THINKING PRECAST?
THINK FP MCCANN

PRECAST TUNNEL & SHAFT SOLUTIONS

v4.2


COVER & LANDING SLABS


SMOOTH-BORE TUNNEL & SHAFT SEGMENTS







JACKING PIPES


CAISSON UNITS



FPMCCANN.CO.UK

FP McCann is the UK's market leader in the manufacture, supply and delivery of precast concrete solutions. Our comprehensive precast concrete business extends to include:

AGRICULTURE I ARCHITECTURAL PRECAST I BOX CULVERTS I BUILDING PRODUCTS DOCK LEVELLERS I DRAINAGE I FENCING I FILTER BED SYSTEMS I FLOORING POWER & INFRASTRUCTURE I RAIL I SPECIALIST PRECAST I STRUCTURAL PRECAST TANKS & CHAMBERS I TUNNELS & SHAFTS I WALLING

Modern manufacturing plants at Alnwick (Northumberland), Armagh (Northern Ireland), Byley (Cheshire), Cadeby (Warwickshire), Ellistown (Leicestershire), Grantham (Lincolnshire), Lisnaskea (Northern Ireland), Littleport (Cambridgeshire), Lydney (Gloucestershire), Magherafelt (Northern Ireland), Uddingston (Lanarkshire) and Weston Underwood (Derbyshire) incorporate the latest computerised batching, distribution, casting, curing and handling systems and are operated by skilled and experienced workforces to ensure consistency of quality. Their geographical spread gives us an unrivalled ability to serve the construction industry throughout the UK and Ireland.

By applying the DFMA principles, FP McCann's design engineers are able to evaluate individual precast concrete products part by part, in addition to documenting the assembly process step by step. This allows them to generate the cost, part count and assembly time to provide a benchmark to measure its success and identify the parts and process improvement opportunities. In turn, this has allowed FP McCann to design and manufacture more cost-effective and efficient high-quality precast concrete products with less wastage and greater on-site recycling. As a result, increased productivity, combined with a reduction in production time and costs, allows FP McCann to be more competitive within the marketplace.

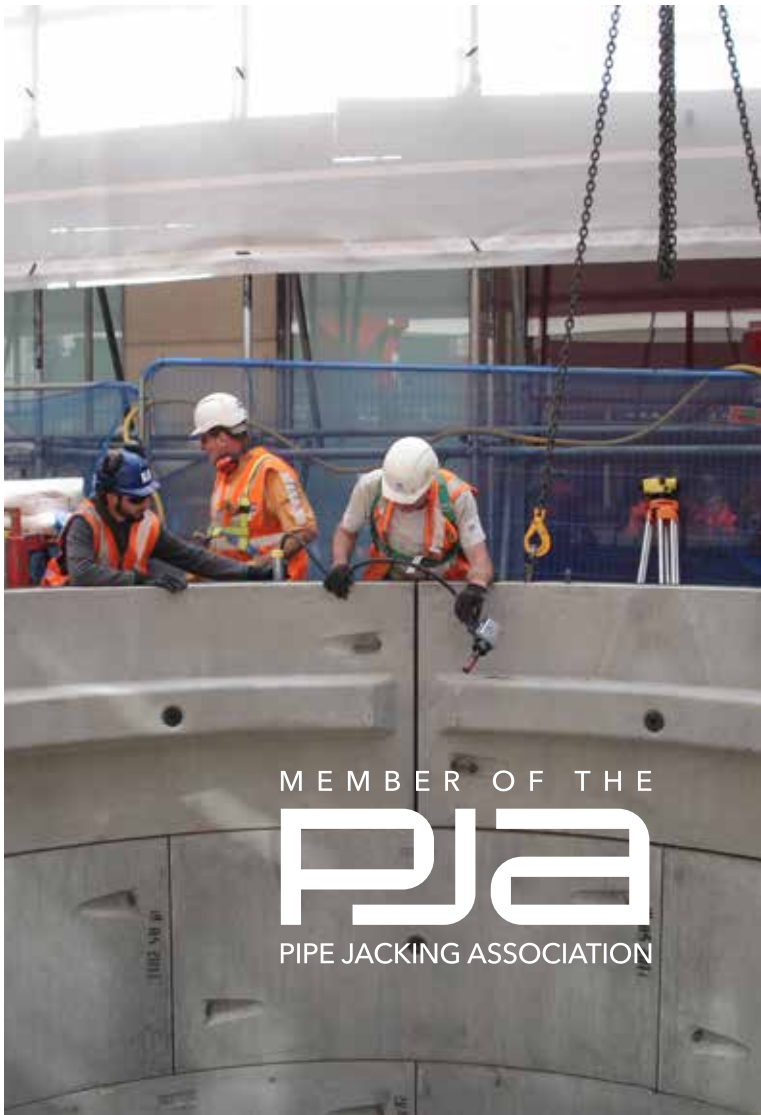
Please note: all information is correct at time of going to print.

PRECAST TUNNELS & SHAFTS SOLUTIONS

The FP McCann range of tunnel and shaft products have been developed to meet the requirements of the latest industry standards, which include the British Tunnelling Society Specification and the Civil Engineering Specification for the Water Industry. Designed to facilitate the ease of construction and speed of installation, FP McCann's tunnelling and shaft systems offer strength, stability and overall performance in all types of ground conditions. Tunnel and shaft products are manufactured in accordance with FP McCann's Quality Management System, BSI accredited to ISO 9001.

Products manufactured include:

- Smoothbore Tunnel and Shaft Linings
- Cover and Landing Slabs
- Caisson Units
- Jacking Pipes



SMOOTHBORE TUNNEL AND SHAFT LININGS

FP McCann has developed a comprehensive range of smoothbore shaft and tunnel linings. Each size is specifically designed to meet the tunnelling industry's exacting and varied needs, recognising the key criteria as being strength, stability and the capability of performing in all types of ground conditions.

DESIGN FEATURES

All rings, with the exception of the cutter choker, comprise of ordinary segments and two top segments. The top segments have one tapered cross joint so that they can be installed with an EPDM gasket. The cutter choker comprises all ordinary segments.

SEALING

FP McCann is the only precast concrete manufacturer to supply pre-fitted, tailor-made EPDM rubber gaskets on the full range of smoothbore shaft and tunnel linings. The gaskets provide an immediate water-tight seal on construction and are fully compliant with the requirements of the British Tunnelling Society specification. Speed of build, safety and increase on-site productivity are key benefits.

CONNECTION

Cross joint connections are made using a spear bolt passing through a pocket in one segment and a plastic socket in the adjacent segment. Circle joint connections are made using a T bolt passing through a hole in one segment and into a T box in the adjacent segment. Bolts are designed to fully compress the gasket. All connections are sherardised. (Other finishes to fittings, including galvanised, are available on request). FP McCann manufactures front bolted and back bolted linings on all diameters. For diameter 10.5m and above, universal linings are available to allow for changes in construction method. (Build manual available upon request).

RING TYPES

Segmental rings are front or back bolted and include:

1. Standard rings
2. Corbel rings
3. Recessed rings (standard, choker or cutter choker)
4. Choker rings
5. Combined cutter choker rings

MIX AND REINFORCEMENT

Each segment is wet cast to achieve a smooth internal finish. The concrete mix provides a Design Chemical Class 4 (DC4) with a minimum 28 day characteristic cube strength of 55 N/mm2. Alternative mixes are available. The segments are reinforced with either a reinforcing cage or structural synthetic and steel fibres to suit both design and customer requirements.

BUILD METHODS

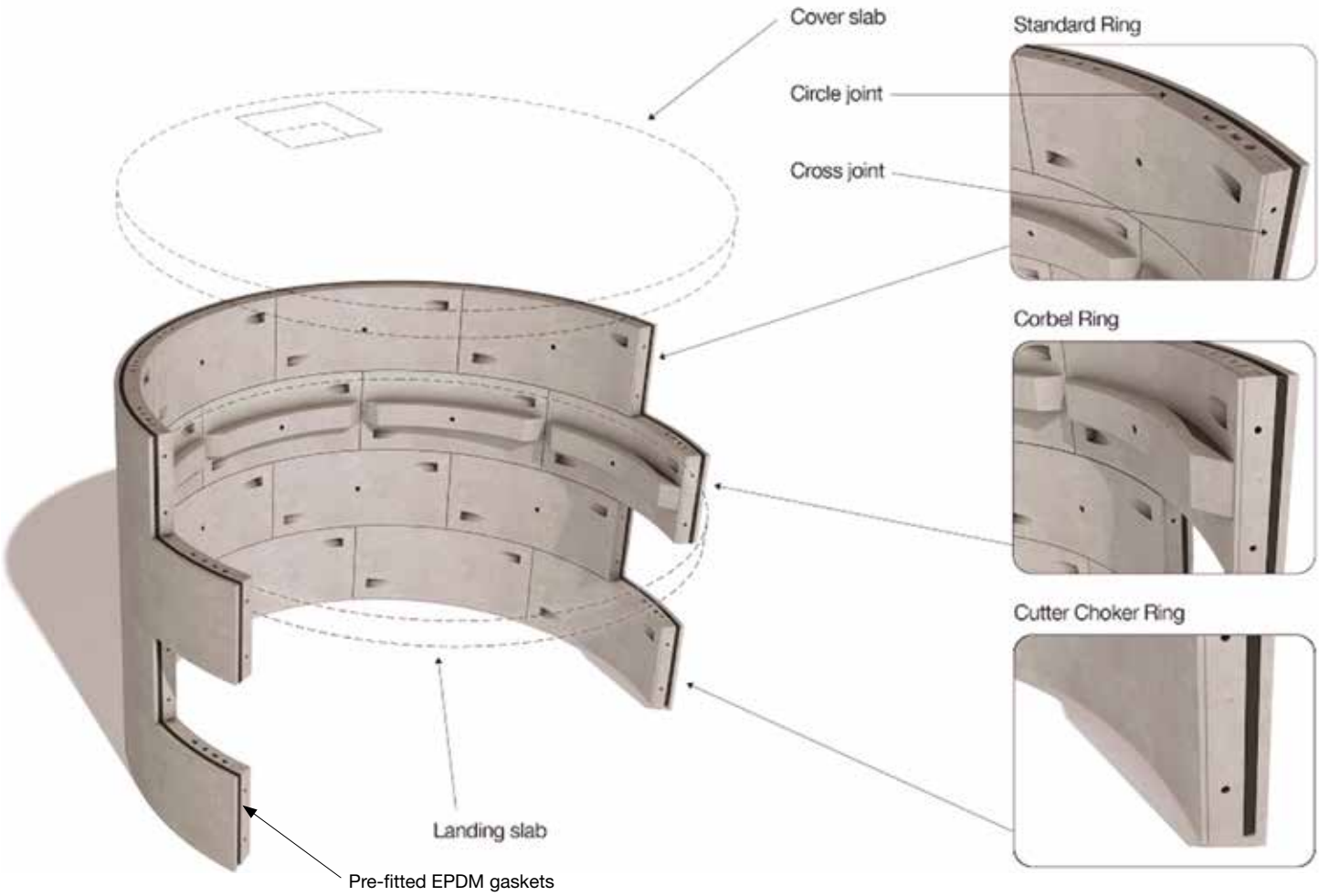
The segmental rings are suitable for underpinning, caisson and chimney construction methods.

QUALITY

FP McCann conducts all operations using an Integrated Management System accredited to ISO 9001.

KEY FEATURES AND BENEFITS

- Smooth internal faces
- Simple locking process
- Speedy installation
- Immediate watertight seal
- Cost-effective
- Added safety features
- Technical advice and support



FP MCCANN SMOOTHBORE SHAFT LININGS

Size (Standard ring)			Segments per ring (Std ring)		Vol per ring (Std ring) (m^3)	Wt per Standard ring* (tonnes)	Standard segment weight* (Kg)	Corbel segment weight* (Kg)	Choker segment weight* (Kg)	Cutter / choker seg wt* (Kg)	Excavations m^3 per standard ring			Grout per ring (m^2)	Caulking	
											mm over extrados					
Internal diameter (m)	External diameter (m)	Width (m)	Ord	Top							0	25	50		Circle (lin m)	Cross (lin m)
2.440	2.740	0.75	3	2	0.92	2.29	458			924	4.42	4.59	4.75	6.46	7.74	4.50
3.050	3.450	1.00	3	2	2.04	5.11	1021	1149	1296	1364	9.35	9.62	9.90	10.84	9.66	5.00
3.660	4.060	1.00	4	2	2.43	6.06	1011	1140	1280	1345	12.95	13.27	13.59	12.75	11.58	6.00
4.000	4.400	1.00	4	2	2.64	6.60	1100	1244	1391	1463	15.21	15.55	15.90	13.82	12.64	6.00
4.500	4.900	1.00	5	2	2.95	7.38	1055	1194	1332	1400	18.86	19.24	19.63	15.39	14.22	7.00
5.000	5.400	1.00	6	2	3.27	8.17	1021	1156	1289	1354	22.90	23.33	23.76	16.96	15.79	8.00
5.500	5.900	1.00	6	2	3.58	8.95	1119	1270	1411	1484	27.34	27.81	28.27	18.54	17.36	8.00
6.000	6.450	1.00	7	2	4.40	11.00	1222	1369	1506	1585	32.67	33.18	33.70	20.26	18.93	9.00
6.500	6.950	1.00	8	2	4.75	11.88	1188	1331	1463	1540	37.94	38.48	39.04	21.83	20.50	10.00
7.000	7.450	1.00	8	2	5.11	12.77	1277	1456	1571	1653	43.59	44.18	44.77	23.40	22.07	10.00
7.500	7.950	1.00	9	2	5.46	13.65	1241	1416	1527	1605	49.64	50.27	50.90	24.98	23.64	11.00
8.200	8.700	1.00	10	2	6.64	16.59	1383	1559	1669	1757	59.45	60.13	60.82	27.33	25.84	12.00
9.000	9.500	1.00	10	2	7.26	18.16	1514	1708	1826	1922	70.88	71.63	72.38	29.85	28.35	12.00
10.500	11.100	1.00	12	2	10.18	25.45	1818	2015	2130	2284	96.77	97.64	98.52	34.87	33.07	14.00
11.400	12.000	1.00	12	2		28.98	2.07		2.42							
12.500	13.200	1.00	12	2	14.13	35.32	2523	2941	2895		136.85	137.89	138.93	41.47	39.35	14.00
15.000	15.700	1.00	14	2	16.88	42.20	2637	2890	3024		193.59	194.83	196.07	49.32	47.20	16.00
17.500	18.300	1.00	16	2	22.49	56.23	3124		3524		263.02	264.46	265.90	57.49	55.06	18.00
20.000	20.900	1.00	18	2	28.91	72.28	3614		4025		343.07	344.71	346.36	65.66	62.91	20.00
25.000	25.900	1.00	22	2	35.98	89.95	3748		4172		526.85	528.89	530.93	81.37	78.62	24.00

*Nominal weights. Increase by 5% for sizing of lifting equipment and reduce by 5% for floatation design.

TUNNEL SEGMENTS

FP McCann designs and manufactures a bespoke range of both Trapezoidal and Expanded Segmental Smoothbore tunnel linings, designed to provide durability, speed and ease of installation in tunnel construction. Trapezoidal tunnel linings are developed to work alongside technologically advanced tunnel boring machines, with linings designed and manufactured to suit exacting project requirements.

Tunnel segments can be modified to suit a variety of joint fixings, segment thickness and tunnel diameters. The latest manufacturing techniques incorporate steel fibre dosing to guarantee a high quality, reliable product. The wedge-shaped design of individual segments eliminates the requirement for a special closure segment.

FP McCann has the in-house expertise to manufacture concrete moulds to meet the latest BTS specification. Alternatively, projects can be supplied utilising specialist manufactured steel moulds, if required.

TRAPEZOIDAL TUNNEL LININGS

Size				No of segments per ring	Vol per ring (m^3)	Weight per ring* (tonnes)	Average weight/ segment (kg)
Internal diameter (m)	External diameter (m)	Min Ring Width (m)	Max Ring Width (m)				
2.440	2.800	0.990	1.010	6	1.48	3.70	617
2.850	3.210	0.988	1.012	6	1.71	4.28	714
3.050	3.400	1.187	1.209	6	2.12	5.31	885
4.000	4.450	0.975	1.025	8	2.99	7.47	933

*Nominal weights. Increase by 5% for sizing of lifting equipment and reduce by 5% for floatation design.

EXPANDED TUNNEL LININGS

Size			Segments per ring			Vol per ring (m^3)	Weight per ring* (tonnes)
Internal diameter (m)	External diameter (m)	Ring Width (m)	Ord	Top	Key		
2.590	2.950	1.000	5	2	1	1.57	3.92
3.050	3.400	1.200	5	2	1	2.13	5.32

*Nominal weights. Increase by 5% for sizing of lifting equipment and reduce by 5% for floatation design.

THINKING PRECAST?
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TUNNELOCK

PLASTIC TUNNEL LINING CONNECTION

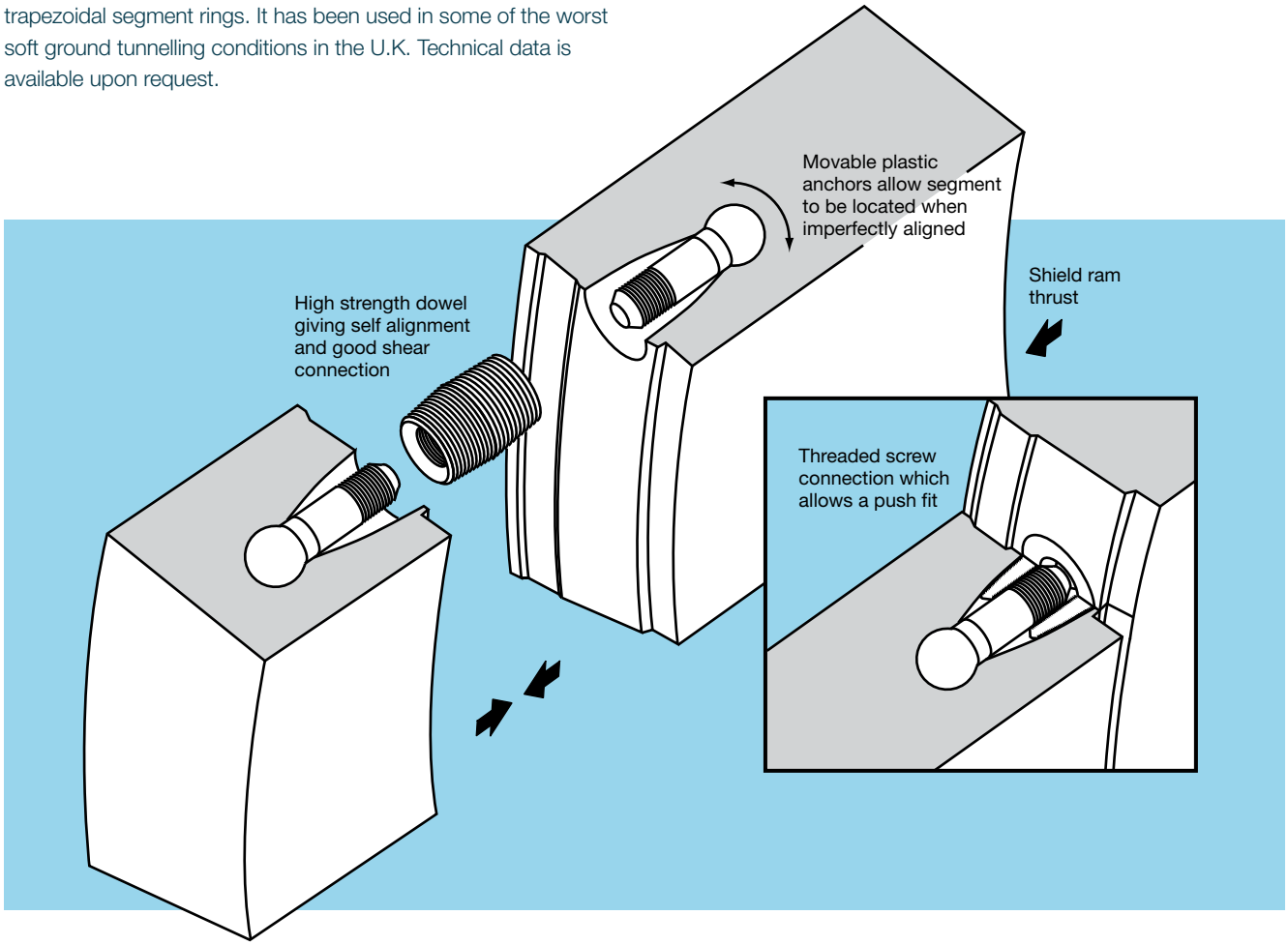
Combining the advantages of a solid dowel and a secure threaded connection, this self-locking plastic connector provides a superb circle joint fixing for tunnel linings. Suitable for use with packings, hydrophilic seals and EPDM compression gaskets, it is fast and easy to build and has no pockets/ recesses to fill.

DESIGN

The Tunnelock circle joint connection has been developed over many years to provide the ideal connection between tunnel rings. Manufactured from a high strength durable plastic, it combines the advantages of a bolted connection with the speed, economy and alignment characteristics of a dowel. The system has been developed in conjunction with major tunnelling contractors and is suitable for use in traditional open face shields or with the latest full face tunnel boring machines. The dowels allow a very fast ring erection sequence and are designed to reduce lipping between segments. The secure interlocking system is tolerant of a dirty environment and allows for the initial misalignment of segments to compensate for tapered joints and gaskets. Therefore, it is suitable for use with all types of tunnel rings and, in particular, with the trapezoidal segment rings. It has been used in some of the worst soft ground tunnelling conditions in the U.K. Technical data is available upon request.

BENEFITS

- Highly durable connection with no corrodible parts
- Fast ring construction
- Minimum building clearance (50mm standard, 75mm heavy duty) allows the use with most types of tunnelling machine and ram length
- The rigid dowel action of the coupler re-aligns the segment and minimises the stepping of joints
- No extra reinforcement required
- Suitable for trapezoidal segment rings
- Simple and easy to use
- Does not induce bursting forces in the concrete
- No circle joint pockets to fill
- Suitable for use with all types of sealing system, including EPDM compression gaskets and hydrophilic seals
- Self-locking
- Self-aligning



COVER & LANDING SLABS

COVER AND LANDING SLABS

Reinforced cover and landing slabs are an integral part of FP McCann's tunnels and shafts product range, manufactured at the company's specialist precast concrete facility. Both cover and landing slabs are cast to design specifications and made to order for just-in-time delivery. On site, the slabs can be quickly installed and provide an integral secure shaft cover or internal landing.

SIZES

Cover and landing slabs are generally circular to match the FP McCann range of smoothbore shaft segments and other segmental linings. They are available in 1, 2, 3 and 4+ sections. The standard range of sizes are highlighted opposite. A bespoke design facility is available for non-standard shapes and sizes.

One piece Cover Slabs			
Shaft internal diameter (mm)	**Shaft external diameter (mm)**	**Slab thickness (mm)**	**Total slab weight (T)**
2100	2350	250	2.82
2400	2680	275	4.03
2700	3000	275	5.05
3000	3360	300	6.92
Two piece Cover Slabs			
Shaft internal diameter (mm)	**Shaft external diameter (mm)**	**Slab thickness (mm)**	**Total slab weight (T)**
3000	3360	300	6.92
3660	4060	300/325	9.84/11.27
4000	4400	350	13.84
4500	4900	375	18.39
5000	5400	400	23.82
Three piece Cover Slabs			
Shaft internal diameter (mm)	**Shaft external diameter (mm)**	**Slab thickness (mm)**	**Total slab weight (T)**
5000	5400	400	23.82
5500	5900	425	30.21
Four + piece Cover Slabs			
Shaft internal diameter (mm)	**Shaft external diameter (mm)**	**Slab thickness (mm)**	**Total slab weight (T)**
5500	5900	425	30.21
6000	6450	450	38.23
6500	6950	475	46.85
7500	7950	525	67.76
8000	8500	550	81.15
9000	9500	600	110.58
10500	11100	675	169.83
12500	13200	775	275.75

COVER & LANDING SLABS

Cover Slabs with RC Beams			
Shaft internal diameter (mm)	**Shaft external diameter (mm)**	**Slab thickness (mm)**	**Number of RC beams**
8000	8500	250	2
9000	9500	250	2
10500	11100	275	2
12500	13200	350 to 250	2, 3 or 4
15000	15700	400 to 300	2, 3 or 4
Cover Slabs with RC Beam or Pre-stressed Beams			
Shaft internal diameter (mm)	**Shaft external diameter (mm)**	**Slab thickness (mm)**	**Number of RC beams**
20000	20900	Special	Special
25000	25900	Special	Special
One piece Landing Slabs			
Shaft internal diameter (mm)	**Slab diameter (mm)**	**Slab thickness (mm)**	**Total slab weight (T)**
2100	2050	175	1.50
2400	2350	175	1.97
2700	2650	200	2.87
3000	2950	200	3.55
Two piece Landing Slabs			
Shaft internal diameter (mm)	**Slab diameter (mm)**	**Slab thickness (mm)**	**Total slab weight (T)**
3000	2950	200	3.55
3660	3610	225	5.99
4000	3950	250	7.97
4500	4450	275	11.12
5000	4950	300	15.01
5500	5450	325	19.71
6000	5950	350	25.30
Three + piece Landing Slabs			
Shaft internal diameter (mm)	**Slab diameter (mm)**	**Slab thickness (mm)**	**Total slab weight (T)**
6000	5950	350	25.30
6500	6450	375	31.86
7500	7450	425	48.17
8000	7950	450	58.08
9000	8950	500	81.79

MIX AND REINFORCEMENT

Slab sections are wet cast in fabricated steel moulds and are steel cage reinforced. The concrete mix design is to a standard characteristic strength of 55N/mm2 at 28 days. Alternative mixes are available.

DESIGN FEATURES

Design and detailing can be undertaken by FP McCann to our customers' design specification. Reinforced cover slabs are generally designed to withstand loads in accordance with the recommendations of relevant British Standards (e.g. BS EN 1990 and BD37/01, usually adopting 30HB loading or Eurocodes with appropriate load models, in conjunction with relevant overburden). Landing slabs are designed for an imposed loading of 5kN/m2.

LIFTING AND HANDLING

Depending on lifting requirements on site, FP McCann is able to supply fitted lifting loops or cast-in sockets and spherical head lifting anchors.

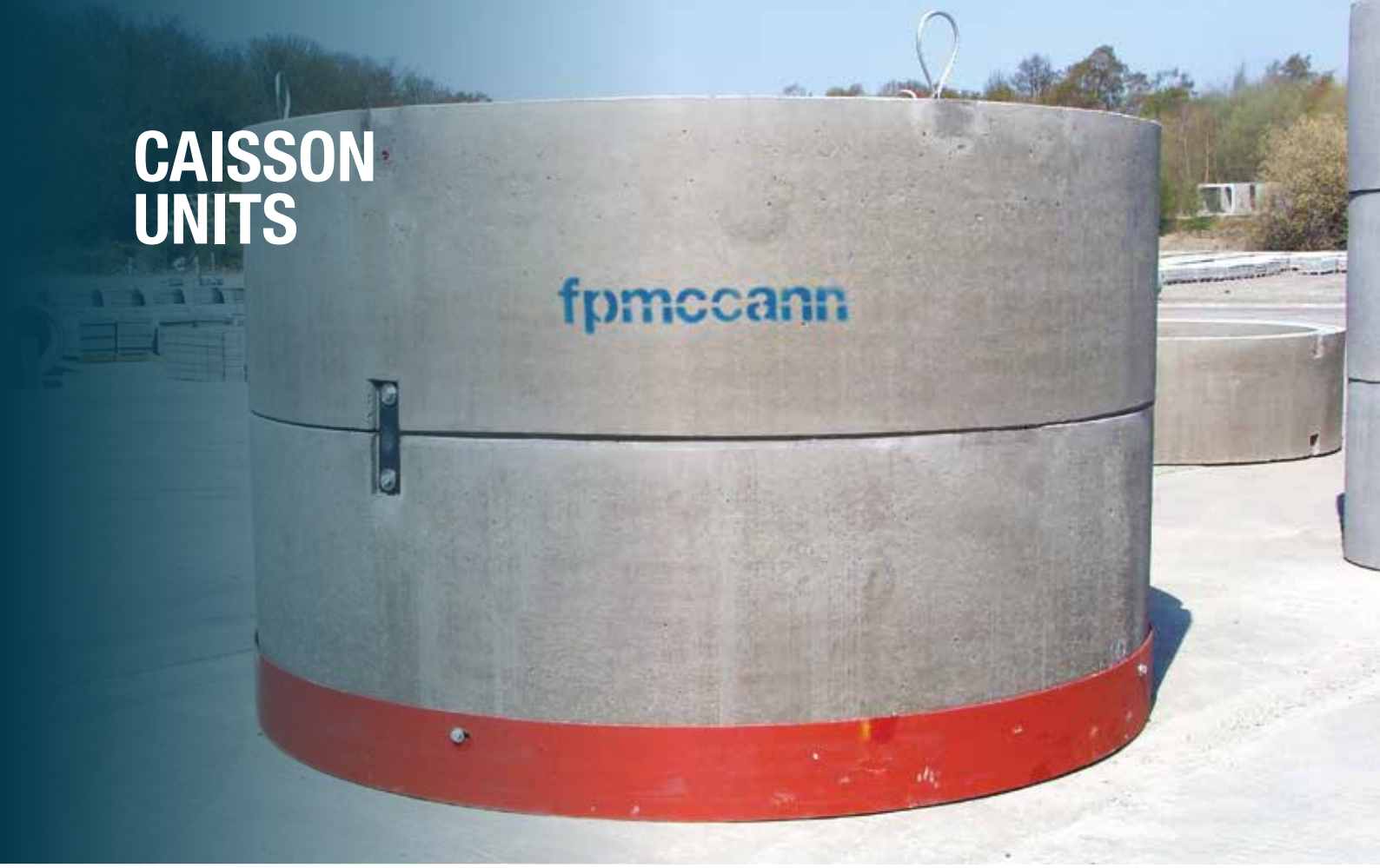
QUALITY STANDARDS

Shaft cover slabs and landing slabs are manufactured in accordance with FP McCann's quality management system, BSI accredited to ISO 9001.

KEY FEATURES AND BENEFITS

- No formwork or ready mixed concrete required
- Simple jointing system
- Speedy installation
- Bespoke design and casting service
- Technical advice and support

CAISSON UNITS



FP MCCANN CAISSON RANGE

Caissons Shafts DN	Available Depths (mm)			Barrel DN	Wall Thick-ness	Lifting (Cast in Socket)
mm	1000	750	500	mm	mm	Qty per unit
2100	✓	✓	✓	2350	125	3 No. RD24 Wavy Tail Inserts
2400	✓	✓	✓	2680	140	3 No. RD24 Wavy Tail Inserts
2700	✓	✓	✓	3000	150	3 No. RD30 Wavy Tail Inserts
3000	✓	✓	✓	3360	180	3 No. RD30 Wavy Tail Inserts
3600	✓	✓	✓	3970	185	3 No. RD30 Wavy Tail Inserts
*4000	✓	✓	×	4400	200	6 No. RD36 Wavy Tail Inserts

*DN4000 supplied as a two piece unit.

FP McCann manufactures a range of reinforcing units suitable for sinking by the caisson method. Caisson shaft units can be supplied with diameters of 2100mm up to 4000mm. Caissons are manufactured within the scope of the ISO9001 accredited Quality Management System and in accordance with BS EN 1917 and BS5911-3, where appropriate^.

Open caisson-sinking techniques permit a shaft structure to be progressively sunk, either under its own weight or with the aid of caisson jacks, in a controlled manner from the surface to a predetermined depth. Caisson shafts are constructed using a metal cutter ring and base section with rings being added on top as excavation proceeds. The technique is suited to shaft construction through weak soils, high-plasticity clays, silts, sands and gravel, particularly below the water table.

CAISSON RINGS - TABLE OF WEIGHTS (DN 2100-4000)

Caissons Shafts DN	Cutting Shoe Weight (Kg)		Approx. Weight p/metre Caisson (with cutting shoe) (Kg)**		Approx. Weight p/metre Caisson (without cutting shoe)**
mm	10mm	20mm	10mm	20mm	Kg
2100	320	581	2590	2851	2270
2400	378	635	3278	3535	2900
2700	441	794	3931	4284	3490
3000	529	953	5209	5633	4680
3600	641	1148	6361	6868	5720
*4000	725	1298	7585	8158	6860

* DN4000 supplied as a two piece unit.
** Nominal weights increase by 5% for sizing lifting equipment and reduce by 5% for floatation design.
Base units may be fitted with a light duty (10mm) or a medium duty (20mm) cutting shoe.

^ Caisson manholes cannot be CE marked as their diameters are not covered by the scope of the harmonised European Standard BS EN 1917.
However:
2100mm - 3000mm manholes are kite-marked against the scope of the complementary British Standard BS5911-3.
3600mm and 4000mm diameters remain operative within the scope of the ISO 9001 accredited Quality Management System.


FP McCann

JACKING PIPES

MEMBER OF THE PJA PIPE JACKING ASSOCIATION

FP McCann provides an extensive range of concrete pipes and fittings. All products are manufactured from high quality raw materials and are sulphate resistant.

FP McCann's jacking pipes enable pipe installation where the opening of trenches is neither practical nor cost-effective.

FP McCann's jacking pipes are made from dense, durable reinforced concrete. The mix provides a design chemical class 4 (DC4), with a minimum 28 day characteristic cube strength of 50N/mm^2

They are manufactured in accordance with BS EN 1916 and BS 5911-1 and certified by Quality Assessment under the kitemark scheme and ISO 9001.

FEATURES

- Self-lubricating joint gasket
- Built-in handling system with an extensive range to suit most machines and shields

Q&A ON JACKING PIPES

Q. What is pipe jacking?

A. Pipe jacking is a technique for the installation of underground pipes, ducts and culverts with minimal environmental disruption. Jacking pipes can also act as conduits for other utilities like gas, electricity and telecommunications.

Q. How does it work?

A. Tunnelling excavation, by machine or by hand, takes place between two shafts or caissons, whilst specially designed pipes are pushed through the ground by powerful jacks.

Q. Why is pipe jacking used?

A. Primarily to install water and sewerage systems where the opening of trenches is impractical; for example, in environmentally sensitive areas, under railways, motorways, rivers, canals, buildings and in crowded urban sites.

Q. What are the cost advantages?

A. Jacking is cost-effective when compared with deep open cut methods and other forms of tunnelling. It offers low maintenance costs, speed and safety of installation with fewer joints, smooth internal finishes and improved flow characteristics without the need for secondary linings required by some segmental systems.

Q. What are the environmental advantages?

A. Minimum excavation means less disturbance, less pollution, less noise, fewer lorry movements and a reduction in the need for costly traffic diversions and delays. There is a reduced risk of settlement, damage or movement to other structures and services.

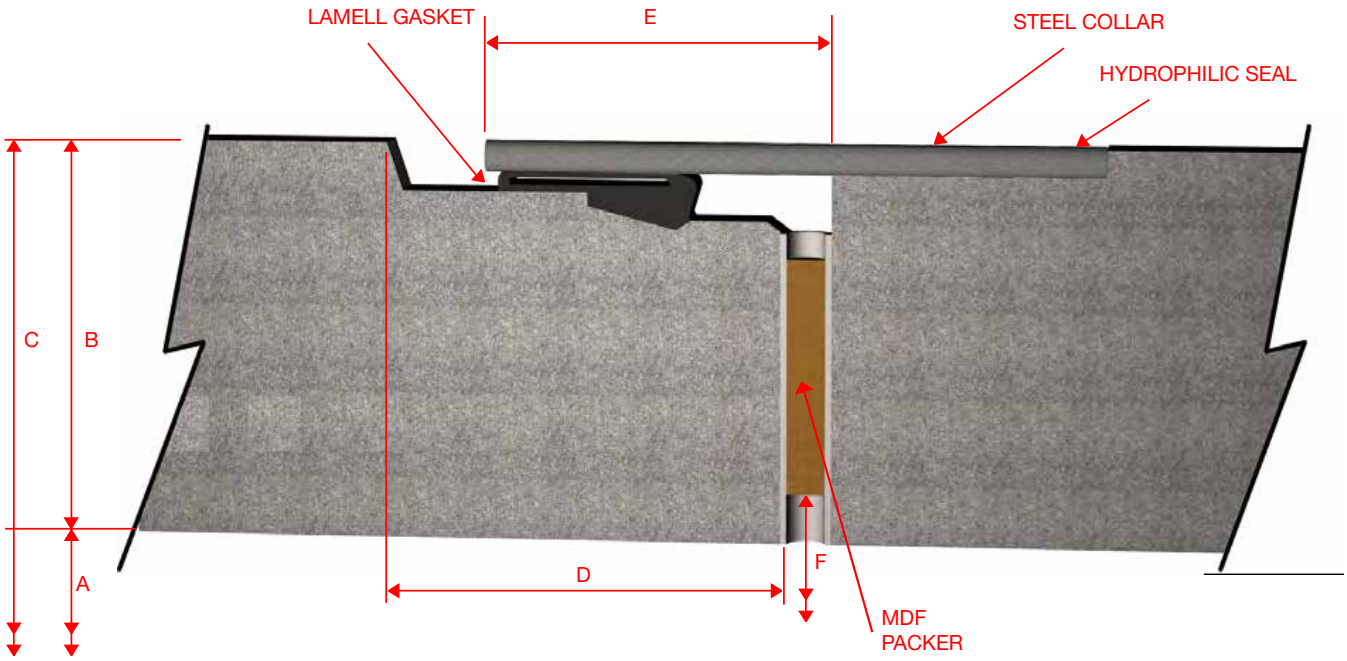
Q. What types of concrete jacking pipe arethere?

A. Pipes with steel collars are manufactured to BS EN 1916 and BS 5911-1. Steel collar pipes incorporate an accurately rolled collar manufactured from BS EN 10025-2:2004 S275 mild steel. They can be used on both machine dug and hand dug drives.

Q. What is meant by microtunnelling?

A. Refers to non-man entry sizes installed by machine, though some consider it to include larger pipes installed by remote control methods.

STEEL COLLAR JOINT



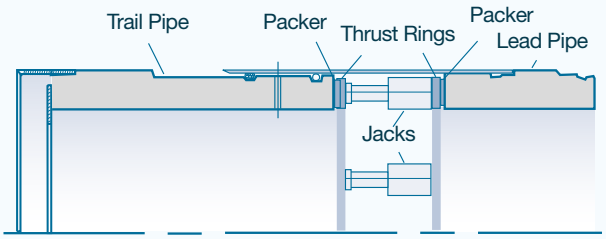
FP MCCANN'S JACKING PIPE RANGE

DN* (mm)	Bore Diameter A (mm)	Wall Thickness B (mm)	Outside Diameter C (mm)	Length Metres	Weight Kg Approx	Spigot Length D (mm)	Socket Length E (mm)	Packer Size Width (mm)	Packer Size Thickness (mm)	Int.Dia to Packer F (mm)	Proof Load kN/m	Maximum Load KN/m
# 450	450	77	604	1.20	430	115	110	33	12	480	36	# 54
# 600	585	90	764	1.20	640	125	110	46	15	611	48	# 72
# 600	585	90	764	2.00	1050	125	110	46	15	611	48	# 72
900	904	98	1100	2.50	2120	130	125	56	15	934	72	108
1000	980	110	1200	2.50	2580	130	125	66	15	1010	72	120
1200	1200	115	1430	1.20	1590	130	125	68	18	1230	96	144
1200	1200	115	1430	2.50	3250	130	125	68	18	1230	96	144
1400	1350	125	1600	2.50	3950	130	125	78	18	1380	112	168
1500	1500	140	1780	2.50	4910	130	125	93	18	1530	120	180
1800	1830	155	2140	2.47	6490	134	125	110	18	1860	145	216
2000	1950	190	2330	2.35	8150	134	125	145	18	1980	160	240
2000	1950	190	2330	2.50	8600	134	125	145	18	1980	160	240
2000	1980	175	2330	2.50	8040	134	125	130	18	2010	160	240
2000	2076	167	2410	2.47	7900	134	125	122	18	2106	160	240
2400	2425	200	2825	2.50	11190	145	140	150	18	2455	200	300

Alternative Length of Pipes (Maximum length 2.5m)
Alternative length of pipes in some of the sizes shown above can be manufactured to order.
FP McCann is always interested in adding to the above range, and would be pleased to discuss the supply of any sizes not shown.

* Nominal size as given by Table 6 BS 5911-1.

\# These items are not covered by BS EN 1916 and BS 5911-1 but have been designed and tested using the same criteria.
Weights given are the nominal weights increased by 5% to allow for variations in material unit tolerance

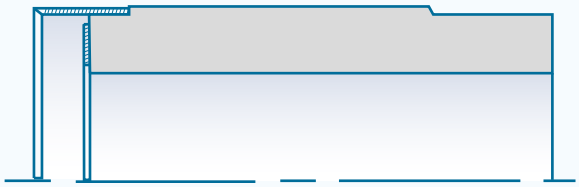


TYPICAL INTERJACK STATION

LEAD PIPES

Lead pipes are located at the front of the drive. It is standard practice to fit a steel shield over the lead pipe in every hand dug drive, providing protection to miners and facilitating steering.

Machine dug drives do not usually require a lead pipe as the contractor can adapt the machine to fit over a standard pipe spigot.



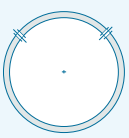
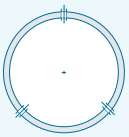
LEAD PIPE

SPECIAL CHARACTERISTICS

- A flat end instead of a spigot - 600mm long by 20mm deep rebate
- Joint gaskets are not supplied as standard with lead Grout Sockets or Lubrication Holes

Designed to reduce friction during jacking, lubricating or grout sockets can be cast into standard pipes to suit customer requirements. They are normally 1 1/4"BSP steel sockets fitted with plugs. Conical non-return valves are supplied as standard. The ratio of pipes with grout sockets to standard pipes varies, depending on ground conditions. As a guide, it can be one pipe in every three or one in every five.

TABLE SHOWING STANDARD CONFIGURATIONS OF GROUT SOCKETS.

Pipe Diameter mm	Number	Location
900-1800	2 holes per pipe	
1950 - 2400	3 holes per pipe	

PACKERS

It is important that suitable packing material is used between adjacent pipes to ensure even stress distribution and load transfer. We recommend medium density fibre board (MDF). FP McCann can supply and fix packers at works, although the contractor usually supplies and fixes them on site prior to pipe installation. It is important that packers are fitted in the correct position.

INTERMEDIATE JACKING STATIONS (INTERJACKS)

Interjacks are frequently installed on drives where the jacking forces required exceed the capability of the pipe or the jacks. Installing interjacks relieves pressure on the whole drive length by first pushing the section of pipes in front of the interjack using jacks installed within the interjack itself; the rear section of pipes is then pushed by the main jacks. Each interjack station comprises two pipes, a lead and a trail, with a steel can or shield which is either cast integrally with the lead pipe - a fixed can, or fitted round the pipe separately - a loose can. The interjack trail pipe is common to both fixed and loose can types. The choice of interjack type is usually left to the contractor's preference.

FIXED CAN INTERJACKS

These are used with steel collar pipes. FP McCann provides the lead pipe with the can already fitted. It then becomes the contractor's responsibility to fit suitable steel thrust rings, packers and jacks inside the can.

LOOSE CAN INTERJACKS

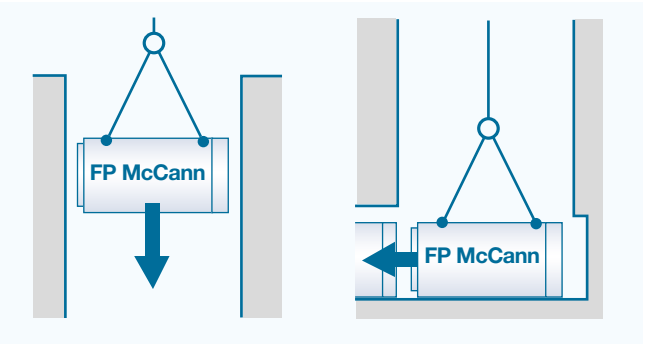
Generally used with in-wall jointed pipes and have a lead pipe with a short 300mm by 20mm recess in place of the socket. The contractor provides the can as well as the thrust rings, packers and jacks.

INTERJACK TRAIL PIPES

Recognisable by their long 1400mm by 20mm rebate instead of the normal spigot. Two recesses are located towards the end of the rebate to take special sealing rings provided by FP McCann. Lubrication points are positioned between the recesses.

INTERJACK TRAIL PIPE

JACKING PIPES




Easi-lift Handling System

To assist the contractor in adopting a safe working method for lowering heavy pipes into deep, confined spaces, the FP McCann Easi-lift handling system is available for pipes from DN 900 to DN 2400. Galvanized lifting anchors are cast into the pipe wall and are used in conjunction with certified lifting shackles and chains to provide a safe, speedy and accurate system of off-loading, stacking and placing. Anchors are positioned below the outside diameter of the pipe to avoid any potential to snag or plough.

BENEFITS OF JACKING PIPES

Safe - Easi-lift ensures a positive horizontal lift every time, no weight balancing is required.

Accurate - pipes can be lowered down deep shafts and onto the jacking cradle in one smooth, easy operation.

Time saving - lifting eyes are engaged and disengaged by rotation in a few seconds.

Cost saving - eliminates the purchase of cumbersome slings and reduces the risk of damage to pipes.

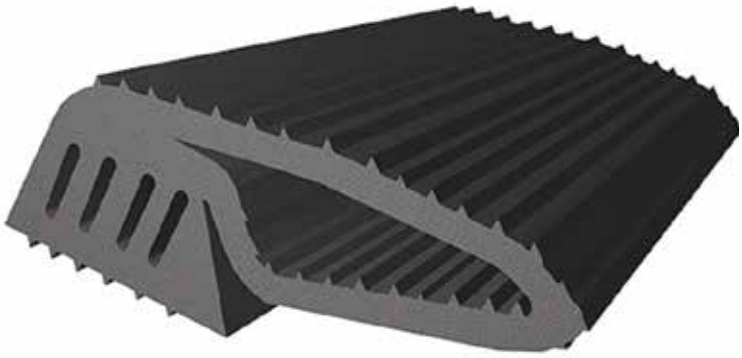
No leaks - through lifting holes which need sealing.

Lamell is a fast, efficient, easy-to-fit pipe joint seal. Incorporating an innovative, self-lubricating SBR gasket, the Lamell seal is ideal for use in wet conditions. Lamell provides a reliable, flexible, water-resistant seal requiring no additional lubrication.

PIPES FOR SPECIAL REQUIREMENTS

FP McCann's jacking pipes are designed to meet all normal in-service conditions. However, there are situations which demand special consideration. FP McCann can offer a number of options to help combat more extreme conditions, such as:

- Stainless steel collars to suit ground or effluent conditions
- Alternative mix designs to suit ground or effluent conditions
- Protective coatings or linings to suit ground or effluent conditions
- Special strength pipes with increased reinforcement
- Secondary seals can be provided, if requested
- Note: special requirements or non-standard products should be ordered in advance of their anticipated delivery dates.



JACKING PIPE INSTALLATION

Note: the mantle is tough but can be damaged by sharp implements. Care should be taken to handle and store gaskets correctly.

HANDLING AND JOINTING - GENERAL

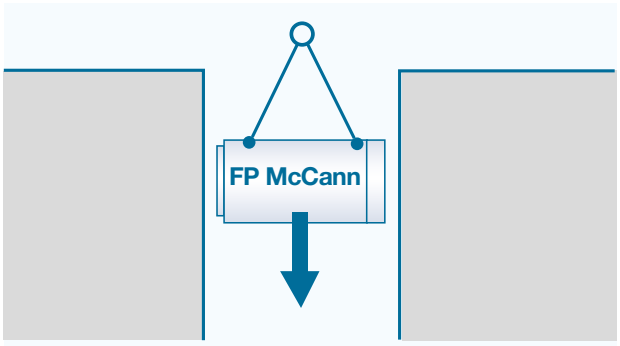
FP McCann's jacking pipes are robust and should arrive on site in good condition. Care in handling is simply a matter of common sense.

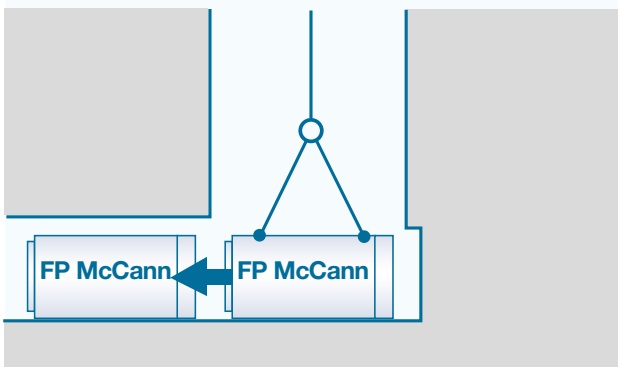
DO TAKE EXTRA CARE WITH THE JOINTS.

Lifting appliances should be capable of smooth hoisting, lowering and travelling with the heaviest pipe and must satisfy the required safety regulations.

EASI-LIFT HANDLING SYSTEM

This is the simplest, safest and most efficient way of handling FP McCann's jacking pipes, DN 900 and above. Place the lifting eyes over the cast-in anchors and rotate ensuring the lugs on each eye are pointing towards the centre of the pipe before commencing the lift.



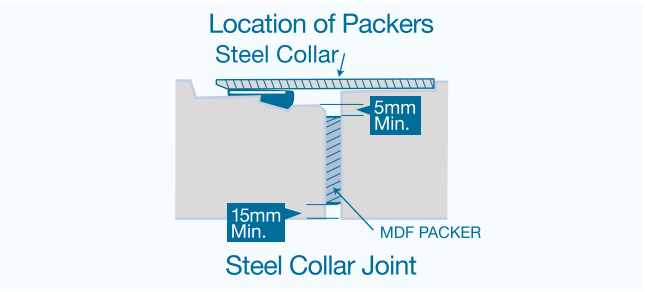


If easi-lift is not used then:

- Webbed slings should be used to handle pipes round the barrel rather than through the bore. Should slings be used through the bore, pipe ends must be protected from chafing. Wire ropes and chain slings are not recommended.
- Pipes should be stacked on firm, level ground. The bottom layer must be securely chocked and the height of the stack should not exceed two metres.
- Store rubber rings and gaskets away from strong sunlight and frost.

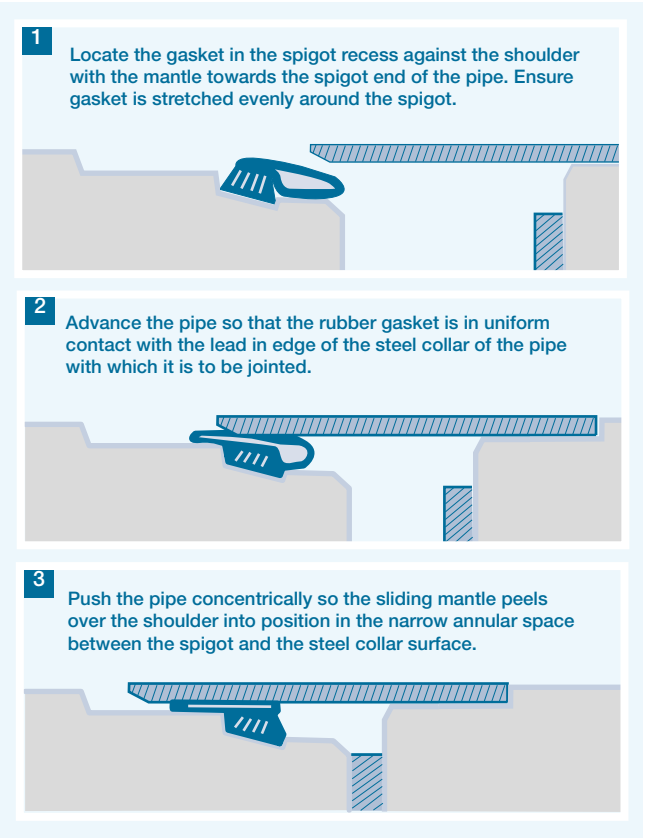
PACKERS

It is preferable to fit packers just prior to jointing as they remain clean and dry and are less likely to work loose. It is important they are fitted concentrically and should be offset from the pipe faces as per the minimum dimensions shown below, especially the inside bore.



JOINTING USING THE LAMELL SEAL

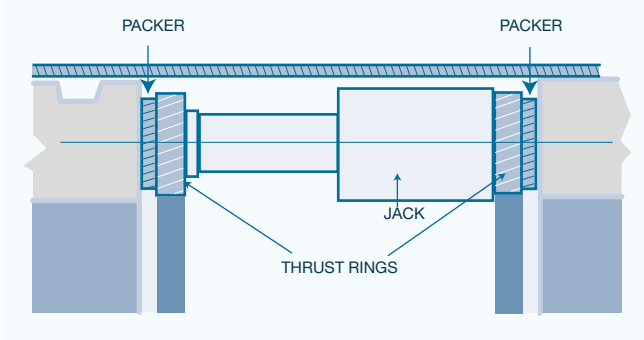
Prior to placing ensure the gasket and the joint surfaces are clean. Lubrication is not required and **MUST NOT** be applied.



STANDARD INTERJACK INSTALLATION

It is assumed that:
All preparatory work will have been completed before the installation of the interjack, ie. drilling and fixing of brackets, fixing of segmented thrust rings and hydraulics
The jacks are securely restrained so they will not become misaligned during use

IMPORTANT
The hydraulic jacks must be positioned so that their centre line is the same as that of the pipe wall. All thrust rings should be of adequate stiffness to prevent joint loading.



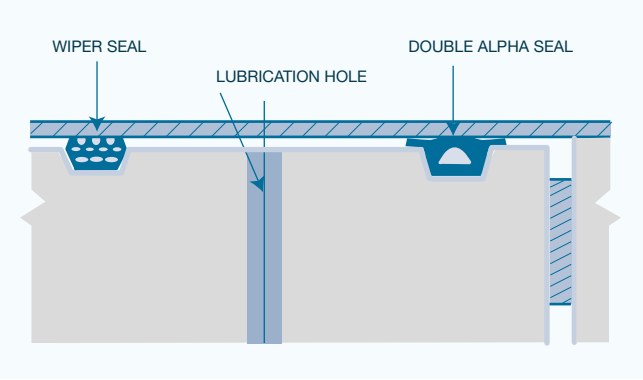
Typical position of jacks relative to pipe wall

ASSEMBLING A FIXED CAN INTERJACK

1. When installing the lead pipe into the drive a suitable spacer must be inserted into the can to provide adequate clearance between it and the pit thrust ring

   IMPORTANT
   No Load should be applied to the end of the steel can.

2. Fit the seals to the interjack trail pipe ensuring that they are fitted in the correct position to maintain a watertight seal. Lubrication points (usually 3/4" BSP) are provided between the two seals to allow effective lubrication



Typical sealing arrangement of fixed and loose can interjack

3. Lubricate the two parts of the interjack station. Both the inside of the steel can and seals must be liberally coated. Use FP McCann lubricant. Petroleum lubricants must not be used as this will cause degradation of seals

4. While jointing ensures the trail pipe is offered up squarely and neither of the two gaskets are displaced during assembly. During use the interjack station must be continuously lubricated by maintaining a minimum pressure of 5psi (0.4 bar) between the seals, preferably by automatic systems

5. If the final location of the seals is in doubt, the trail pipe must be withdrawn and the procedure repeated

ASSEMBLING A LOOSE CAN INTERJACK

Follow the previous 5 steps, remembering the steel can is added separately and is usually supplied by the contractor.

Note: Standard interjack stations are designed to withstand an internal pressure of 0.07N/mm2. We cannot guarantee performance at pressures above this figure. It is not normally possible to fit Interjack pipes with the Easi-Lift handling system.

JACKING LOADS

FP McCann's jacking pipes are designed to meet the requirements of British Standard 5911 Part 1 and European Standard BS EN 1916. The Maximum Jacking Force (Fjmax *) which can be applied to a pipe is determined by the pipe strength, the configuration of the thrust ring and the tunnel alignment, i.e. the angular deflection between pipes. The maximum load decreases as angular deflections occur during jacking. Should deflection exceed that which can be accommodated by the packer, the maximum load decreases significantly. The figures below are for guidance only. For further assistance, contact FP McCann's technical department.

* It is important to note that the table indicates the loads for which each pipe was designed and does not include any safety factor used by the contractor (Refer to clause 5.3.4 BS EN 1916)

MAXIMUM DESIGN LOADS - (TONNES)

					Angular Deflection				
Pipe Nominal Size mm	Pipe I/D mm	Pipe O/D mm	Packer Depth mm	Packer Thickness (mm)	0**	Angle Varies ***	0.25	0.5	1.0
					degrees		degrees	degrees	degrees
450	450	604	33	12	111	56	56	56	35
600	585	764	46	15	200	100	100	86	52
900	904	1100	56	15	365	183	183	117	73
1000	980	1200	66	15	468	234	234	141	86
1200	1200	1430	68	18	581	291	252	156	95
1350	1350	1600	78	18	749	375	298	186	112
1500	1500	1780	93	18	994	497	365	227	134
1800	1830	2140	110	18	1427	714	461	287	166
1950	1950	2330	145	18	2029	1015	612	373	203
1980	1980	2330	130	18	1832	916	556	343	192
2100	2076	2410	122	18	1790	895	534	332	188
2400	2425	2825	150	18	2573	1287	687	419	225

** The load must be perpendicular to the joint face (no deflection and all jacking forces perfectly square)
*** There is angular deflection but there is no joint gap i.e. any deflection being taken up within the packer

HAULAGE LOAD QUANTITIES

Table showing quantities per 24.5 tonne load

In-wall joint 2.5m long			Steel Collar joint 2.5m long					
	Approx. number of			Approx. number of			Approx. number of	
Nominal Dia. mm	pipes	metres	Nominal Dia. mm	pipes	metres	Nominal Dia. mm	pipes	metres
900	8	20.0	900	11	27.5	1950	3	7.50
1050	6	15.0	1000	9	22.5	2100	3	7.50
1200	5	12.5	1200	7	17.5	2400	2	5.00
1500	4	10.0	1350	6	15.0	Microtunnelling pipes 2m long		
1800	3	7.50	1500	5	12.5	600	24	48.0
2000	2	5.00	1650	4	10.0	675	21	42.0
2400	2	5.00	1800	3	7.50	Microtunnelling pipes 1.2m long		
1.2m long			1.2m long			450	60	72.0
900	17	20.4	1200	15	18.0	600	40	48.0

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