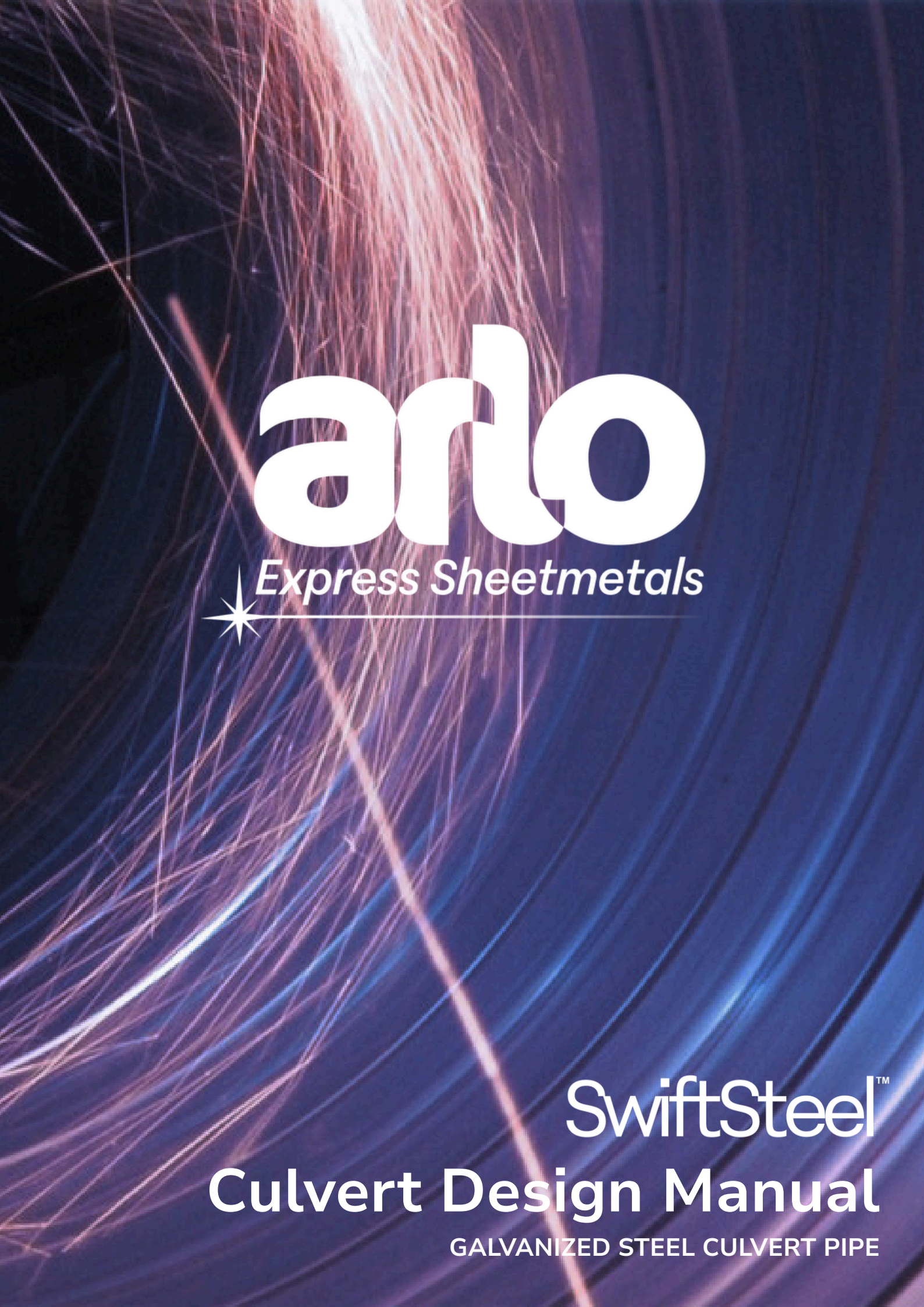


SwiftSteel™

Culvert Design Manual

GALVANIZED STEEL CULVERT PIPE

Introduction

SWIFTSTEEL (formerly DURADUCT) CULVERT has a long history in the New Zealand market and is recognized as a proven performer in many thousands of installations throughout New Zealand and the South Pacific.

Properties

Durability, strength, lightweight and ease of installation makes SWIFSTEEL CULVERT for ARLO Express Sheetmetals NZ Limited ideal to meet your civil engineering, forestry and farm culvert needs.

Strength

Roll formed with an incredibly strong ball swage rib helically wound with continuous lock formed seams, SWIFSTEEL CULVERT is extremely robust and allows for outstanding 'height of fill' performance. (see table P6)

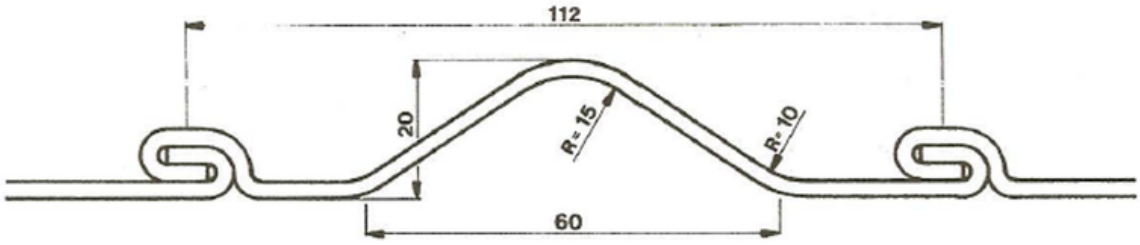
Materials

- SWIFSTEEL CULVERT is manufactured from G250 steel and coated with a Z600 galvanised cover in accordance with the material requirements of NZ4405-86
- Material Test Certificates are available on request.

Manufacture

PIPE CONSTRUCTION

- SWIFSTEEL CULVERT is manufactured using a strip coil and roll forming process. The resulting helically wound, continuous lock seamed pipe is extremely robust.
- The CUX profile is unique to SWIFSTEEL CULVERT in New Zealand and provides outstanding 'height of fill' performance (see table P6).



JOINT/COUPLING SYSTEM

- Jointing is achieved through proprietary jointing or coupling band. The couplings are manufactured in either one- or two-pieces dependent on diameter.
- Coupling bands are designed for easy installation and profiled to ensure a secure joint.
- Sealed coupling bands are available on request.

END TREATMENT & SPECIAL FITTINGS

- Bevelled or skew cut ends are available on application as are special fittings that are required as part of individual project design.
- Wingwalls can be made to order and are available on application per requirement as part of individual project design.

Installation

General standards for the installation of Helical LOCK - SEAM CORRUGATED STEEL PIPES are set out in NZ4406-86. (Detailed installation practices are set out in page seven of this manual).

Standards

SWIFTSTEEL CULVERT pipe has been independently tested and evaluated by Thorburn Consultants limited, in conjunction with the University of Auckland, and complies with:
NZ4405-86 - HELICAL LOCK-SEAM CORRUGATED STEEL PIPES
NZ4406-86 - HELICAL LOCK-SEAM CORRUGATED STEEL PIPES

DESIGN AND INSTALLATION

ARLO Express Sheetmetals NZ Limited refers to several additional standards, conventions and specifications relevant to culvert pipe and its use in New Zealand.
These Include:

- NZTA F3: 2010 NZ TRANSPORT AGENCY - SPECIFICATION FOR PIPE CULVERT CONSTRUCTION
- MTE - CULVERT AND BRIDGE CONSTRUCTION: GUIDELINES FOR FARMERS

Product Information

Pipe Dimension

Diameter	Availability	1.2mm	1.6mm	2.00mm
300	EX	•		
400	EX	•		
450	EX	•		
600	EX	•		
750	EX	•		
900	EX		•	
1000	MTO		•	
1200	MTO		•	
1500	MTO			•
1750	MTO			•
2000	MTO			•

EX: Ex-stock items held in both 4- & 6-meter lengths
MTO: Manufactured items can generally be supplied within 10 working days from receipt of order.

GAUGE:	Material gauges are as set out in table as above
PIPE DIAMETER:	The diameter of DURADUCT CULVERT is measured Internally across the inside of pipe corrugation flats
PIPE LENGTHS:	Minimum: 3 metres, Maximum: 10 metres. Stock: 4 & 6 metres
LOCK SEAM DOUBLE:	The pipe is lock manufactured with a continuous helical lock form and swage for increased rigidity

Structural Design

SWIFSTEEL CULVERT is manufactured in accordance with, and complies with the provisions of **NZS4405-86**

STRUCTURAL PROPERTIES

Material: Z275 Galvanised 250 Mild Steel

E 69,000 MPa
Fu 240 MPa
Ry 165 MPa

Flexibility Factor: -0.5mm/N

Metal Thickness mm	*A-sect Area A mm2/mm*	*M2nd Moment / mm4/mm*	*Radius of Gyration K mm*
1.2	1.58	23.47	3.85
1.6	2.18	41.74	4.37
2.5	3.75	108.0	5.90

Maximum Cover No Traffic Surcharge				Highway HO Loading			
Pipe Diameter	Base metal Thickness (mm)			Pipe Diameter	Base Metal Thickness (mm)		
mm	1.2	1.6	2.5	mm	1.2	1.6	2.5
300	69.3	95.7	-	300	69.2	95.6	-
400	52.0	71.9	-	400	51.8	71.7	-
450	46.2	63.8	-	450	46.1	63.7	-
600	34.6	47.9	-	600	34.5	47.7	-
750	27.7	41.0	51.1	750	37.6	38.2	47.6
900	2.1	31.9	39.8	900	23.0	31.8	39.6
1000	20.8	28.7	35.8	1000	20.7	28.6	35.7
1200	16.9	23.9	29.8	1200	16.7	23.8	29.7
1500	-	17.7	23.3	1500	-	17.5	23.2
1750	-	-	18.3	1750	-	-	18.1
2000	-	-	14.2	2000	-	-	14.1

Minimum Cover

Adequate minimum pipe cover (over crown) is essential for the successful installation of SWIFTSTEEL CULVERT pipe. Minimum cover shall be 600mm. However, local site conditions should be always considered (NZS4406-86-2.8.3,2.8.4) as special conditions may apply.

Handling & Installation

Transport

Care needs to be taken during transportation to avoid possible damage. Packing of pipes should be as follows:

- Dunnage required between both horizontal planes to achieve separation.
- Pipes can be nested for transportation.
- If metal strapping is used it should be isolated with a soft liner to isolate pipe from strapping

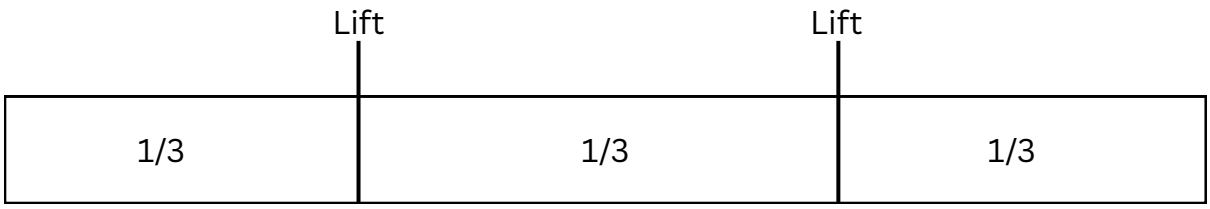
Storage

To preserve goods levels of site safety, pipe needs to be secured to prevent accidental movement. Eg: working machinery or strong winds.

Handling

Impact against hard objects can cause minor mechanical and cosmetic damage and care needs to be taken to avoid this when handling pipe products as product performance may be affected by damage incurred. Should severe surface scratching occur, cold-galvanize finish should be applied to the affected area to preserve external protection.

For small diameters normally less than 600mm, pipes can generally be handled without lifting equipment. Larger diameters, or those pipes of longer lengths, may require light lifting equipment. Recommended practice is to sling pipes at two lifting point approximately 1/3 length with soft webbing straps or rope as per diagram below.



Installation

The successful installation of SWIFTSTEEL CULVERT pipe is dependent on a number of factors and should always be in accordance with the provisions of NZS4406-86

Assembly

- The manufacturers proprietary coupling should be used to join pipes at all times and care taken to match pipes to end marking where this appropriate.
- Pipes will also be identified with culvert number and/or description and, in addition, be marked with the total number of pipes making up that complete unit. (i.e. 1-4) see below

Coupling Bands

- Coupling bands come in a one- or two-piece configuration dependent on culvert diameter.
- The gap between the pipes to be joined should be no more than 25mm and ends should be free of any debris or loose fill to ensure a successful joint. Coupling bands should, as far as is practicable, overlap evenly on both sides of the joint.

Sealed Coupling Bands

- Sealed bands are available where a watertight joint is required. This is achieved through the use of a sealing band which is held in position by the coupling itself.
- Details installation instructions are available from Express Sheetmetals as required

PIPE INSTALLATION DETAIL

Foundations

- Excavate to firm sub-grade.
- The trench width to be the pipe diameter plus 600mmm.
- Where soft ground is encountered, over excavate to a width of two pipe diameters down top solid.
- Backfill to sub-grade in compacted hardfill.
- Foundations shall at all times be maintained dry and free from debris.

Bedding

- Provide bedding to a minimum of 75mm beneath the pipe invert.
- Bedding material shall be selected friable material or gravel with a maximum aggregate size of 12mm contacted and shaped to match the barrel of the pipe.
- Prior to laying the pipe, spread a 25mm layer of loose bedding material to receive the corrugated profile of the pipe.

Camber

- Where foundation settlement is predicted due to the surcharge load imposed in an embankment situation, the pipe may be laid at a camber to counteract this settlement.

Backfilling

- Backfill pipes to a depth of 600mm above the crown in selected friable material, compacted with handheld equipment.
- Place and compact backfill simultaneously to both sides of the pipe in layers not exceeding 150mm. The elevation of the backfill material shall be always maintained even on both sides of the pipe.
- Backfill density shall be compacted to a dry density not less than 95% of the maximum dry density determine by test NZS4402.

Protection

- Heavy compaction and construction equipment should be kept clear of pipe until it has been backfilled to a minimum depth of 600mm.

Temporary Bracing

- Where pipe exceed the recommended flexibility limits set out in NZS4405-86, or bracing may be required to prevent distortion and maintain its roundness.

Budget Friendly
Exceptional Strength
Light & Easy to Handle

ARLO Express All-Weather

SwiftSteel™ Culvert

arlo Express Sheetmetals

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Liability Waiver