

Installation Guide for Precast Concrete Culverts

PD90 Rev D



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1.0 Scope of guide

Under normal conditions this technical guide gives basic guidance on the installation of precast concrete box culverts and AquaCulvert supplied by Stanton Bonna. When circumstances vary, for example varying ground conditions and vehicle loadings, supplementary instructions may be required.

Please note: this document is not a comprehensive guide to box culvert/AquaCulvert installation and it is expected that the work is executed under the control of suitably qualified and experienced personnel.

For the purposes of this document box culvert and AquaCulvert will be termed as 'culvert' or 'culverts'.

Box culverts are manufactured according to the design specification data provided by the customer. In the absence of customer data 'default' data will be used.

2.0 Receipt of goods

On receipt the delivery should be checked to ensure that :

- Delivery note corresponds to the goods on the consignment.
- Product is free from damage especially the corners (no spalling near gasket).
- Positioning of the gasket on the spigot is correct with no gaps.
- Lubricant material, if ordered, is supplied in a sealed container.
- Offloading and handling equipment is available, including clutches.

Once you are confident with the above then sign the delivery note.

Any defects should be noted on the delivery note.

Reminder: Signature of the delivery note means acceptance of the delivered products.



3.0 Handling and Storage of Product

Unloading, handling and storage on site must be undertaken carefully in order to avoid damage to product while ensuring the safety of workers. Particular care should be taken to avoid impact damage to the corner edge and gasket face of units.

Please ensure the crane or excavator being used to off load has the capacity to lift the culverts off the lorry at the desired reach, in certain situations a lift plan may be required.

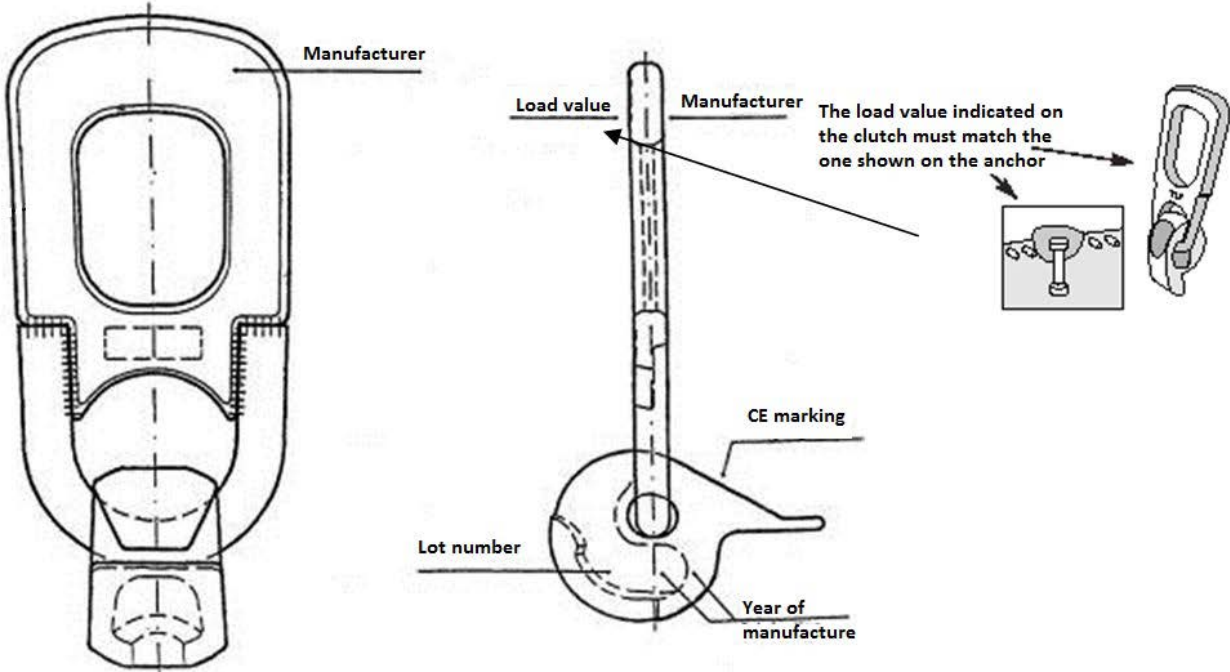
3.1 Handling

Culverts are fitted with cast-in lifting anchors to be used with matching company lifting clutches. Before any use, the contractor shall:

- Ensure that the lifting clutches are the correct size and type for the product and from the same manufacturer. (The value of the load indicated and the manufacturers brand on the clutch must match the ones shown on the anchor).
- Ensure the lifting clutches and anchors are fit for purpose and not damaged or defective.
- Verify that the lifting clutches are accompanied by the CE mark certificate from the manufacturer.

Please Note: The anchors and clutches are designed for handling only a single unit precast concrete culvert and no additional products added to the load.

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3.2 Attaching clutch

Engage sphere head with anchor pin and turn tongue until flat to concrete face. Ensure that clutch coupler is pointed in same direction as the tongue (towards the middle of the culvert) to ensure the clutch does not accidentally unengaged.



	Engage	Lift	Release
Anchors on top of the culvert			
Anchors on the side of the culvert			

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3.3 Lifting

Ensure that the crane hoist is centrally placed between the two anchors to lift the culvert. Ensure the angle between a chain and the vertical does not exceed 30°. Lifting should be carried out slowly and steadily, avoiding all shocks and impacts.



DO NOT :

- Drive crane over rough terrain with culvert suspended.
- Lift culvert without using all the anchors.
- Use lifting anchors for any other purposes than what they were designed for eg. jointing .
- Use the lifting anchors to lift a product from frozen or boggy ground.
- Break concrete around the anchors to expand the recess.
- Weld or change the anchor or the lifting clutch for any reason whatsoever.
- Walk under a suspended culvert.
- Loop chain at the end or through the culvert.
- Offload using a hook as this is extremely dangerous and will damage the culvert.

3.4 Storage

It is the installing company's responsibility to ensure product quality is maintained during offloading and storage. Particular care must be taken with ends and gasket faces.

The storage area must be flat, stable, clean and free from rubble. Products must be positioned with care on top of suitable wooden beams (eg. 75x75mm). Maintain adequate space between products and do not store against solid structures such as fences or walls in order to avoid damage.

Do not store the box culverts directly on top of mud. A large suction force (which might be increased when freezing) may be generated. This could also overload the anchors or/and the lifting chains.



If the construction site is small, stacking is possible in a maximum of 2 layers, separated by 2 parallel wooden beams positioned one fifth of the total length from each end of the culvert. See photo above.

4.0 Excavation and formation

While laying in trenches the contractor must ensure the bottom trench width is as per design specification.

If particular site conditions require larger trench widths, the contractor must take the advice from the designer and the manufacturer as this will influence loads acting on the structure.

The contractor shall, with the approval of the designer, organise site removal of water (rainwater, ground water seepage, spring water, water from leaking pipes etc.)

4.1 Formation

It is essential to ensure uniform support of the culvert. Hard or soft spots in the formation should be removed and replaced with bedding or selected backfill material.

Prepare trench to the required depth to suit ground conditions and loading, as per design requirements.



4.2 Bedding Material

Box culverts may be laid on:

- a properly designed bed that could consist of compacted MOT1 type material. This would have to be screed with a blind of sand (10 to 15mm) or a dry mix of sand and cement (50mm).
- concrete, adding a layer of mixed sand and dry cement, especially for large dimension culverts.

If the ground is suitable (this will be the responsibility of the trench designer) culverts could be laid directly on to compacted soil, again using a blind of dry sand and cement.

NEVER lay box culverts directly on concrete.

The bedding layer of mixed sand and dry cement (cement proportion 200kg/m³) should be 50mm thick and flattened to an even thickness. Bed width should be approximately 500mm wider than the culvert.

Similar techniques that are used for laying block paving can be adopted for ensuring a flat and smooth finish to the sand/ sand cement mix eg. guide rails and a straight edge.

Warning: The bedding must be perfectly flat, compacted and free from protrusions. If there is a risk of migration from the surrounding soil into the backfill, wrapping the bedding in a geosynthetic material will be necessary.

Remember the bedding is likely to sink due to the weight and movement of the culvert whilst jointing. This can be accommodated by ensuring the bedding is slightly higher than required.



5.0 Installation of the culverts

Lifting is undertaken with the use of the cast-in lifting anchors and clutches. Details provided in 'Handling and storage of product' section.

Culverts shall be installed from downstream to upstream and the spigot end shall always be inserted in the socket end of the preceding culvert, this determines the orientation of the first culvert.

5.1 Preparation of the ends

If appropriate, clean and dry the inside of the socket.

The spigot end must also be free of any contamination or snags before insertion.

Wearing protective gloves, apply lubricant directly by hand:

- around the gasket and along the spigot end.
- around and along the socket end.

Once lubricant is applied, place the application gloves in a clean safe place to avoid contamination of grit and dirt.

DO NOT use a brush for applying lubricant. The use of a glove enables feeling of small stones while ensuring the cleanliness of ends.



5.2 Jointing of culverts

Before pulling or pushing culverts together ensure that on the sand and dry concrete bedding, a channel across the front of each culvert (100 mm wide and 20 mm deep) is created to avoid material being trapped in the socket. See image opposite.

During installation a crane is used only to relieve weight of the culvert.

5.2.1 Jointing with a hydraulic or manual puller

Equipment required:

Hydraulic puller eg. TIRFOR with minimum capacity 5 tonne (two TIRFOR may be required for larger culverts).

Three main methods can be used to anchor ends of the jointing tackle:

1. Suitable beams of either wood or a wooden faced steel section eg RSJ placed across both ends of the culvert see image opposite. This option is limited by the length of cable available.
2. Use a dead-man inside the first pipe (see image below) to anchor the puller. This can be repositioned when the puller cable is too short to join the next pipe. A contact area of about 300x300mm is recommended so as to spread the load created by the jointing forces.
3. By using a culvert puller. These usually anchor themselves in to one of the culverts and are hydraulically operated. They can be moved up the pipeline as necessary and work similar option 2.

A weight may need positioning on top of the first box culvert so that it does not move during pulling/pushing.

Using the hydraulic puller, pull the units together until the spigot end contacts the socket end and there is compression in the joint. Make sure the ends stay free of debris and bedding during this operation.

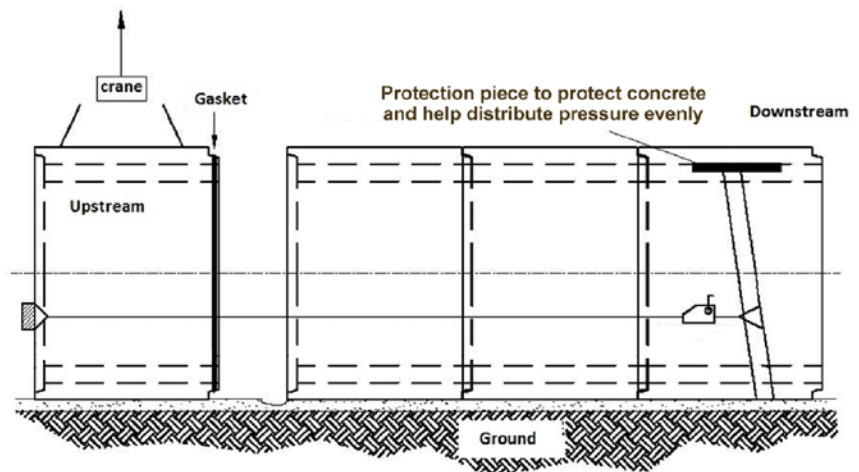
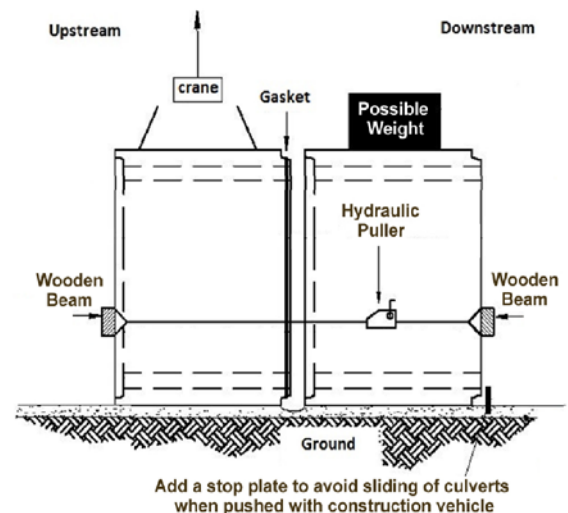
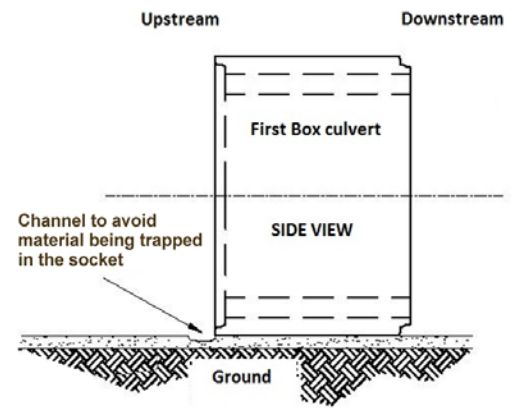
Once the required joint gap is achieved, keep the jointing force on for around 15 to 20 seconds. This allows tension of the gasket to be evenly distributed.

It is not unusual for the culvert to creep forward by about 10mm after jointing force is release.

Always ensure the culvert joints squarely. Using two pullers enable steering of the culvert to achieve this. If only using one puller, regular repositioning of the cable may be needed from the center point on the beam of the culvert being pulled. Under no circumstance let one side joint first and then try to joint the other, this could result in bursting the socket.

Add the next channel across the front of the culvert and then position the next culvert ensuring correct alignment and continue installation process.

Place a protection piece between the surface contact of the strut and the concrete in order to distribute the compression evenly. The use of a hydraulic puller requires continuous checks in order to avoid unexpected cracking during operation of the puller.



5.2.2 Jointing using a construction vehicle

DO NOT use a fork lift truck to push a culvert.

Jointing with an excavator:

Using a wooden buffer between the beam/bucket push until the spigot face contacts the socket face and the culvert is fully and squarely home. Great care must be taken to ensure the culvert joints squarely, never try to bully the culverts together. Initially another excavator, a stop plate or extra weight will be needed to stop the first pipe moving forward.

Before releasing the jointing force/load. wait for approximately 15 seconds to regulate the compressive stresses in the gasket.

Add the next channel across the front of the culvert and then position the next culvert ensuring correct alignment and continue installation process. After two or three culverts are laid no restraint is required in the first pipe.

NEVER push directly on the socket end. Always place a wooden beam between the device and the product.



5.3 Adjustments

Any necessary level adjustments should be made by raising or lowering the bedding level ensuring each time the box culvert is laid on its entire length.

A temporary support (eg wooden beam) is not acceptable and will not serve as a long term solution.

A slight misalignment can be corrected by jacking at the side of the trench or trench box. Care must be taken when carrying out this operation as the jacking load must be spread out over a large area of the culvert to avoid damage. Pulling on one side with a puller or gentle pushing with an excavator (using a suitable buffer) should also correct any misalignment.

To adjust for level a gentle side to side movement of the culvert will encourage the culvert to sink in to the bedding.



DO NOT adjust levels by applying a downward pressure on to the culvert with an excavator.

5.4 Control of the joint:

The **nominal joint gap is 15mm but should not exceed 30mm.** It should also be **minimum 10mm.** On no account concrete to concrete contact should happen during the jointing process. If necessary, 10mm spacers can be added to the socket end at the factory.

5.5 Additional sealing (for specific site conditions and uses)

A seal is provided by the elastomeric gasket mounted on the spigot. For certain site specific conditions and uses, we recommend an enhanced seal through an internal or external sealing method. An example product which can be used is MS600.

5.6 Filling of anchor recesses

After jointing fill lifting anchor recesses with suitable sand, cement, mortar. Adding SBR will aid the bonding.



5.7 Backfilling and compaction

Material for backfill should be similar in character to the surrounding soil. It should be readily compactable, free from large lumps, roots, rubbish and building rubble.

Backfilling and compaction are performed layer by layer alternatively on each side of the culvert until level with the top of the culvert.

Continue by adding bedding over the top of the culvert. No compaction should be done directly over the culvert until a minimum of 0.50m of back fill is placed. Below this level use of heavy compacting vehicles is not permitted as they could causes damage to the units.

Quality and particle size of the filling material must comply with the compaction conditions defined by the designer.

Trench support must be removed with care.

Construction vehicle passage is only possible when the embankment has reached a sufficient height to permit a good load distribution. These details should be available in the design specification.

5.8 Specials

Please note: If taking delivery of specials eg. end walls and side or top entries the lifting anchors will be fill in. In these cases we would recommend the use of canvas sling to off load install these products.

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