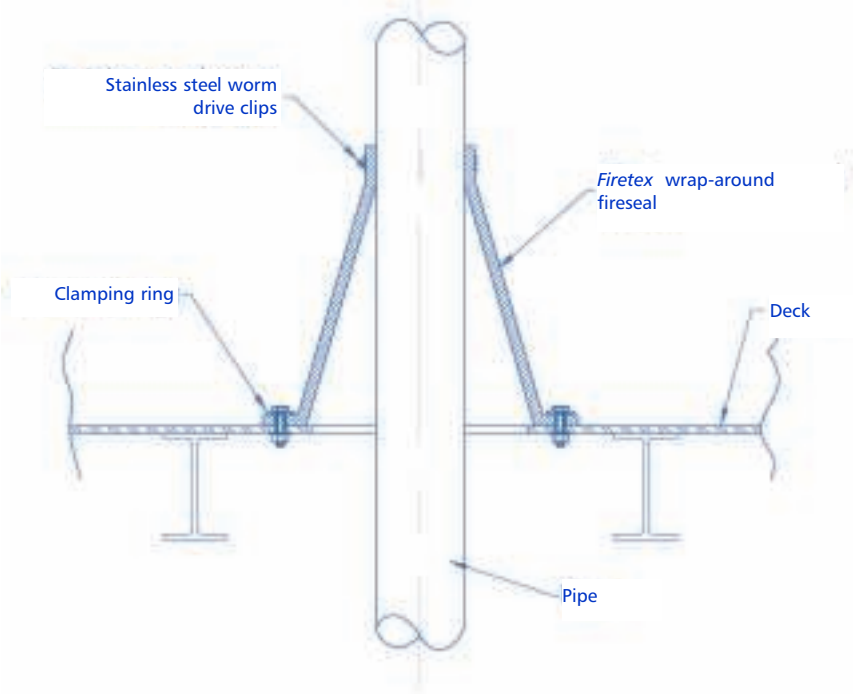


PLAN VIEW OF SPIGOT PLATE



(SECTIONAL VIEW)

3. The alternative to 1. and 2. is the flanged Firetex variant. Instead of the simple wrap around seal, MCL can manufacture the seal with a flanged end which in turn may be secured to the barrier using a split retaining ring.



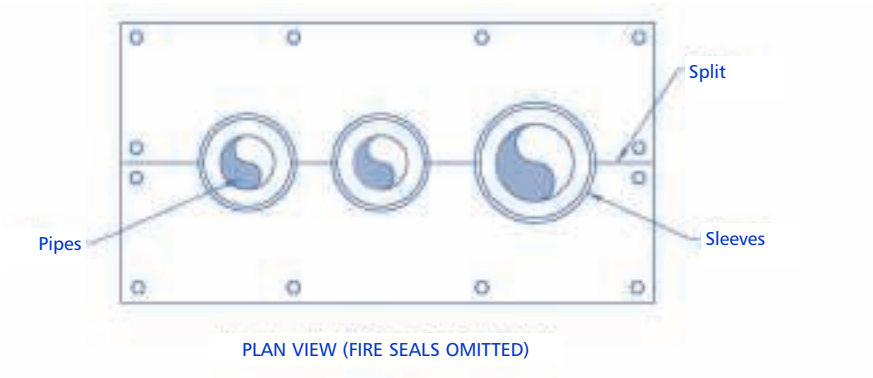
(SECTIONAL VIEW)

Ask our engineering department for data sheet PPS-0220.

Multi-Pipe Penetrations

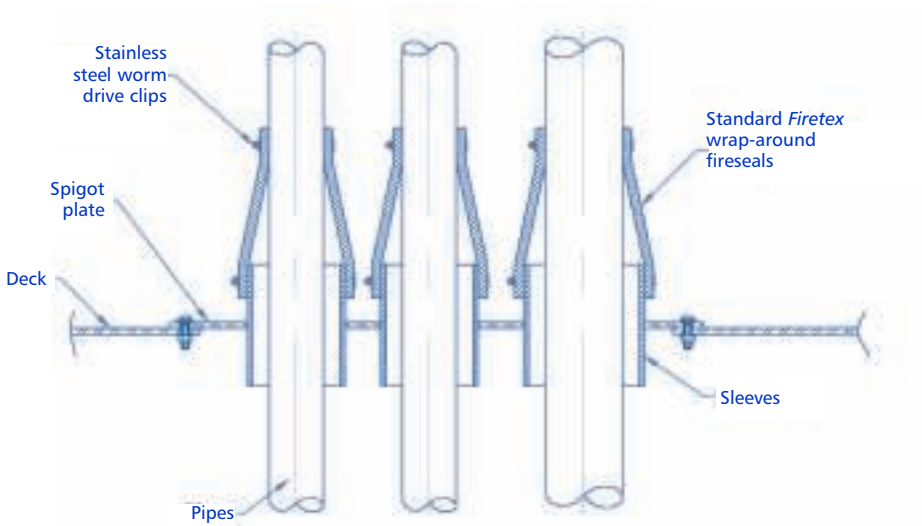
There are occasions where more than one pipe passes through the same penetration opening. Ideally, this situation should be avoided but where this is not possible, MCL offer two possible solutions:

1. The multi-pipe spigot plate. This arrangement creates split sleeves for each penetrating pipe and thus allows the fitting of standard Firetex seals. The plate may be fixed over an existing upstand or may alternatively be fixed directly to either deck or bulkhead.



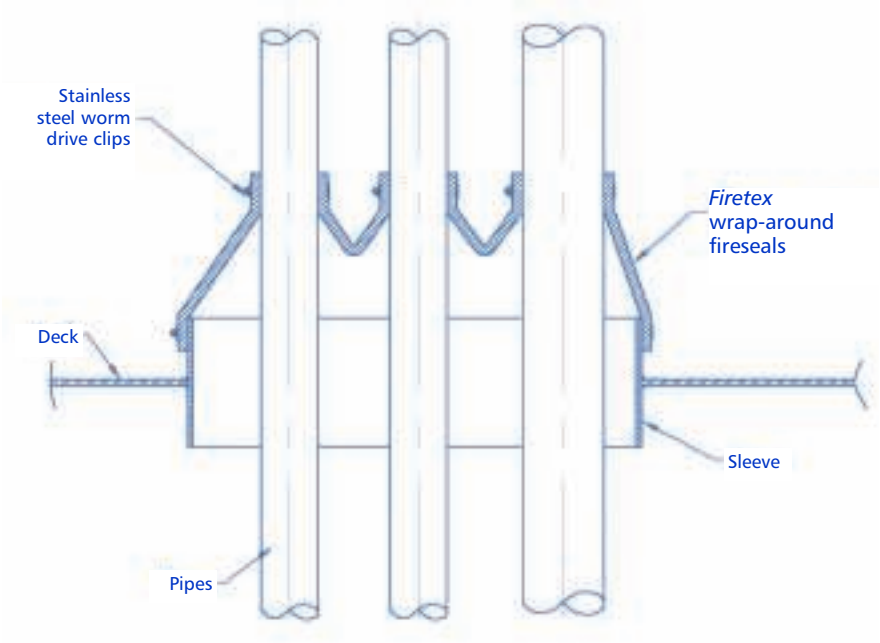
PLAN VIEW (FIRE SEALS OMITTED)

Ask our engineering department for data sheet PPS-0340.



(SECTIONAL VIEW)

2. Option 1. will generally provide the most cost effective solution but where 'mechanical fixing' is restricted/prohibited, MCL are able to manufacture a fully flexible multi-pipe seal. With overlap joints on each pipe, the seal may be retrofit.



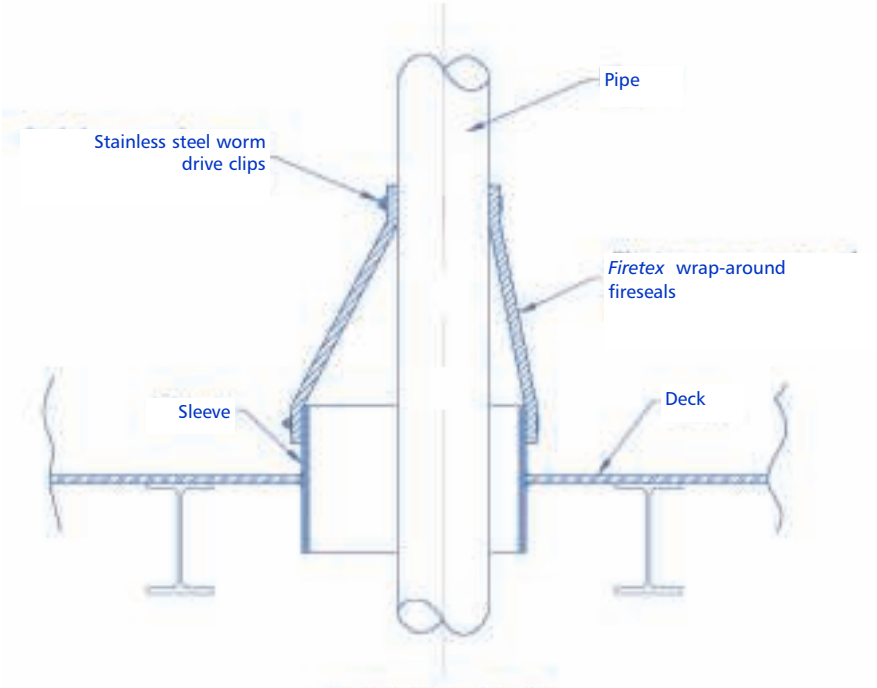
(SECTIONAL VIEW)

Ask our engineering department for data sheet PPS-0330.

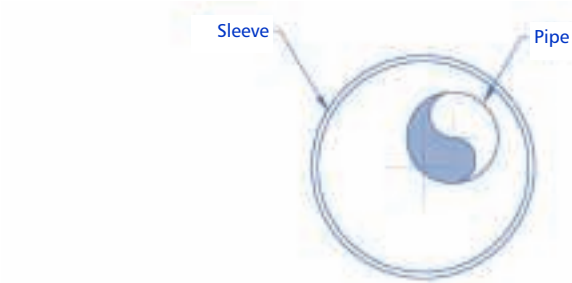
Pipe/Sleeve Eccentricity

As MCL's Firetex seal is designed to tolerate relative movement between pipe and sleeve, nominal eccentricities can be accommodated when fitting a standard seal. If however eccentricity is significant, client surveyors should record pipe and sleeve centreline misalignment dimensions or basic dimensional detail as shown in the following illustration.

Ask our engineering department for data sheet PPS-0200.



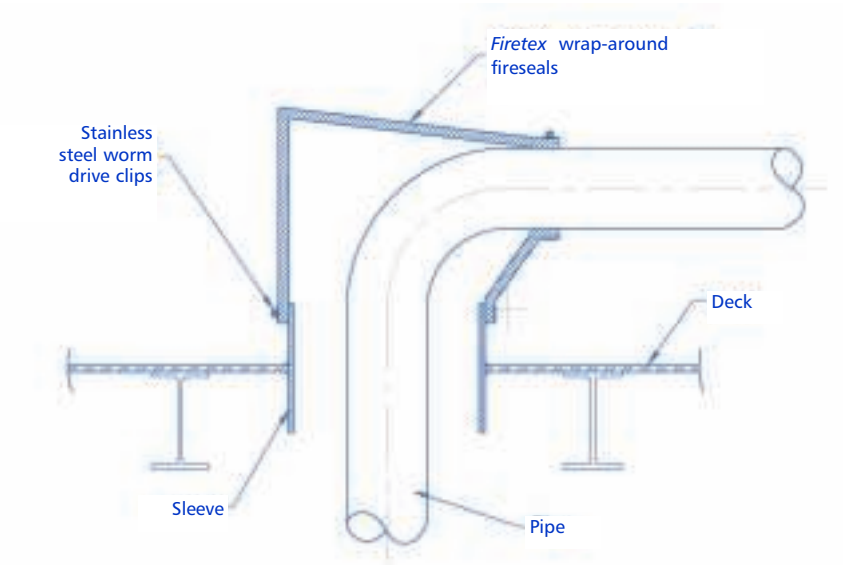
(SECTIONAL VIEW)



PLAN VIEW
(FIRE SEAL OMITTED)

Pipe Bend Penetrations

Where a penetrating pipe has a bend within, or close to a sleeve, client surveyors should note the dimensional detail to enable MCL's engineers to establish a suitable seal design. This may be an angled seal fixed into the bend throat or a full 90 degree elbow seal.



(SECTIONAL VIEW)

Ask our engineering department for data sheets PPS-0300 and PPS-0310.

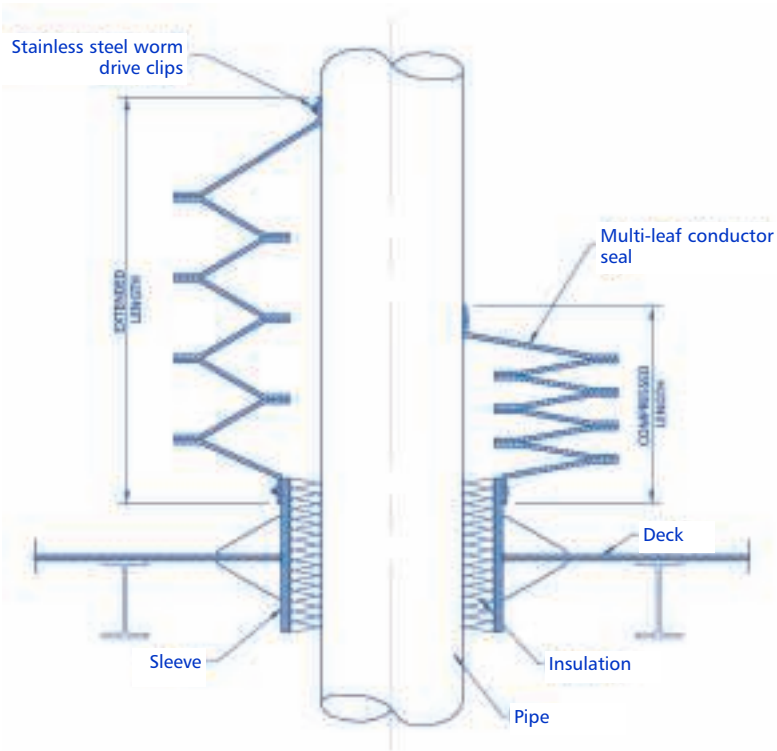
Penetration Obstructions, Tees, etc.

It is important that client surveyors note and record all 'obstructions' in the area of the pipe penetration. Provided that dimensional detail is accurately recorded, MCL's engineers can design a solution. Eccentricity and bend penetrations are covered above but flanges, valves, and tee intersections in the area of penetration are also potential obstructions to be considered. To establish what is deemed 'the area of penetration', MCL's seal reference table should be consulted to check the required seal length.

Multi-Leaf Seal System

In situations where greater than normal movement is required, the 'multi-leaf' seal may be an option. The convoluted design allows for significant movement, particularly in the axial direction.

Ask our engineering department for data sheet PPS-0230.



(SECTIONAL VIEW)

Exhaust Pipe Penetrations

Where MCL's Firetex seal is to be installed onto a high temperature service such as an exhaust pipe, there is a likelihood that the seal's coating will harden or 'craze'. This will not affect the seal's integrity but will allow ingress of water. To prevent this occurrence, the seal may be supplied with an additional ceramic tape gasket, either separately or adhered to the seal clipping area, to provide a thermal break.

Firetex Seal Arrangements

A0 and H0 Seal Arrangement

Hazards A0 and H0 are defined within this guide. For such applications a single seal only is required. However, it should be understood that a standard Firetex seal has a 'hot face' and a 'cold face'. Clearly, the hot face of the seal should be installed to face the fire hazard. If it is unclear as to the direction of any potential fire hazard or indeed, if there is a possibility of fire from both sides of the barrier, a seal should be installed on each side of the barrier.

There is an alternative solution to this problem. MCL have a formal agreement from Lloyd's Register of Shipping that where an A0/H0 fire hazard is identified on both sides of a bulkhead/deck, a 'double hot face' Firetex construction may be installed.

Ask our engineering department for data sheets PPS-0220 and PPS-0130.

A60 through H120 Seal Arrangement

Hazards A60 through H120 are defined within this guide. For such applications, a double seal arrangement is required. By definition, this seal arrangement will resist the specified hazard from either side of the bulkhead/deck. Although no insulation infill is required between the two seals, the fixing clips at the barrier face should be insulated and the pipe clips should also be insulated and back along the pipe itself to a minimum of 450mm from the barrier face. These measures remove the possibility of 'hot spots' and thus safeguard the insulation criteria of the installation.

Ask our engineering department for data sheets PPS-0100 and PPS-0110.

There are occasions where the installation of a seal on both sides of the fire barrier is impractical. For such instances, MCL have a single Firetex seal arrangement to suit. The installation consists of a single seal to one side and insulation to the other. The systems' movement capability may be somewhat restricted in these instances and as such, MCL's engineering staff should be consulted for advice.

Ask our engineering department for data sheet PPS-0150.

Ask our engineering department for data sheet PPS-0400.

J60 Seal Arrangement

Jet fire hazards are defined within this guide. MCL's jet fire seal system is in fact an enhancement of the standard Firetex seal. Based upon MCL's unique 'Jettex' material, the standard seal is supplied with an 'overshroud' consisting of Jettex, stainless steel mesh and a silica cloth. This robust construction withstands not just the high hydrocarbon burn temperature but also the physical impingement created in a jet fire.

Ask our engineering department for data sheet PPS-0410.

J120 Seal Arrangement

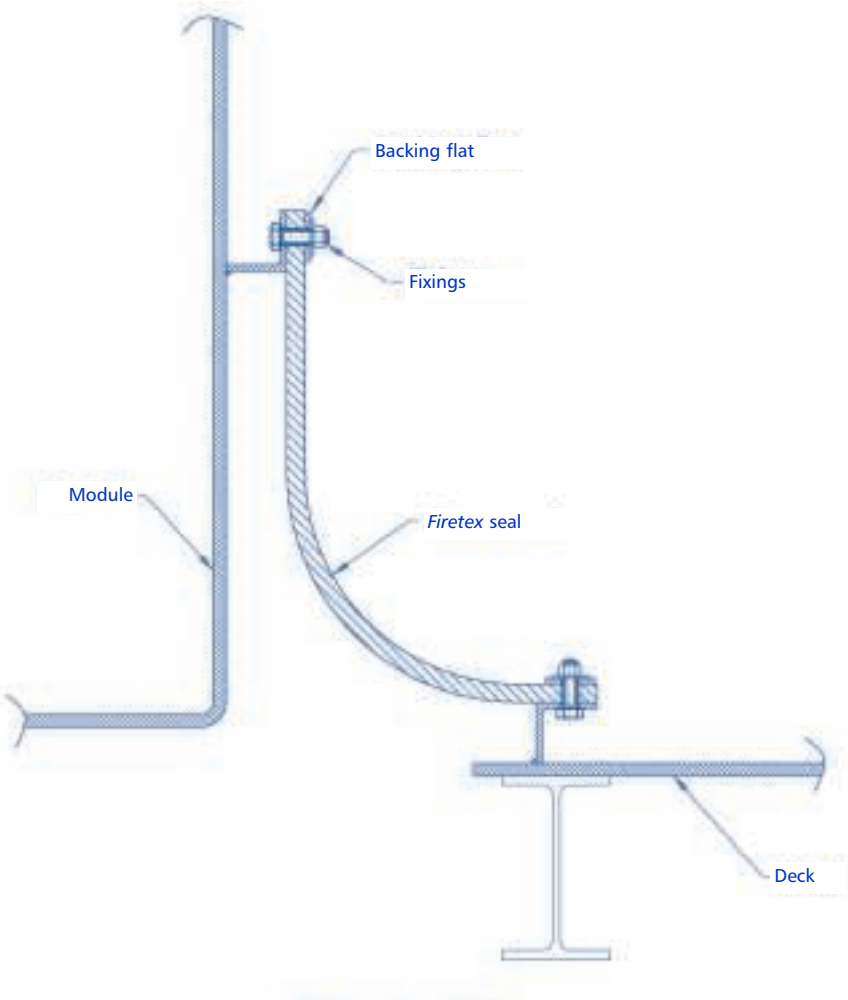
Jet fire hazards are defined within this guide. Like the J60 seal arrangement, MCL's J120 seal is a further enhancement of the standard Firetex seal. In addition to the Jettex overshroud, the installation consists of a further Jettex based shroud which also includes a final protective layer of incoloy mesh.

Ask our engineering department for data sheet PPS-0420.

Where there is little or no design movement, MCL have a second qualified J120 seal system. The seal arrangement consists of a standard Firetex seal, complete with a stainless steel shroud.

Firetex Skirt Seal System

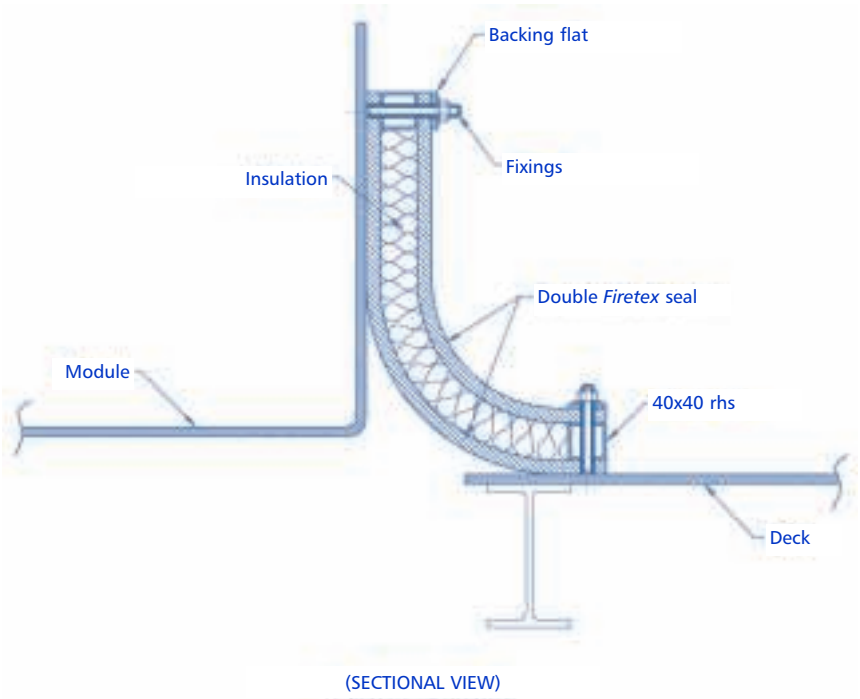
For pipe penetrations greater than 42" diameter, large diameter vessel penetrations, rectangular duct penetrations and for module/module and module/deck seal systems, MCL offer their Firetex Skirt Seal System. A single skirt installation provides A0 and H0 protection and has been proven to withstand blast overpressures up to 1.16 bar g.



(SECTIONAL VIEW)

Ask our engineering department for data sheet MSS-0120.

For applications of A60 through to H120, a double seal is required with an infill of 38mm thick, 128 kg/m³ ceramic fibre blanket.



(SECTIONAL VIEW)

Ask our engineering department for data sheet MSS-0100.

In addition to these hydrocarbon duties, MCL have also successfully tested their skirt seal system with a stainless steel mesh reinforced Jettex over shroud and have proven integrity through 58 minutes. Testing was carried out in strict accordance with the HSE's specification OTI 634 95.

Firetex skirt seals are manufactured to suit and are supplied in straight lengths with ends prepared for jointing. Factory manufactured corners, bends and T-pieces may be supplied where required with ends similarly prepared.

Ask our engineering department for data sheet MSS-0400.

There are a number of fixing options for the Firetex Skirt Seal System, some of which are shown on the relevant Technical Data Sheets. Our engineering department are always available to assist with specific project requirements.

Frequently Asked Questions

Q. Can I retrofit the seal?
A. Yes. The Firetex seal is supplied in a 'wrap around' form and may be installed after pipework installation is complete.

Q. Your Firetex seal system has been tested on carbon steel pipes. Can I still use the seal on plastic, GRP and copper pipes?
A. Yes, provided the pipework itself is fire protected. Such alternative pipework materials will fail at high temperature therefore, without fire insulation, integrity will be lost. MCL can advise on alternate seal systems in these instances.

Q. Why do I need to insulate the clipping areas and the pipeline back to 450mm from the bulkhead or deck for A60 – H120 applications?
A. Fire testing over many years has shown that the application of this insulation retards heat transfer and thus aids the insulation criteria of the rating.

Q. Is the Firetex seal waterproof?
A. MCL's seal systems are finally encapsulated in a strong silicone coated glass cloth which provides environmental protection. They will resist water splash and damp saline conditions but are not designed to be immersed in water or subjected to frequent water deluge. Where site conditions are extreme, the seal may be enhanced with additional coated cloth. MCL's engineers will be pleased to advise on this and other variants to meet exact client requirements.

Q. I have an exhaust pipe penetration which has a surface temperature of 550 degC. Will the Firetex seal be affected?
A. High temperatures will not affect the integrity of a Firetex seal but the external coating may deteriorate and thus render the seal prone to water absorption. To counter this problem, MCL will provide a ceramic tape gasket to place under the pipe seal clipping area and provide a 'thermal break'.

Q. The Firetex seal arrangement for A60 and H120 hazards appear to be the same. Is there any construction difference?

A. No. MCL offer a full H120 specification to meet the hazard range A60 through to H120.

Q. Do I require any special tools to install the seal?

A. No special tools are required for the installation which may be carried out by competent fitters in accordance with the clear instructions provided.

Q. How long will the seal last?

A. Provided the seal is not subjected to any mechanical abuse, the Firetex seal should last the lifetime of the installation.

Q. I have an alternative mastic/filler type system being offered to me which shows some cost benefit. Why should I buy Firetex?

A. The true cost of a fire seal system should include not just material price but installation cost also. This fact is particularly relevant to offshore installations where labour costs are extremely high. The Firetex seal has been designed for fast and easy installation and will typically be many times quicker to install than filler systems.

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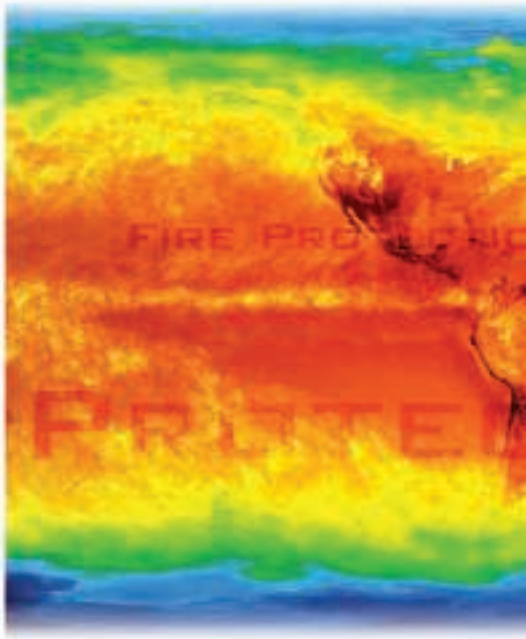
MCL House
Adams Close
Heanor Gate Industrial Park
Heanor, Derbyshire, DE75 7SW, England
Telephone: +44 (0)1773 761226
Facsimile: +44 (0)1773 711874

www.mclunitex.com

MCL unitex LTD



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