

# Hyforce® Concrete Jacking Pipe System

Technical Guide D1.18

The Hyforce® concrete jacking pipe range is designed for easy installation across a wide range of trenchless applications. These include Micro Tunnelling and Pipe Jacking.



03.23 | DRAINAGE | D1.18 HYFORCE CONCRETE JACKING PIPE SYSTEM

## Applications

Gravity Stormwater pipelines  
 Gravity Sewer pipelines  
 Gravity Sewer pipelines – HDPE Lined  
 Road and rail culverts  
 Carrier pipes  
 Bespoke Low Pressure pipelines

## Approvals/Standards

Jacking Pipes are designed and manufactured to AS/NZS 4058 and,  
 CPAA Engineering Guideline – Manufacturing Precast Concrete Jacking Pipe and,  
 CPAA Pipe Jacking – Design Guidelines  
 Elastomeric Seal Rings are manufactured in accordance with EN 681-1

## Quality

ISO 9001 Quality Management Standard

*We are the supply partner of choice for New Zealand's civil construction industry, specialising in water and infrastructure based solutions.*

Hynds is the leading manufacturer of steel reinforced concrete jacking pipes in New Zealand. The comprehensive world-class jacking pipeline system is ideally suited for use with traditional pipe jacking and micro-tunnelling, and, guided auger boring.

The pipe diameters cover a range from DN700 through to DN3000, these are available Butt (BJ) or In-Wall (IWJ) joint options, typically Class 4 strength.

Steel Reinforced Concrete Jacking Pipes (SRCJP) are designed for load requirements, and longitudinal forces arising from the jacking process.

Hyforce® Concrete Jacking Pipes are manufactured to AS/ NZS 4058: 2007 – Precast Concrete Pipes (Pressure and Non-pressure).

### Benefits and Features

- Specially designed to sustain high axial jacking forces.
- Tight dimensional tolerances.
- Available in pipe-lengths up to 3m nominal length (to minimise the number of joints required).
- Smooth concrete surface internally and externally.
- HDPE lining option available for aggressive sewer and industrial trade waste applications.



**FIG. 1** 2100mm diameter Hyforce® Concrete Jacking Pipes complete with 316 Stainless Steel fixed collars



**FIG. 2** Typical example of Micro Tunnelling operation illustrating launch shaft, hydraulic jack, concrete jacking pipes, tunnel boring machine (TBM) and retrieval shaft.



## Pipe Jacking and Micro Tunnelling

Micro tunnelling and pipe jacking are methods of tunnel construction that are used to thrust the jacking pipes through the ground behind a shield or Tunnel Boring Machine (TBM), from a launch shaft to a retrieval shaft. The term Micro Tunnelling is often used to describe non man entry pipe installation.



FIG. 3 Typical Hydraulic Jack and Concrete Jacking Pipe being installed.

## Pipe Joints

The HYFORCE® range of Concrete Jacking Pipes are available with two joint profiles:

1. Butt Joint (BJ) – Robust, flexible water-tight joint incorporating a cast-in 316 Stainless Steel collar and single wide jacking face. This joint is suitable for large radii curved alignments.

**Note:** Our standard Hyforce™ fixed collar range utilizes grade 316 Stainless Steel. Please contact your Hynds representative to discuss alternative material types.

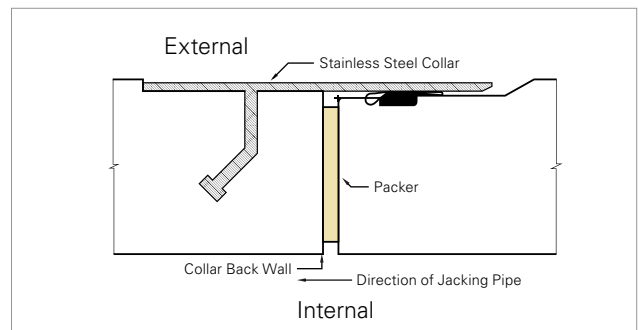


FIG. 4 Butt Joint (BJ)

2. In-Wall Joint (IWJ) – Flexible water-tight joint with concrete collar and two narrow jacking faces. This joint is an economic option for short and/or straight alignments

**Note:** Only available where the jacking pipe wall thickness is sufficient to form a concrete collar within the OD of the pipe. (Refer to Table 1 for details)

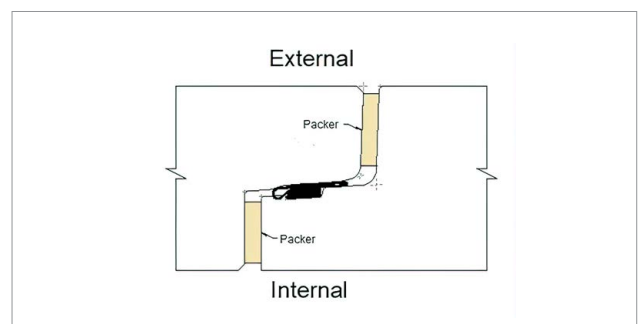


FIG. 5 In-Wall Joint (IWJ)

## Elastomeric Seal

Both the BJ and IWJ joint profiles use the Forsheda® pre-lubricated sliding rubber ring fitted to the spigot end of the pipe.

The pre-lubricated ring does not require joint lubricant, avoiding the need for on-site lubricant application.



FIG. 6 Installation, fitting and pretensioning of seal rings prior to install.

### Joint Packers

- Usually made of Strandboard or Medium Density Fibreboard (MDF).
- Joint packers are required to ensure even load transfer across the joint face to accommodate small variances in the concrete faces.
- Recommended packer thicknesses are given in Table 1.
- Packers are usually fixed on site by the Contractor to the spigot and collar backwalls prior to installation.

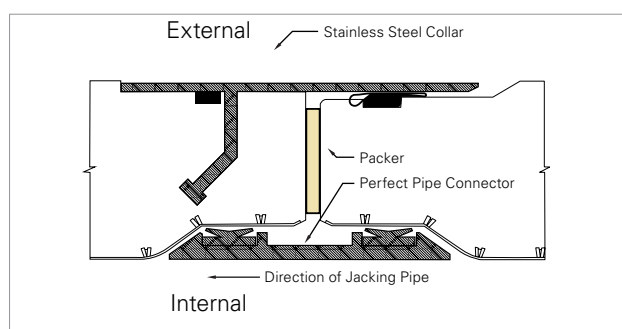


**FIG. 7** Showing fixing of MDF packers prior to PERFECT® HDPE lined pipes being installed at Haytons Road Trunk Sewer project, Christchurch.

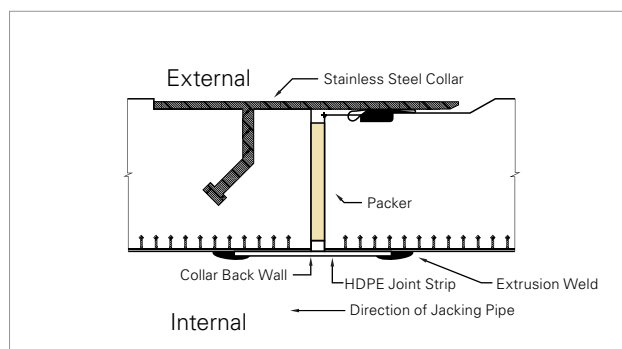
### Linings

The Hyforce® range is available with HDPE linings to suit waste water and aggressive industrial trade waste pipelines.

- The Perfect® lining system is generally available from 700 to 1200mmØ. This system includes a proprietary connector eliminating the need for on site HDPE joint welding.
- The Hyliner HDPE liner is available for 1200 to 3000mm Ø range.
- The HDPE liners are resistant to biogenic and chemical acid attack as well as providing higher abrasion resistance.



**FIG. 8** Illustrating BJ, SS collar, Stirrups, timber packer, Perfect® HDPE liner and Perfect® internal joint connector



**FIG. 9** Illustrating BJ, SS Collar, Stirrups, timber packer, Perfect® HDPE Liner and HDPE internal joint-strap completed post installation.

### Design

#### Structural Load and Pipe Classes

Hyforce® Jacking Pipes are available in standard Class 4 strength. Other classes are available to suit specific project requirements.

#### Permissible Jacking Loads

Permissible jacking loads are calculated based on the Concrete Pipe Association of Australasia (CPAA) publication, Pipe Jacking – Design Guidelines document.

The allowable jacking loads and deflections are a function of the pipe diameter, wall thickness, joint type and packer thickness. Refer to Table 2 for permissible jacking loads and joint deflections.

The packer in the joint is designed to spread the load onto the concrete faces of the jacking pipe. This is usually Strandboard or Medium Density Fibreboard (MDF). Materials with a high Poisson's ratio such as rubber or plastics are not suitable as they are likely to cause spalling of the joint edges.

Hyforce® Jacking Pipe joints are generally designed to accommodate a maximum joint deflection of 0.5° whilst remaining watertight. Refer to Table 2.

**Note:** Timber packers sold separately

## Intermediate Jacking Pipes

Leading and Trailing intermediate jacking pipes are available upon request. These are often bespoke designs to suit the Contractor's equipment and other on-site requirements. Contact your Hynds representative to discuss specific requirements for Interjack Can and, Leading and Trailing pipe design.



**FIG. 10** Typical interjack station illustrating Hydraulic Jacks and Steel CAN

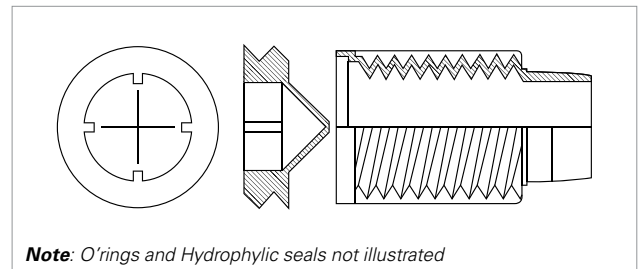
## Lubricating and Grout Ports

Lubricating and grout ports can be cast in to the pipes during manufacture to suit the Contractor's requirements. The following should be nominated:

- Quantity
- Location
- Orientation

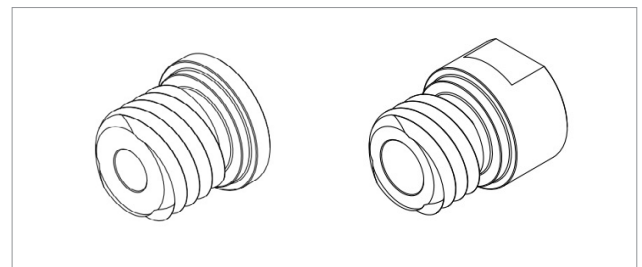
Typical lubricating/grout ports consist of a socket, non-return valve and sealing cap. Refer to Figure 11.

Grout port connectors are also available to suit Contractor lubrication system threaded and connections available. Refer to Figure 12.



**Note:** O-rings and Hydrophylic seals not illustrated

**FIG. 11** Lubricating/grout port



**FIG. 12** Grout port connectors



**FIG. 13** Image showing grout port connections and drilling fluid pipes and other services.

TABLE 1 Hyforce® Jacking Pipe Product Range and Geometry

| Size         | Joint Type | Liner Type<br>(if applicable) | Diameters of Pipes |                   |                     | Mass                  |                     | Product Codes   |                       |                            |
|--------------|------------|-------------------------------|--------------------|-------------------|---------------------|-----------------------|---------------------|-----------------|-----------------------|----------------------------|
| Dia.<br>(mm) |            |                               | Internal Dia. (mm) | Outside Dia. (mm) | Wall Thickness (mm) | Effective Length (mm) | Overall Length (mm) | Weight (Tonnes) | Packer Thickness (mm) | Pipe Seal ring             |
| 700          | IWJ        | -                             | 700                | 1080              | 190                 | 2500                  | 2616                | 3.38            | 12                    | PC070025JIC4M RS0700IWJ    |
| 700          | IWJ        | Perfect®                      | 700                | 1080              | 190                 | 2957                  | 3073                | 3.95            | 12                    | PC070030JIC4LM RS0700IWJ   |
| 900          | IWJ        | -                             | 900                | 1280              | 190                 | 2500                  | 2616                | 4.13            | 12                    | PC090025JIC4M RS0900IWJ    |
| 900          | IWJ        | Perfect®                      | 900                | 1280              | 190                 | 2957                  | 3073                | 4.83            | 12                    | PC090030JIC4LM RS0900IWJ   |
| 1000         | BJ         | -                             | 1000               | 1280              | 140                 | 2750                  | 2878                | 3.60            | 12                    | PC100027JBC4M RS1000BJ     |
| 1000         | BJ         | Perfect®                      | 1000               | 1280              | 140                 | 2952                  | 3080                | 3.90            | 12                    | PC100030JBC4LM RS1000BJ    |
| 1200         | BJ         | -                             | 1200               | 1490              | 145                 | 2500                  | 2628                | 3.95            | 12                    | PC120025JBC4M RS1200BJ     |
| 1200         | BJ         | Perfect®                      | 1200               | 1490              | 145                 | 2952                  | 3080                | 4.80            | 12                    | PC120030JBC4LM RS1200BJ    |
| 1500*        | BJ         | HDPE                          | 1500               | 1820              | 160                 | 2952                  | 3080                | 6.5             | 12                    | PC150030JBC4W RS1500BJ     |
| 1950         | IWJ        | HDPE                          | 1950               | 2350              | 200                 | 2500                  | 2622                | 8.59            | 16                    | PC195025JIC4W RS1950IWJ    |
| 2100         | IWJ        | HDPE                          | 2100               | 2520              | 210                 | 2500                  | 2623                | 9.70            | 16                    | PC210025JIC4W RS2100IWJ    |
| 2100         | BJ         | HDPE                          | 2100               | 2525              | 212.5               | 2925                  | 3090                | 11.80           | 25                    | PC210030JBC4W RS2100BJ     |
| 2400         | BJ         | HDPE                          | 2400               | 2805              | 202.5               | 2925                  | 3090                | 12.80           | 25                    | PC240030JBC3W RS2400BJ     |
| 2550         | IWJ        | HDPE                          | 2550               | 3000              | 225                 | 2968                  | 3092                | 14.93           | 20                    | PC255030JIC4W RS2550IWJ    |
| 2550*        | BJ         | HDPE                          | 2550               | 3000              | 225                 | 2925                  | 3090                | 15.23           | 25                    | PC255030JBC4W RS2550BJ     |
| 3000         | IWJ        | HDPE                          | 3000               | 3520              | 260                 | 2720                  | 2850                | 18.50           | 25                    | 3000JACZSRJHYS R3000SKIDBB |

\* **Note:** Subject to detailed design at time of mould purchase/modification

TABLE 2 Allowable Jacking Force and Deflection Guide

| Internal Dia.<br>(mm) | Liner Type | Outside Dia. (mm) | Wall Thickness (mm) | Jacking Force Capacity (Tonnes) |       |      |
|-----------------------|------------|-------------------|---------------------|---------------------------------|-------|------|
|                       |            |                   |                     | 0°                              | 0.25° | 0.5° |
| 700                   | -          | 1080              | 190                 | 251                             | 251   | 209  |
| 700                   | Perfect®   | 1080              | 190                 | 200                             | 200   | 175  |
| 900                   | -          | 1280              | 190                 | 316                             | 316   | 230  |
| 900                   | Perfect®   | 1280              | 190                 | 270                             | 270   | 192  |
| 1000                  | -          | 1280              | 140                 | 425                             | 425   | 331  |
| 1000                  | Perfect®   | 1280              | 140                 | 342                             | 342   | 246  |
| 1200                  | -          | 1490              | 145                 | 562                             | 562   | 388  |
| 1200                  | Perfect®   | 1490              | 145                 | 444                             | 444   | 306  |
| 1500                  | HDPE       | 1820              | 160                 | 756                             | 756   | 492  |
| 1950                  | HDPE       | 2350              | 200                 | 693                             | 610   | 395  |
| 2100                  | HDPE       | 2520              | 210                 | 788                             | 654   | 431  |
| 2100                  | HDPE       | 2525              | 212.5               | 1388                            | 1388  | 944  |
| 2400                  | HDPE       | 2805              | 202.5               | 1534                            | 1534  | 989  |
| 2550                  | HDPE       | 3000              | 225                 | 1029                            | 875   | 581  |
| 3000                  | HDPE       | 3520              | 260                 | 1550                            | 1150  |      |

**Notes:** Pipes with higher thrust force capacity are available upon request (\*) Maximum recommended deflection to ensure joint seal is 0.5° in final alignment. Working deflection range is expected between 0° and 0.25°.



## Delivery and Site Handling

Hyforce® Jacking Pipes are delivered to site on flat-bed trucks for offloading and handling using two swiftlifts placed at 12 o'clock on the pipe barrel. The correct lifting clutches must be used for off-loading and handling at all times.

Hyforce® Jacking Pipe Swiftlifts are designed and manufactured 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 are fitted with Swiftlifts for safe handling into the jacking pit and must be used with the correct lifting clutch.  
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.

Options for additional swiftlifts for site specific off-loading and handling on site are available subject to discussion with the manufacturer at the time of tender and/or confirmation of order.

## Storage

Pipe products should be stockpiled on a flat and level base with adequate support to prevent shifting.

Single layer stacking is recommended.

Pipes stored horizontally must be positioned to allow ground clearance at the socket end of the pipe to avoid collar damage.

All pipes must be transported and stored with Swiftlifts™ in the 12 o'clock position.

Internal bracing maybe required for large diameter pipes stored horizontally for extended periods.

The pre-lubricated Forsheda® elastomeric seal rings must be stored flat (not hung) to ensure that the lubricant in the mantle does not drain to a single point of the seal and stored in a cool dry place away from oil, grease, dirt and direct sunlight.



FIG. 14 Typical storage of pipes on dunnage on site.

## Field Watertightness Testing

Field watertightness testing requirements should be specified and agreed at the time of order.

In the absence of any other specification refer to the Concrete Pipe Association of Australia (CPAA) publication, Performance Testing of Installed Non-Pressure Rubber Ring Jointed Concrete Stormwater Pipelines – Engineering Guidelines.

**Branches Nationwide Support Office & Technical Services 0800 93 7473**

**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.

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