PINNACLE

Pinnacle® Series Concrete Pipes

Technical Guide D1.14

Date Issued: 10.25

Manufactured at our state of the art world leading concrete manufacturing plant in Pōkeno, the "Pinnacle® Series Concrete Pipe" has an improved joint using a pre-lubricated sliding rubber ring to provide a watertight seal.

Applications

- Stormwater, Wastewater and Irrigation
- Installation in a wide variety of locations

Product Attributes

- Strong and durable
- Proven history
- Watertight joint
- Steel formed finish

Approvals/Standards

- Designed and manufactured to AS/NZS 4058:2007 Precast Concrete Pipes
- Rubber rings manufactured to EN 681-1 Elastomeric seals for water and drainage applications

Sustainability

- Available in Hynds LC® low carbon concrete
- Environmental Product Declaration (EPD) or verifiable carbon footprint data available
- Customisable for climate-resilient infrastructure

Quality/Environment/Health & Safety

- Hynds management systems are certified to ISO 9001:2015, 45001:2015, and 14001:2018 standards

HYNDS PIPE SYSTEMS

Introduction

The Pinnacle® range of Concrete Pipe is our new and improved range of Concrete Pipe from our state-of-the-art, world leading concrete manufacturing site in Pōkeno, Auckland.

The automated manufactured range of Pinnacle® Pipe is manufactured using a highly automated process utilising the latest European manufacturing technology. Each pipe has an unique product marking allowing for product traceability after production and delivery to site. The automated manufactured range also includes in-line vacuum testing of the full pipe length. This state-of-the-art process helps to ensure that a high-quality pipe is produced consistently, with smooth surface finishes and precision dimensional accuracy especially around the Joint profile.

The larger diameter pipes in our Pinnacle® range are manufactured using the latest European Mould technology ensuring that the product meets our strict quality requirements.

The new Pinnacle® range incorporates a joint profile specifically designed to accommodate a pre-lubricated elastomeric seal, which is extensively used in Europe and elsewhere in the world.

Our Pinnacle® range of Concrete Pipe is generally only supplied to North Island Projects but can be shipped to South Island projects where required.

Joint Types

The Pinnacle® range of Concrete Pipe comes with one of two joint types depending on the size and application for the pipe.

Belled Socket Joint (BSJ)

Belled Socket Joint Pipe (previously known as Rolling Rubber Ring Joint (RRJ) or Collared Pipe) is typically used for small to medium pipe where the wall thickness of the pipe is insufficient to accommodate the joint profile.
A projecting collar is provided which extends outside the outer surface of the pipe barrel.

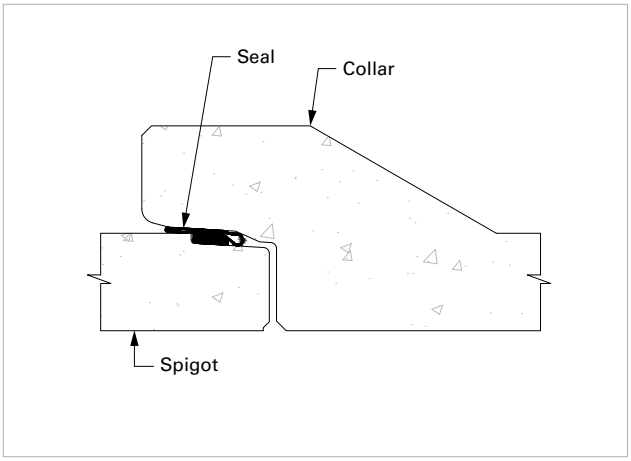


FIG. 1 BSJ Joint Profile

In-Wall Joint (IWJ)

In-Wall Joint pipe (previously known as Skid Ring Joint (SRJ) pipe) is typically used for larger diameter pipes, or medium diameter pipes that have sufficient wall thickness to accommodate the joint profile. In-Wall Joint profiles are used widely in NZ for trenchless installations and other non-standard applications.

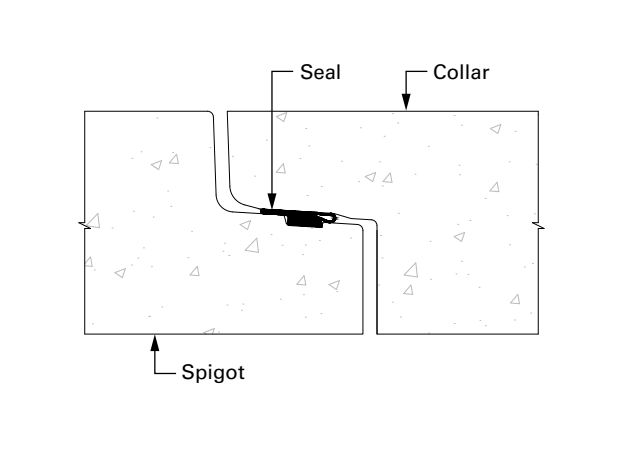


FIG. 2 IWJ Joint Profile

Standard Range Specifications

Our Standard Range products cover the majority of everyday applications.

- Sizes DN525 – 3050mm
- Manufactured to AS/NZS 4058 requirements
- Designed to suit a 'normal' environment as defined in AS/NZS 4058:2007
- Generally available in two main strength classes, with Class 2 being the standard load strength and Class 4 providing double the strength of Class 2.
- Internal installed working pressure up to 50kPa (5 metre head) and factory tested to 90kPa (9 metre head).
- Standard effective length is 2500mm.

Made-to-Order or Custom Product Options

We recognise that every job is different and that our Standard Range of products may not be suitable for your installation. We have a number of product options ready that are made-to-order to suit these installations and if required we will look at new solutions to meet your needs.

Below are options that fit within the made-to-order or custom product options.

Refer to our Concrete Pipe National Catalogue or your local Hynds representative for more details.

Application	Hynds Options
Higher Strength Classes	Class 6 and higher classes are available made-to-order.
Sewer - Some wastewater pipelines have the potential to produce high concentrations of Hydrogen Sulphide (H_2S). Where this gas is not ventillated, it can lead to corrosion of concrete and there are options available	Sacrificial Liner - Increase concrete cover internally by 25mm to act as a sacrificial layer of concrete. Available in some sizes and classes. Lined Pipe - Line the pipe internally with High Density Polyethylene. Below are two products that we can provide: • PERFECT® Pipe - New PE lined pipe technology with coupler. Refer to Technical Guide D1.17 PERFECT Pipe • Hyliner - PE lined pipe with welded joints. Refer to Technical Guide D1.12 Hyliner AKS
Marine - Marine environment as defined in AS/NZS 4058:2007.	Marine - Marine grade options with additional cover as defined in AS/NZS 4058:2007 are available in some sizes and classes. Refer to Technical Support Sheet D1.1A Marine Environment Options and the Concrete Pipe National Catalogue for more detailed information.
Acidic or Acid Sulfate Soil	Increase concrete cover internally and/or externally by 10mm to act as sacrificial layer or, HYDURA Concrete / 30% Fly Ash or both of the above. Refer to CPAA Technical Brief Concrete Pipe in Acid Sulfate Soil Conditions for recommendations.
Jacking Pipe	Refer to Technical Guide D1.16 Pinnacle® Concrete Jacking Pipe.
Internal Watertightness Installed	All of our Pinnacle® range pipes can offer a hydraulic seal up to an internal pressure of 50kPa. Pressures greater than this require specific design as a pressure pipe.
Fabricated specials	Fabricated specials such as cut pipe, bends and offtakes are available. Some pipe diameters are available in longer/shorter lengths than the 2500mm nominal length. Alternatively other lengths can be fabricated by cutting and joining at the specified length. Fabricated bends can be made at a number of angles. Offtakes can also be made at various positions in a pipe length. Contact us for more information.
Other options	Hynds can work together with parties to investigate and design a specific solution to fit the customers need.

TABLE 1 Class 2 Pinnacle® Pipe Geometry (BSJ and IWJ)

Nominal Diameter	Barrel Internal Diameter	Barrel External Diameter	Collar External Diameter	External Collar Length	Overall Length	Barrel Length	Wall Thick-ness	Nominal Minimum Joint Gap	Recom-mended Working Maximum Joint Gap	Product Mass (kg)	Lifting Clutch Size (Tonnes)	Hynds Product Code
-	A	B	C	D	E	F	t	x*	-	-	-	-
BSJ												
525	525	633	763	243	2600	2495	54	5	15	690	1.3	PC0525BSJC2M
600	600	715	845	243	2600	2495	57.5	5	15	820	1.3	PC0600BSJC2M
675	675	779	911	244	2600	2495	52	5	15	850	1.3	PC0675BSJC2M
750	750	860	997	248	2600	2495	55	5	15	980	1.3	PC0750BSJC2M
825	825	955	1084	242	2600	2495	65	5	15	1300	1.3	PC0825BSJC2M
900	900	1026	1175	259	2600	2495	63	5	15	1390	1.3	PC0900BSJC2M
1050	1050	1202	1379	293	2606	2494	76	6	16	1950	2.5	PC1050BSJC2M
1200	1200	1362	1541	295	2606	2494	81	6	16	2290	2.5	PC1200BSJC2M
1350	1350	1520	1699	295	2606	2494	85	6	16	2690	2.5	PC1350BSJC2M
1500	1500	1740	1942	315	2617	2492	120	8	18	4045	5.0	PC1500BSJC2W
1650	1650	1870	2104	343	2617	2492	110	8	18	4330	5.0	PC1650BSJC2W
1800	1800	2040	2288	355	2617	2492	120	8	18	5140	5.0	PC1800BSJC2W
IWJ												
0700	700	1080	-	-	3072.7	2945	190	12	21	3997	5	PC070030JIC2M
0900	900	1280	-	-	3072.7	2945	190	12	21	4902	5	PC090030JIC2M
1950	1950	2350	-	-	2622	2484	200	16	23	8560	10	PC1950IWJC2W
2100	2100	2520	-	-	2623	2484	210	16	23	9660	10	PC2100IWJC2W
2300	2300	2630	-	-	2860	2720	165	20	30	8950	10	PC2300SRJC2W
2550	2550	3000	-	-	2624	2480	225	20	30	12450	10	PC2550IWJC2W
3000	*	*	*	*	*	*	*	*	*	*	*	*

Notes:

1. All diameters and lengths are in millimetres.

2. Effective length is the barrel length plus the nominal laying gap.

3. To match recommended joint deflection limits (refer to Table 3).

** Refer to figure 8*

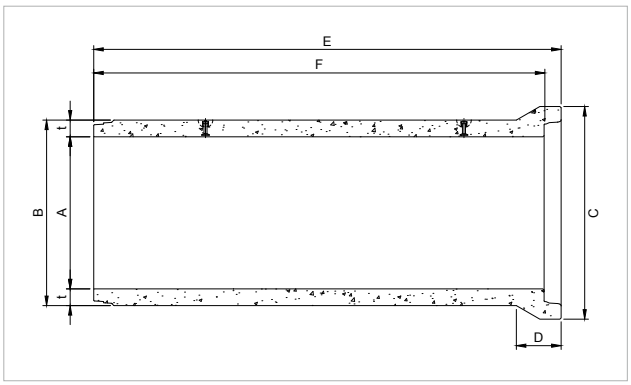


FIG. 3 BSJ Pipe Geometry

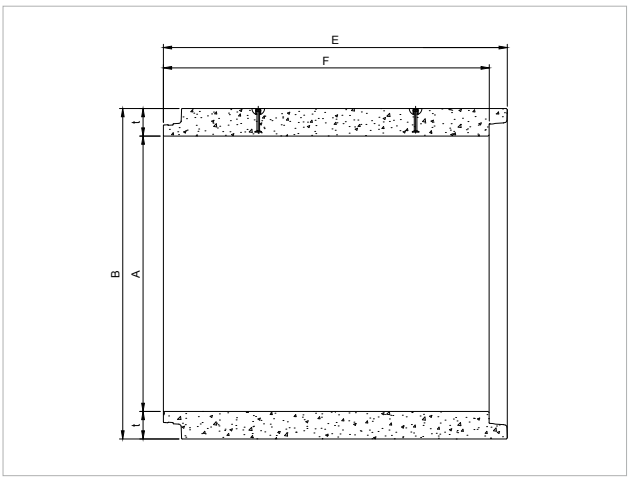


FIG. 4 IWJ Pipe Geometry

TABLE 2 Class 4 Pinnacle® Pipe Geometry (BSJ and IWJ)

Nominal Diameter	Barrel Internal Diameter	Barrel External Diameter	Collar External Diameter	External Collar Length	Overall Length	Barrel Length	Wall Thick-ness	Nominal Minimum Joint Gap	Recom-mended Working Maximum Joint Gap	Product Mass (kg)	Lifting Clutch Size (Tonnes)	Hynds Product Code
-	A	B	C	D	E	F	t	x*	-	-	-	-
BSJ												
525	525	633	763	243	2600	2495	54	5	15	700	1.3	PC0525BSJC4M
600	600	715	845	243	2600	2495	57.5	5	15	820	1.3	PC0600BSJC4M
675	675	789	911	244	2600	2495	57	5	15	950	1.3	PC0675BSJC4M
750	750	872	997	248	2600	2495	61	5	15	1120	1.3	PC0750BSJC4M
825	825	955	1084	242	2600	2495	65	5	15	1300	1.3	PC0825BSJC4M
900	900	1056	1175	233	2600	2495	78	5	15	1630	2.5	PC0900BSJC4M
1050	1050	1202	1379	293	2606	2494	76	6	16	1950	2.5	PC1050BSJC4M
1200	1200	1372	1541	295	2606	2494	86	6	16	2460	2.5	PC1200BSJC4M
1350	1350	1530	1699	295	2606	2494	90	6	16	2880	2.5	PC1350BSJC4M
1500	1500	1740	1942	315	2617	2492	120	8	18	4300	5.0	PC1500BSJC4W
1650	1650	1900	2104	343	2617	2492	125	8	18	4770	5.0	PC1650BSJC4WSF
1800	1800	2070	2288	355	2617	2492	135	8	18	5600	5.0	PC1800BSJC4WSF
IWJ												
0700	700	1080	-	-	3072.7	2945	190	12	21	3870	5	PC070030JIC4M
0900	900	1280	-	-	3072.7	2945	190	12	21	4902	5	PC090030JIC4M
1950	1950	2350	-	-	2622	2484	200	16	23	8560	10	PC1950IWJC4W
2100	2100	2520	-	-	2623	2484	210	16	23	9660	10	PC2100IWJC4W
2300	2300	2630	-	-	2860	2720	165	20	28	12400	10	PC2300SRJC4W
2550	2550	3000	-	-	2624	2480	225	20	30	12634	10	PC2550IWJC4W
3000	*	*	*	*	*	*	*	*	*	*	*	*

Notes:

1. All diameters and lengths are in millimetres.

2. Effective length is the barrel length plus the nominal laying gap.

3. To match recommended joint deflection limits (refer to Table 3).

** Refer to figure 8*

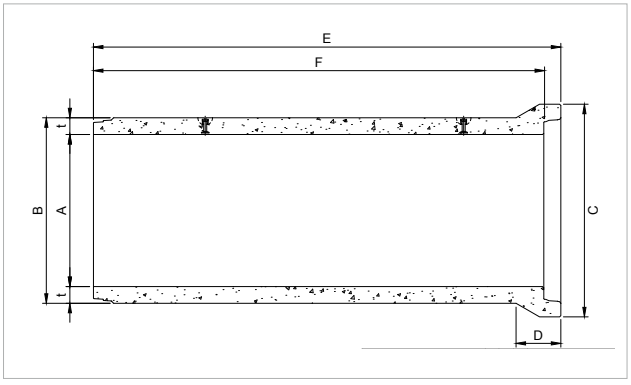


FIG. 5 BSJ Pipe Geometry

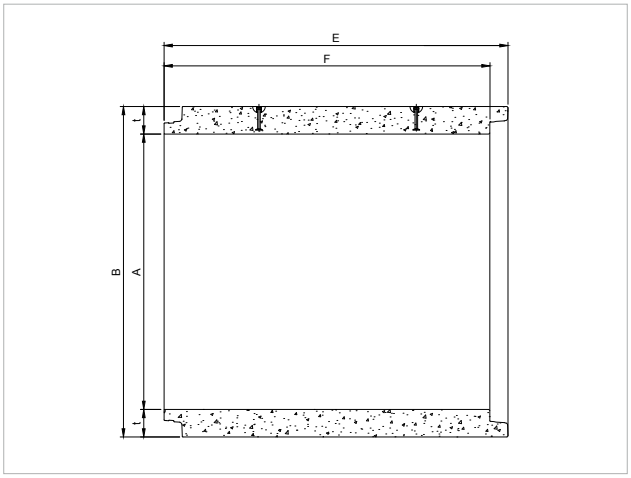


FIG. 6 IWJ Pipe Geometry

Joint Deflection

From time to time pipe joints need to be deflected to achieve a certain angle or to bring the pipeline back to line and grade. Before deflecting the pipe ensure the joint gap is kept at the nominal minimum joint gap.

Joint gaps between the pipes ensure that the pipes are able to deflect without damage. Nominal minimum joint gaps are detailed in Table 1 & 2 for each respective diameter and class.

All vertical and horizontal deflections should be within the recommended range. Refer to Table 3.

TABLE 3 Pinnacle® BSJ and IWJ Pipe Deflection Limits

Nominal Diameter	Recommended Working Limit			
	Nominal Minimum Joint Gap	**Deflection** (mm)	**Deflection** (Degrees)	**Centreline Radius** (m)
525 BSJ	5	48	1.1	131
600 BSJ	5	44	1	144
675 BSJ	5	34	0.8	180
750 BSJ	5	34	0.8	180
825 BSJ	5	30	0.7	205
900 BSJ	5	26	0.6	239
1050 BSJ	6	21	0.5	287
1200 BSJ	6	21	0.5	287
1350 BSJ	6	17	0.4	359
1500 BSJ	8	17	0.4	359
1650 BSJ	8	13	0.3	478
1800 BSJ	8	13	0.3	478
700 IWJ	12	0	0.7	246
900 IWJ	12	0	0.6	286
1950 IWJ	16	8	0.2	717
2100 IWJ	16	8	0.2	717
2300 SRJ	20	9	0.2	717
2550 IWJ	20	8	0.2	717
3000 SRJ	25	11	0.25	624

Notes:

1. Assuming that pipes are installed with the nominal laying gap given in Tables 1 and 2, the allowable deflections are determined by the amount of concrete to concrete overlap remaining after the tabulated offset. Refer to figures 5 and 6.

2. Offsets greater than those tabulated may be achieved with negative overlaps, but these will fall outside the design philosophy and joint performance cannot be guaranteed. In particular, radial shear protection is reduced.

The sealing performance of the pipe joint permits a flexible pipeline with hydraulic integrity.

There are a wide range of ever-changing ground conditions which, when combined with superimposed loads, can cause original pipeline alignment to alter significantly:

- Changes in the character of the bedding and compaction conditions may cause differential settlement and movement in any buried pipeline.
- Movement between pipes can also occur from traffic and construction loads, backfilling, marine conditions or inadequate bearing capacity.

To maintain the desired pipeline performance, the pipe joint utilises a pre-lubricated sliding rubber ring to provide the necessary flexure characteristics. This ring is capable of exerting a minimum of 150 kPa seal pressure.

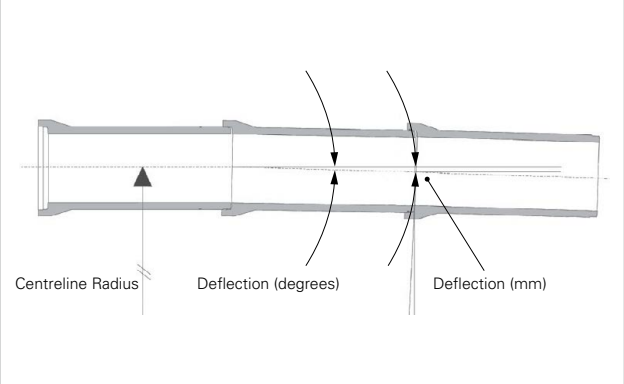


FIG. 7 Pinnacle® BSJ pipe joint flexure

The joint system has been designed to allow:

- Angular rotation of adjacent pipe lengths to accommodate axial deflection;
- Telescopic action of adjacent pipe lengths to accommodate a maximum axial movement (joint draw) of twice the nominal laying gap.
- Resistance against excessive radial shear which could lead to seal failure and possible root penetration.

For values of offset angles and deflections corresponding to each pipe size, refer to Table 3.

The recommended angular rotation of a pipe is the amount of joint deflection which is accommodated whilst maintaining concrete to concrete overlap "Y" (refer to Figure 8).

The maximum angular rotation of a pipe is the amount of joint deflection when the concrete to concrete overlap is approximately zero.

These deflection conditions assume that each individual pipe is jointed with the minimum nominal joint gap and then deflected by the tabulated amount detailed in Table 3.

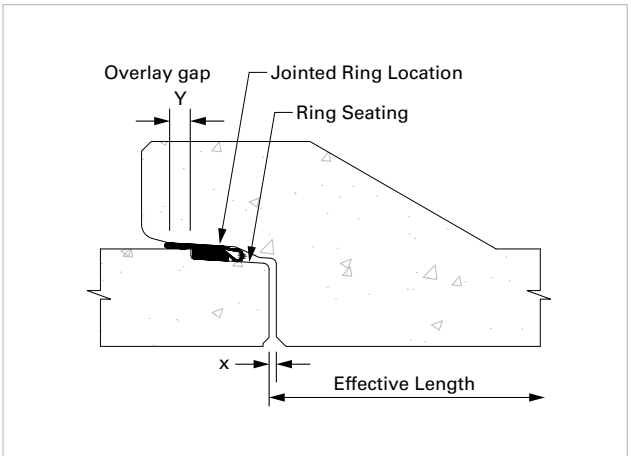


FIG. 8 Section through Pinnacle® sliding ring joint. Non-flexure condition.

Pre-lubricated Sliding Rubber Ring

Both the BSJ and IWJ joint profiles in our Pinnacle® Concrete Pipe range use the Forsheda 146 Pre-Lubricated Sliding Rubber Ring. The ring is fitted to the spigot of the pipe. No joint lubricant is required as the lubricant is enclosed in the sliding mantle of the ring. This results in a cleaner joint and also less force required when jointing, as there is no friction between the rubber ring and concrete.

The joint is designed so that the pre-lubricated mantle rolls onto the top of the spigot shoulder and into the small gap between spigot and socket during installation. This prevents concrete to concrete contact and provides efficient distribution of transverse shear loads across the joint.

The design optimises joint performance to provide:

- an exceptionally high level of operational reliability,
- a large contact area between the rubber ring and concrete surface which provides better watertightness,
- easier and quicker jointing due to less force required to push the pipe home

Forsheda 146 seals are manufactured to BS EN 681-1 & BS EN 681-2 European Standards for "Elastomeric Seals – Material requirements for pipe, joint seals used in water and drainage applications".

Forsheda 146 seals also carry Kitemark and CE certificates.

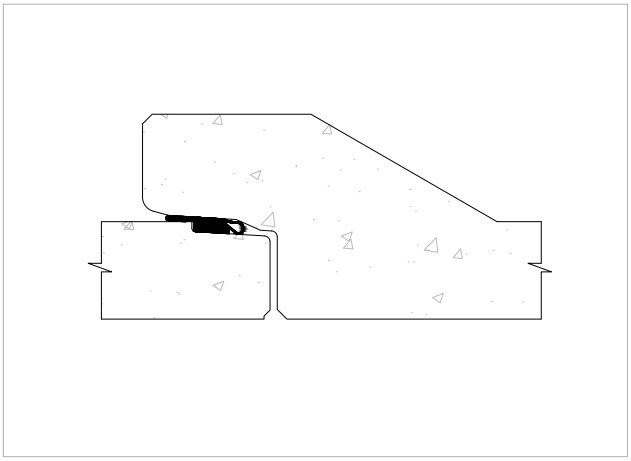


FIG. 9 Joint Profile

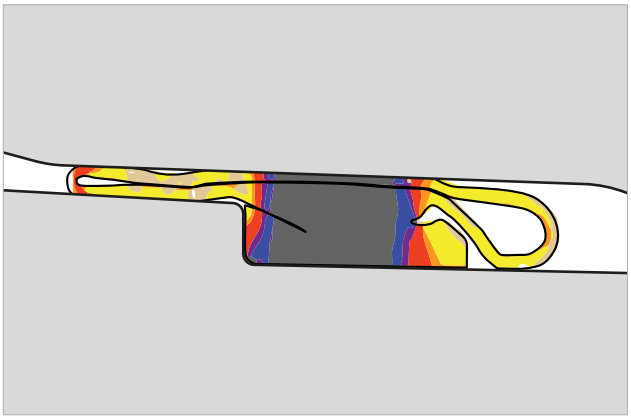


FIG. 10 Joint Profile representing stresses applied to the rubber ring.

TABLE 4 F-146 Ring and Skid Ring Dimensions

Nominal Pipe Diameter	Unstretched Seal Internal Diameter (mm)	Uncompressed Seal Height (mm)	Hynds F-146 Seal Code	Skid Rubber Ring	Description
525	525	18.5	RS0525		Ring Rubber Ø525 for BSJ Concrete Pipe EPDM
600	600	18.5	RS0600		Ring Rubber Ø600 for BSJ Concrete Pipe EPDM
675	675	18.5	RS0675		Ring Rubber Ø675 for BSJ Concrete Pipe EPDM
750	730	18.5	RS0750		Ring Rubber Ø750 for BSJ Concrete Pipe EPDM
825	800	18.5	RS0825		Ring Rubber Ø825 for BSJ Concrete Pipe EPDM
900	901	18.5	RS0900		Ring Rubber Ø900 for BSJ Concrete Pipe EPDM
1050	1028	20.0	RS1050		Ring Rubber Ø1050 for BSJ Concrete Pipe EPDM
1200	1195	20.0	RS1200		Ring Rubber Ø1200 for BSJ Concrete Pipe EPDM
1350	1300	20.0	RS1350		Ring Rubber Ø1350 for BSJ Concrete Pipe EPDM
1500	1515	24.5	RS1500		Ring Rubber Ø1500 for BSJ Concrete Pipe EPDM
1650	1600	24.5	RS1650		Ring Rubber Ø1650 for BSJ Concrete Pipe EPDM
1800	1745	24.5	RS1800		Ring Rubber Ø1800 for BSJ Concrete Pipe EPDM
700	770	20	RS0700IWJ		Rubber Ring Ø700mm for IWJ Concrete Pipe EPDM
900	945	20	RS0900IWJ		Rubber Ring Ø900mm for IWJ Concrete Pipe EPDM
1950	1835	24.5	RS1950IWJ		Ring Rubber Ø1950 for IWJ Concrete Pipe EPDM
2100	2100	24.5	RS2100IWJ		Ring Rubber Ø2100 for IWJ Concrete Pipe EPDM
2300	-	-		R2300SKIDF	Skid Ring Rubber Ø2300 F In-Wall
2550	2355	28.0	RS2550IWJSBR		Ring Rubber Ø2550 for IWJ Concrete Pipe SBR
3000	-	-		R3000SKIDJ	Skid Ring Rubber Ø3000 J In-Wall

Notes:

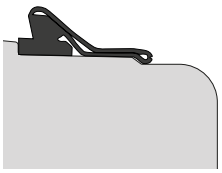
1. For identification of a Hynds pre-lubricated rubber ring refer to the Unstretched Seal Internal Diameter (mm) and Uncompressed Seal Height.

2. The same size of rubber ring is used for both Class 2 and Class 4 Pinnacle® pipes.

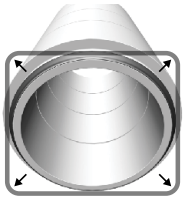
3. Skid rubber rings are used for 2300 and 3000mm diameter Pinnacle® pipes. For more information refer to Technical Guide D1.4 Hynds Skid Ring Joint. These require lubrication to be applied to the collar surface of the joint.

Joint Assembly

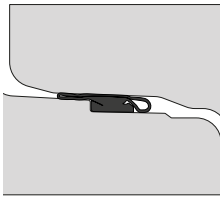
1. Stretch the seal onto the spigot and position against the shoulder.



2. Equalize the stress in the seal by lifting and releasing at a few points. The seal must sit evenly against the spigot shoulder all around the joint. Lubrication of the socket or spigot is not required.



3. Centre the joint and assemble. The position of the seal in the final joint is shown in the figure. If re-jointing is required ensure the sliding skin is drawn back to the position as shown in step 1.



Storage of Pipe

- Some pipes have elliptical steel reinforcing cages. These pipes are marked with the word "TOP" adjacent to the lifting anchors. All pipes marked with "TOP" must be transported and stored with this marking in the 12 o'clock position.
- Pipes larger than 2100mm diameter should not be stored horizontally for more than 7-10 days. If pipes are to be stored longer than this period then they must be stored vertically. Care needs to be taken while rotating the pipe from the vertical positon to not damage the ends of the pipe. For more info refer to Delivery Guideline Standard Large Diameter Precast Concrete Pipe DN2100 – 3000.
- When storing pipes horizontally ensure pipes are adequately supported to prevent point loading, particular care needs to be taken with BSJ pipes.
- Single layer stacking is recommended, however where pipes are required to be stored in layers it is recommended to have dunnage in between the layers to prevent concrete to concrete contact.

Storage of Rubber Rings

- The storage temperature should be below 25°C and preferably below 15°C.
- The seals should be protected from light, in particular, strong sunlight and artificial light with a high ultra-violet content.
- The seals should not be stored in a room with any equipment capable of generating ozone, eg. mercury vapour lamps, high voltage electrical equipment, which may give rise to electrical sparks or silent electrical discharges.
- The seals should be stored in a relaxed condition free from tension, compression or other deformation. For instance, they should not be suspended from any part of the circumference.
- The seals should be maintained in a clean condition.

Lifting & Handling

All Pinnacle® pipes feature certified concrete lifting anchor systems, designed and tested to guarantee safe and secure handling.

Hynds Pipe Systems has designed and manufactured Pinnacle® Concrete Pipes with a minimum dynamic factor of 1.2. This dynamic factor requires that all the following conditions are observed when lifting, moving or placing the pipes:

1. Lifting with mobile plant *(such as an excavator or similar)* where equipment is specifically exempt from the requirements of the PECPR Regulations 1999, subject to the conditions outlined in the New Zealand Gazette, No. 104, September 2015 and
2. Lifting, travelling and placing over rough or uneven ground where anchor failure is not anticipated to cause harm or injury, by adopting procedures such as:
   a. Transporting the element as close as practical to ground level (300mm recommended.)
   b. Establishing and maintaining exclusion zones
   c. Transporting only precast concrete elements that are unlikely to topple if they were to hit the ground
   d. Inspecting lifting anchors both after transportation and before final lifting into place
3. All Hynds concrete lifting anchor systems are engineered in accordance with Haeussler specifications, ensuring full compatibility with Reid, Deha, CLS, and Ancon lifting clutches, as well as recess formers, across corresponding load ranges.

Refer to "Safe work with precast concrete - Handling, transportation and erection of precast concrete elements" published by Worksafe New Zealand (October 2018).

Shock loads resulting from travelling with suspended pipes over rough terrain and uneven ground may exceed design, dynamic and safety factors of the lifting systems. It is essential that care is taken during lifting and transporting as additional stresses could result in anchor failure.

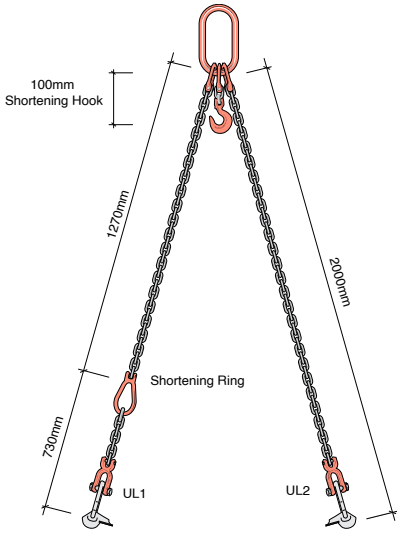
Correct on Site Handling & Jointing of Pipes

FOR 2.5M LONG PIPES ONLY. Chain lengths for 3m long pipe will be different

The Sling

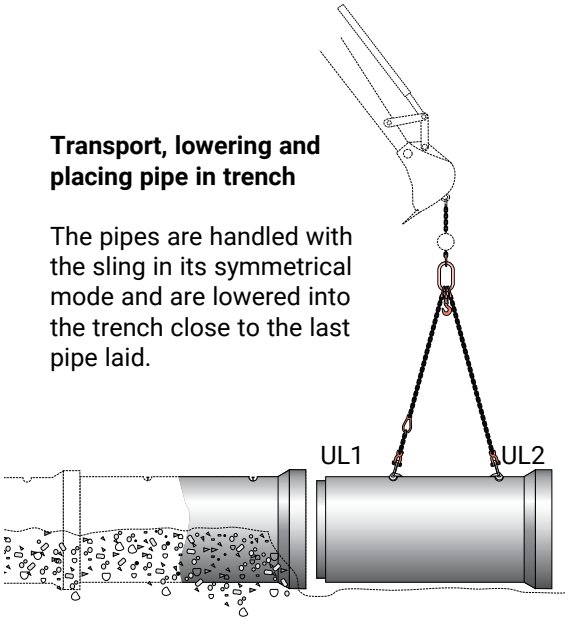
The sling is made up as a two-legged chain sling with two lifting clutches and a shortening hook to enable one chain leg to be shortened.

Please consult the *Hynds Precast Safe Lifting Guide* for safe handling technique.



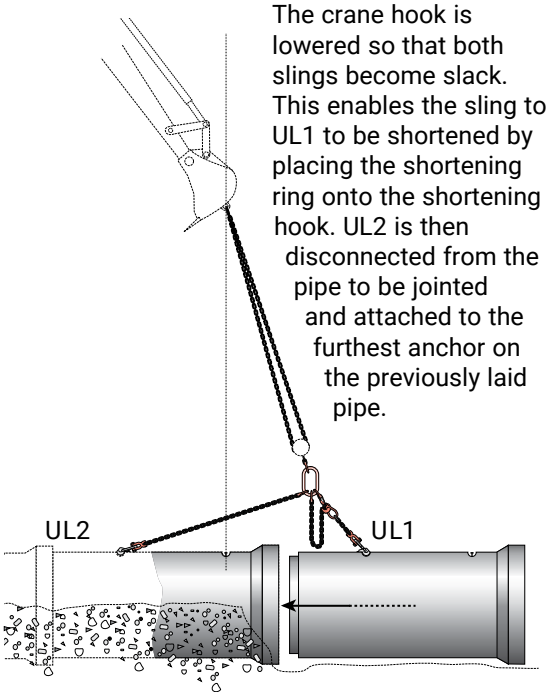
Transport, lowering and placing pipe in trench

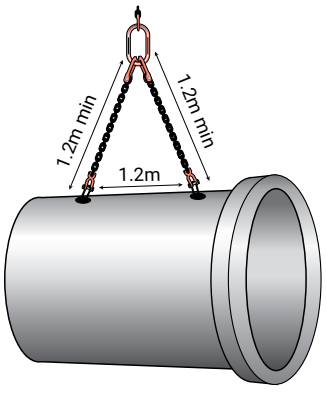
The pipes are handled with the sling in its symmetrical mode and are lowered into the trench close to the last pipe laid.



Jointing the pipes

The crane hook is lowered so that both slings become slack. This enables the sling to UL1 to be shortened by placing the shortening ring onto the shortening hook. UL2 is then disconnected from the pipe to be jointed and attached to the furthest anchor on the previously laid pipe.



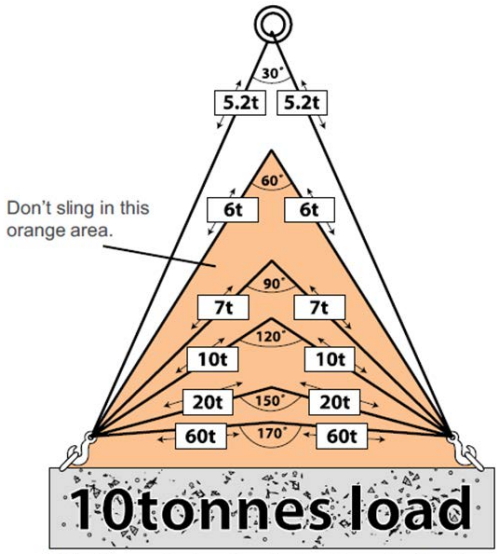


Never make chain length shorter than the distance between two anchors.

Effective Rigging and Sling Angles

The larger the sling angle the higher the load on the chains. For example at an included angle of 170° the load on each sling is six times the weight of the actual load being lifted. Do not put more than the recommended safe working load on equipment. Pinnacle® concrete pipes are fitted with lifting anchor inserts, thus providing safe lifting when slung in the correct manner. However, care still needs to be taken when lifting the Hynds concrete pipes, especially over uneven surfaces as shock loading may exceed the designed safety factor.

Please note: An insert with a nominal clutch size rating stamped on the head does not necessarily have the same safe working load limit because of the various insert lengths available.



Note: Always aim to make sling length greater than the distance between two anchors.

Pipe Installation

AS/NZS 3725:2007 Design for installation of buried concrete pipes defines pipe installation options and procedures for determining the class of pipe required."PipeClass" is a software package that enables the designer to design a pipeline installation for AS/NZS 3725:2007. This is available free of charge from the Concrete Pipe Association of Australasia (CPAA).

Concrete pipe is generally installed following the steps below:

1. Excavate trench and remove backfill
2. Prepare bed zone
3. Dig recess out of the bed zone for the socket
4. Carefully lift the pipe and apply the rubber ring
5. Carefully place pipe in trench
6. Align the pipe
7. Push the pipe home
8. Place fill into haunch zone
9. Compact fill evenly on each side

More information on installation can be found on the CPAA (Concrete Pipe Association) website under Resources www.cpaa.asn.au

The CPAA provide Installer Training for Laying Concrete Pipe. For training dates and locations please contact your local Hynds Pipe Systems Branch.

Also see

Disclaimer: While every effort has been made to ensure that the information in this document is correct and accurate, users of Hynds product or information within this document must make their own assessment of suitability for their particular application. Product dimensions are nominal only, and should be verified if critical to a particular installation. No warranty is either expressed, implied, or statutory made by Hynds unless expressly stated in any sale and purchase agreement entered into between Hynds and the user.