



CUBIS
it's about time

MULTIduct™
ProductFocus

Innovating Underground Network Access

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MULTIduct™ Product Focus

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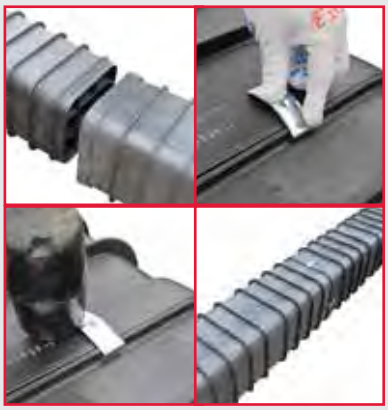

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Introduction

What is MULTIduct™?

MULTIduct™ is a multiple duct system, manufactured by CUBIS Industries, used for constructing under track or road crossings (UTX/URX), bridge crossings and linear routes.

Duct banks are built by connecting nominal 1 metre long sections, either by a steel clip or a push-fit system. There is also a range of accessories that offer flexibility in construction.

MULTIduct™ is manufactured from Nitrogen foamed-High Density Polyethylene, which offers high strength-to-weight properties, resulting in a product that has high crush-resistance but can be lifted by a single person (all parts are below 25kg).

MULTIduct™ has held long-standing approvals from national rail operators and has been installed in other applications across the world for more than 30 years.

CUBIS manufactures MULTIduct™ alongside our STAKKAbox™ access chamber range. Our customer base includes national highways agencies, water utilities, power utilities and telecommunications operators, rail network operators, Government bodies worldwide.

The MULTIduct™ System

- 4, 6 or 9 way Options.
- Each duct space is equivalent to 110mm single duct (160mm option available in 4 way).
- Each section is 1120mm long (lay length is 1070mm).
- Units have socket (female) and spigot (male) joints and are connected by clip-fix or push-fit.
- Accessories to manage common bends, duct configurations and for interfaces with traditional single ducts and access chambers.

Why use MULTIduct™?

Strong

- High crush strength.
- Can be buried much shallower than conventional duct.
- More robust - no breakages.

Environmental

- HDPE material consists of 70% recycled content.
- Completely recyclable.

Superior

- Manufactured to ISO 9001 and ISO 14001.

Light Weight

- All parts under 25kg.
- Reduced health and safety issues.
- Easier to transport on site.

Fast

- Rapid installation for every application.
- More work completed during track possessions or road closures.

Flexible

- Full range of accessories to overcome bends, breakout of runs and interface with standard duct.
- Easily cut on site for termination.

Economical

- Less excavation due to shallower burial.
- No special plant required for lifting.
- No concrete surround, specialist backfill or spacers required.

Applications

Being extremely versatile, the MULTIduct™ System can be applied to any of the following sectors: Rail, Highways, Telecommunications, Power.

Under Track Crossings

- Rail

MULTIduct™ can be utilised to carry and protect cables that have to be routed beneath train tracks. MULTIduct™ is the preferred method of constructing UTX's for railway networks throughout the world.

Under Road Crossings

- Rail
- Highways
- Telecoms
- Power

MULTIduct™ is ideal for building a duct bank for an underroad crossing, potentially allowing for multiple utilities to use the same excavated space.

Buried Cable Routes

- Rail

MULTIduct™ has been used by rail networks to protect cables that have been buried along the trackside in order to prevent cable theft and damage.

Linear Routes

- Rail
- Highways
- Telecoms
- Power

MULTIduct™ is ideal for building runs of multiple duct banks. It drastically cuts down the time taken to place such runs as no spacers are required.

Bridge Crossing

- Rail
- Highways
- Telecoms
- Power

Multiple cables can be supported and protected under a bridge using MULTIduct™, meaning that ducting work does not need to take place in the structure of the bridge.

Tunnels

- Rail
- Highways

MULTIduct™ has been used for carrying cables in tunnels, whereas smaller and shallower excavated area is required when compared to flexible duct provides a cost saving. As the material used in MULTIduct™ is not flame retardant, the duct is then surrounded with a layer of concrete.

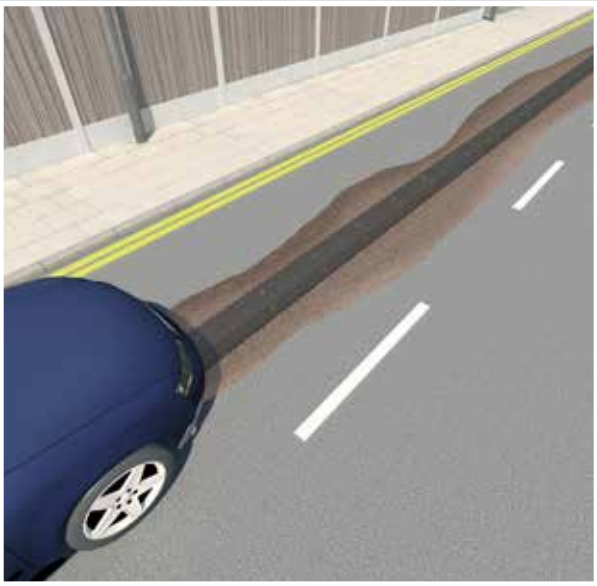
Features and Benefits

Feature	Benefit	Relevant to: Under Track Crossing	Under Road Crossing	Buried Cable Routes	Bridge Crossings	Tunnels
Lays straighter and flatter	No twisting of individual ducts.	✓	✓	✓	✓	✓
	Cabling easier to complete.	✓	✓	✓	✓	✓
No spacers needed	Narrower trench required.	✓	✓	✓		✓
	No graded backfill between ducts.	✓	✓	✓		
	Reduced cost of fitting spacers.	✓	✓	✓		✓
High crush strength	No concrete required - use as-dug material.	✓	✓	✓		
	Reduced excavation due to shallower burial	✓	✓	✓		
	More robust during the installation process.	✓	✓	✓	✓	✓
More secure than surface routes	Less damage / cost from theft.			✓		
Lightweight - all parts below 25kg	Reduced health and safety issues.	✓	✓	✓	✓	✓
	Easy to handle on-site.	✓	✓	✓	✓	✓
	Rapid installation.	✓	✓	✓	✓	✓
Doesn't crack when dropped	Less waste.	✓	✓	✓	✓	✓
70% recycled material	Less landfill after life.	✓	✓	✓	✓	✓
	Reduces carbon footprint.	✓	✓	✓	✓	✓
High Capacity inside duct	Longer cable installations possible.	✓	✓	✓	✓	✓
	Less internal bore surface in contact with a cable.	✓	✓	✓	✓	✓
	Lower pulling forces acting on the cable.	✓	✓	✓	✓	✓
Secure joints	Length cannot pull apart	✓	✓	✓	✓	✓
Large radius of corners	Rodents cannot bite through the duct and gain access to the cables.	✓	✓	✓	✓	✓
Square duct space	Less contact with cable - easier to pull / blow.	✓	✓	✓	✓	✓
Uniform Design	Better organisation of cables.	✓	✓	✓	✓	✓

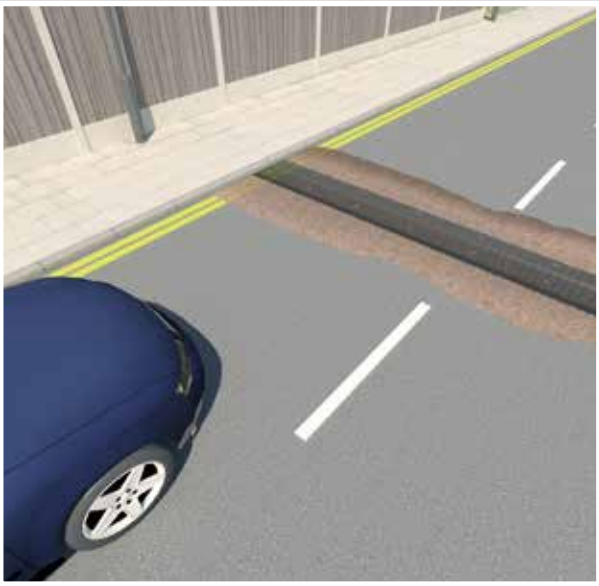
How deep can I bury MULTIduct™?

MULTIduct™ has been extensively tested in order to determine the maximum loading on each unit section (test results are on page 25). These tests demonstrate the suitability of burying MULTIduct™ for road applications at various depths by simulating the highest possible loading, when continously and point loaded, at that depth.

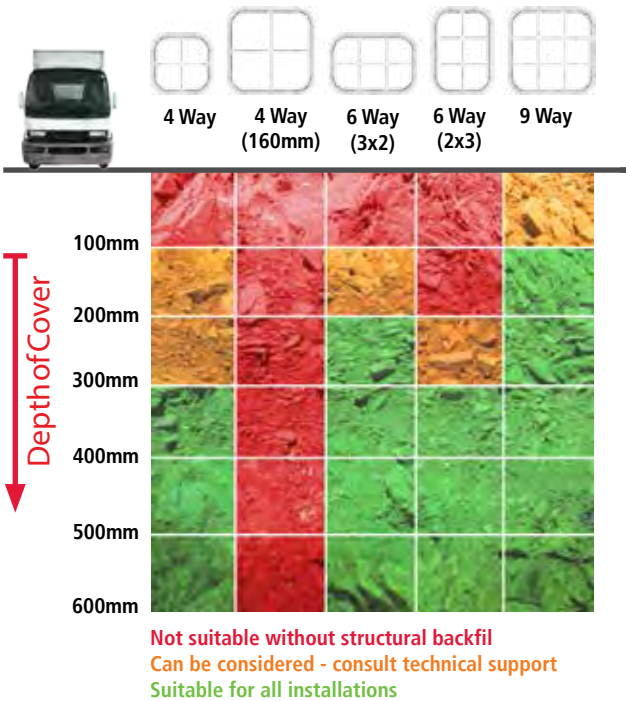
Continuous Loading



Point Loading

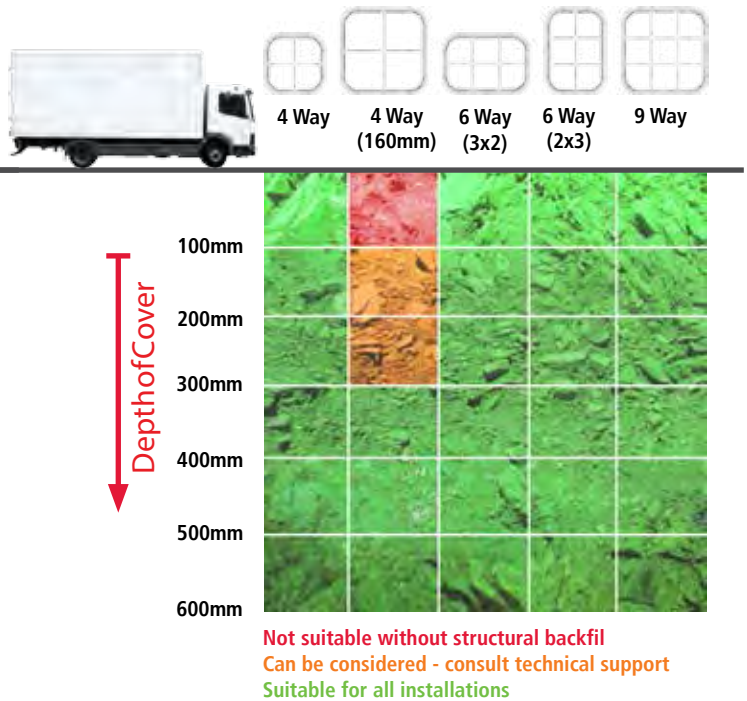


Multiduct™ Configuration



Not suitable without structural backfil
Can be considered - consult technical support
Suitable for all installations

Multiduct™ Configuration



Not suitable without structural backfil
Can be considered - consult technical support
Suitable for all installations

Material Properties

MULTIduct™ is manufactured from **Nitrogen Foamed High Density Polytheylene.**

Property	Method	HighDensityPolyethylene
Tensile Strength	ISO 527-4	26.2 MPA
Flexural Strength	ISO 14125	26.9 MPA
Flexural Modulus	ISO 14125	1.09 GPA
Impact Strength	ISO 179	28 J/mm^2
Deflection Temperature Range (0.46MPA)	ISO 75-2	72.1 deg C
Density (g/cm^3)	ISO 1183	0.95 - 0.98 g/cm^3
Water Absorption	ISO 62	0.01%
Volume Resistivity	IEC 60093	1.00E +16
Fire Performance	UL 94	HB
Limited Oxygen Index	ISO 4589-2	19%

About Structural Foam Moulding

AllMULTIduct™componentsareproducedusingthe'StructuralFoam'mouldingprocesswhichissimilar toinjectionmoulding.Howeverthedifferenceisthatinertgas(nitrogen)isusedtocreateafoaminnercore withinthepart'swallwhileretainingan integralexteriorskin.Thisprocessgivesthefollowingadvantages:

- High strength to weight ratio
- Stress free parts to eliminate warpage
- Excellent chemical and physical properties
- Non-porous surface - will not absorb moisture
- No CFC's used in the process

UV Stability

MULTIduct™exposedtoacceleratedUVExposureconsistedofarepetitivecycleof4hoursofUVlight (UVB-313lamp)at60°Cfollowedby4hourscondensation(UVlightoff)at50°Cforatotalof1000hours.

Specimen	Average Weight Change (%)	AverageDimensionalChanges(%)		
		Length	Width	Thickness
Specimensexposedto1000hoursof Accelerated UV Exposure	-0.04	< 0.05	NoChange	NoChange

Specimen	Average Flexural Strength (%)	Average Change in flexural Strength (%)
UnexposedSpecimen	1472	
Exposed Specimen	1561	6.1%

Chemical Resistance

DeterminationofweightandshapechangesofMULTIduct™beforeandafterexposuretochemicals. Three samples were exposed to each of the listed chemicals for a period of 168 hours.

Exposed Speciment / Chemical Reagant	Average Weight Change (%)	Average Dimensional Changes (%)		
		Length	Width	Thickness
Acetic Acid (5%)	0.09	< 0.005	-0.61	No Change
Hydrochloric Acid (0.1N)	0.02	0.17	-1.78	No Change
Sulphuric Acid (0.1N)	0.01	-0.09	-0.35	No Change
Sodium Carbonate (0.1N)	0.06	< 0.05	-0.35	-0.12
Calcium Carbonate (0.1N)	0.01	< 0.05	-0.35	No Change
Sodium Chloride (5%)	0.02	-0.08	0.42	No Change
Sodium Sulphate (0.1N)	0.04	-0.06	-0.74	No Change
Sodium Hydroxide (0.1N)	0.03	< 0.05	-0.49	-0.28
Kerosene No.2 Fuel Oil	1.84	0.2	-0.14	1.09
TransformerOil(MineralOil)	0.56	< 0.05	0.6	0.24

Product Range Guide

4 Way MULTIduct™

Each duct space is equivalent to 110mm single duct.

4 Way Single Duct Adapter

L252mm x W252mm x D200mm
DUDMD4-00004WAY-GRDA00000

Weight: 1.6kg
Standard Pallet Quantity: 100

4 Way Unit

L252mm x W252mm x D1120mm (lay length 1070mm)
DUDMD4-00004WAY-BK0000000

Weight: 7.3kg
Standard Pallet Quantity: 20

4 Way Socket End Cap

L252mm x W252mm x D73mm
DUDMD4-00000000-00BC00000

Weight: 0.67kg
Standard Pallet Quantity: 160

4 Way Spigot End Cap

L252mm x W252mm x D78mm
DUDMD4-00000000-00SC00000

Weight: 0.75kg
Standard Pallet Quantity: 144

4 Way Double Socket

L252mm x W252mm x D125mm
DUDMD4-00A.24.0-BKDB00000

Weight: 0.87kg
Standard Pallet Quantity: 160

4 Way Double Spigot

L252mm x W252mm x D135mm
DUDMD4-00A.24.0-BKDS00000

Weight: 0.89kg
Standard Pallet Quantity: 144

Clipless System Unit

L252mm x W252mm x D1120mm (lay length 1070mm)
DUDMD4-00004WAY-BKCD00000

Weight: 7.3kg
Standard Pallet Quantity: 20

Product Range Guide

XL 4 Way MULTIduct™

Each duct space is equivalent to 160mm single duct.

4 Single pieces make up one SDA

4 Way (160mm) Single Duct Adapter

L340mm x W340mm x D245mm
DUDMD4-XLA24.05-BKDA00000

Weight: 2.02kg
Standard Pallet Quantity: 45

4 Way (160mm) Socket End Cap

L365mm x W365mm x D78mm
DUDMD4-XLPO4WAY-BKBC00000

Weight: 1.34kg
Standard Pallet Quantity: 144

4 Way (160mm) Double Socket

L365mm x W365mm x D140mm
DUDMD4-XLA.24.0-BKDB00000

Weight: 1.43kg
Standard Pallet Quantity: 81

4 Way Unit (160mm)

L376mm x W376mm x D1120mm (lay length 1070mm)
DUDMD4-XL004WAY-BK0000000

Weight: 13.25kg
Standard Pallet Quantity: 12

4 Way (160mm) Spigot End Cap

L365mm x W365mm x D78mm
DUDMD4-XLPO4WAY-BKSC00000

Weight: 1.35kg
Standard Pallet Quantity: 144

4 Way (160mm) Double Spigot

L365mm x W365mm x D135mm
DUDMD4-XLA.24.0-BKDS00000

Weight: 1.43kg
Standard Pallet Quantity: 81

Clipless System Unit

L376mm x W376mm x D1120mm
(lay length 1070mm)

DUDMD4-XL004WAY-BKCD00000

Weight: 13.25kg
Standard Pallet Quantity: 12

Product Range Guide

6 Way MULTIduct™

Eachductspaceisequivalentto110mmsingleduct.

6 Way Single Duct Adapter

L365mm x W252mm x D200mm
DUDMD6-00006WAY-GRDA00000

Weight: 2.4kg
Standard Pallet Quantity: 60

6 Way Unit

L376mmxW252mmxD1120mm(laylength1070mm)
DUDMD6-00006WAY-BK0000000

Weight: 11kg
Standard Pallet Quantity: 16

6 Way Socket End Cap

L365mm x W252mm x D73mm
DUDMD6-00000000-00BC00000

Weight: 1.04kg
Standard Pallet Quantity: 204

6 Way Spigot End Cap

L365mm x W252mm x D78mm
DUD-MD6-00000000-00SC00000

Weight: 1.09kg
Standard Pallet Quantity: 204

6 Way Double Socket

L365mm x W252mm x D130mm
DUDMD6-00A.24.0-BKDB00000

Weight: 1.24kg
Standard Pallet Quantity: 120

6 Way Double Spigot

L365mm x W252mm x D135mm
DUDMD6-00A.24.0-BKDS00000

Weight: 1.31kg
Standard Pallet Quantity: 108

9 Way MULTIduct™

Eachductspaceisequivalentto110mmsingleduct.

9 Way Single Duct Adapter

L365mm x W365mm x D200mm
DUDMD9-00009WAY-GRDA00000

Weight: 3.3kg
Standard Pallet Quantity: 45

9 Way Socket End Cap

L365mm x W365mm x D78mm
DUDMD9-00000000-00BC00000

Weight: 1.61kg
Standard Pallet Quantity: 144

9 Way Double Socket

L365mm x W365mm x D145mm
DUDMD9-00A.24.0-BKDB00000

Weight: 1.77kg
Standard Pallet Quantity: 81

9 Way Unit

L376mmxW376mmxD1120mm(laylength1070mm)
DUDMD9-00009WAY-BK0000000

Weight: 17.3kg
Standard Pallet Quantity: 12

9 Way Spigot End Cap

L365mm x W365mm x D78mm
DUD-MD9-00000000-00SC00000

Weight: 1.76kg
Standard Pallet Quantity: 144

9 Way Double Spigot

L365mm x W365mm x D140mm
DUDMD9-00A.24.0-BKDS00000

Weight: 2.02kg
Standard Pallet Quantity: 81

Product Range Guide

MULTIduct™ Accessories

Flexible Duct

Available in 110mm and 160mm diameter options
Coil lengths are 50m and 100m

4 Way (160mm) 45 Degree Y-Lateral (Type 2 for 160mm Port)

L126mm x W220mm x D340mm
AC0000-0045PIPE-020000000

Weight: 0.54kg
Standard Pallet Quantity: 100

*Othervariancescanbefabricatedandsupplied.

SpringClips

L70mm x W25mm x D13mm
ACDM00-00000000-00DC00000

Weight: 0.01kg
Standard Pallet Quantity: 600 / Box

4 Way (160mm) 22.5 Degree Y-Lateral (Type 2 for 160mm Port)

L147mm x W200mm x D515mm
AC0000-22.5PIPE-020000000

Weight: 1.04.kg
Standard Pallet Quantity: 100

*Othervariancescanbefabricatedandsupplied.

Rubber Gasket

4 Way

Diameter Ø: 222mm x D20mm
ACDMD4-00004WAY-00DG00000

Weight: 0.06kg
Standard Pallet Quantity: 100 / Box

6 Way

Diameter Ø: 280mm x D20mm
ACDMD6-00006WAY-00DG00000

Weight: 0.07kg
Standard Pallet Quantity: 100 / Box

4 Way XL

Diameter Ø: 335mm x D20mm
ACDMD9-00009WAY-00DG00000

Weight: 0.09kg
Standard Pallet Quantity: 75 / Box

9 Way

Diameter Ø: 335mm x D20mm
ACDMD9-00009WAY-00DG00000

Weight: 0.09kg
Standard Pallet Quantity: 75 / Box

Installation and Use

Ease of Handling

MULTIduct™ offers the unique advantage of being light in weight and yet tough and resilient. These characteristics permit it to easily resist the effects of normal handling and shipping. Obviously, care should be taken to avoid dropping, throwing or dragging in order to protect the ends from damage.

MULTIduct™ is stacked on pallets, no larger than 1500mm x 1200mm. The maximum height is 1200mm. Standard pallet quantities are:

- 4 Way (110mm) - 20 per pallet
- 4 Way (160mm) - 12 per pallet
- 6 Way - 16 per pallet
- 9 Way - 12 per pallet

Trouble Free Storage

MULTIduct™ can be stored stacked indoors or outside, so long as the height does not present a possible safety hazard under the specific storage or working conditions. Stacking should be done so as to avoid any loading on the spigot and flared ends.

MULTIduct™ Installation

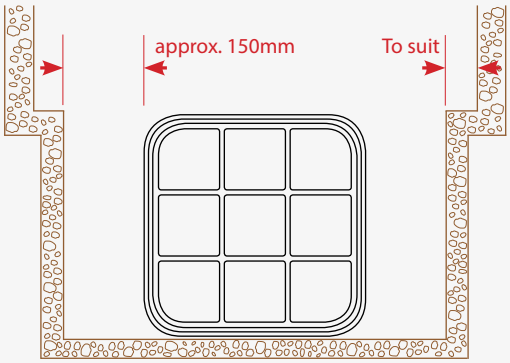
Trenching Installations

This method covers **under track crossings**, **buried cable routes**, **under road crossings** and **linear routes**.

Whatever method of excavation is used, MULTIduct™ will speed and simplify the overall installation process.

Trench Width

Normal trench formations showing clearance required for conduit.



If wider trenches become necessary, theen-largement should be restricted in depth to a grade at or above the top of the final duct formation to minimise backfill loading.

To minimise backfill loading on the MULTIduct™ and for the most economical construction, the trench width should be no greater than that required to provide adequate and safe working space in the trench and to permit proper placement and consolidation at the sides of the MULTIduct™ of the initial backfill materials. This width is approximately 300mm greater in total than the duct formation.

Buried Installation

Trench Depth

Trench depth will vary depending on the duct formation, the cover requirement and any other local regulations.

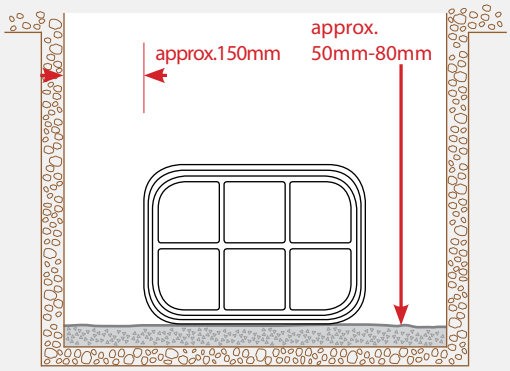
Extensive testing has been carried out on MULTIduct™ which shows it can be buried much shallower than traditional ducts, pipes and conduits.

The table on Page 6 shows the various minimum depths that CUBIS advise MULTIduct™ can be buried at without structural backfill and without compromising on the installation strength.

Basic preparation of foundation and bedding

MULTIduct™ must be installed over an even, firm and stable foundation. Any low spots in the trench bottom or foundation are to be corrected by firmly tamping, in shallow lifts, free flowing granular material. To provide evenly distributed support, the top layer of the foundation should consist of a bedding of approximately 50 to 80mm of an uncompacted cushion of granular material of mixed particle size.

This layer must be free of stones and other hard particles larger than about 20mm to prevent a possible concentrated point loading on the MULTIduct™. In most situations, the final hand grading of a trench bottom will produce a satisfactory cushion.

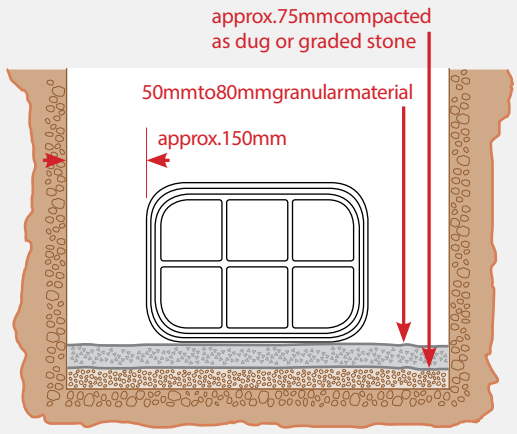


A suitable bedding in stable soil trench is generally produced after final hand grading of the trench as excavated, without the need for special backfills.

Rock / Hard Clay Installations

In Rock, Rocky Soils or Extremely Hard Clay or other materials which will not permit the direct placement of adequate bedding, the trench bottom should be over excavated by approximately 75mm. The correction of low spots in the trench can be done with satisfactory material taken from trench spoils, if this is not available then imported graded stone should be used. This layer should be adequately compacted. A bedding layer of 50 to 80mm of uncompacted granular material of mix particle size as per the standard installation.

When entering an access chamber, building or other rigid structure, the foundation should be particularly firm and stable to ensure the MULTIduct™ will not settle in relation to the rigid structure.



Over-excavation by approximately 75mm is required in rocky soil to permit the placement of a proper supporting cushion.

Other Buried Installations

MULTIduct™canalsobereadilyassembledandpushedthroughanalreadyburiedcasing.Thetablebelow indicates the minimum casing size required for various formations.

Duct Configuration	No. of Ducts	Min. pipe I/D size
4-Way	1x 4W	356mm
6-Way	1x 6W	404mm
8-Way	2x 4W	559mm
9-Way	1x 9W	508mm
12-Way	2x 6W	610mm
12-Way	3x 4W	559mm
16-Way	1x 6W & 1x 9W	737mm
16-Way	4x 4W	711mm
18-Way	2x 9W	813mm
18-Way	3x 6W	838mm
24-Way	4x 6W	914mm
36-Way	4x 9W	1067mm

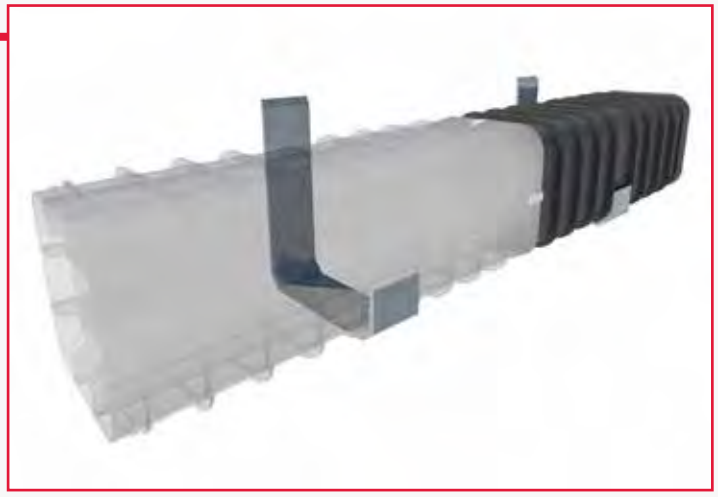
Bridges & Tunnels

Bridge Crossing Installations

MULTIduct™canbeplacedunderthespanofbridgestoprovidearouteforcableswithouttheneedforburial inthebridgedeck.Thisisdonebytheplacementofsteelbracketryat1mspacingsontothesideofthebridge upon which the MULTIduct™ can sit and be strapped to.

Theprojectengineershouldensurethesebracketsarespecifiedaccordinglyduetothevariancesinbridgedesign and MULTIduct™ requirements.

Exampleofastandardbridgecrossinginstallation and bracket system.

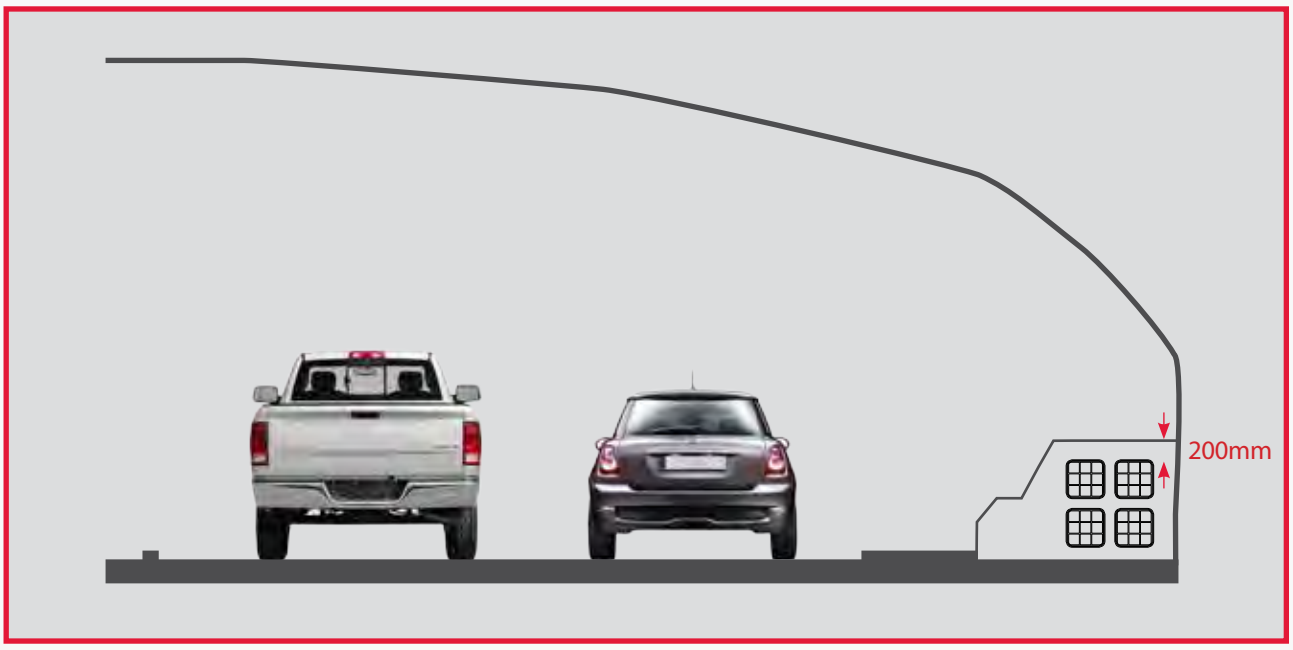


Duetothevariancesofbridgeconstruction;theprojectengineershouldspecifythebrackets and fixing methods to be used.

Tunnels

MULTIduct™isalsoidealforinstallationintunnelswheremanycablesareinstalledatthesideoftheroador rail track. Prepare the base and place the MULTIduct™ in the same way as for a buried application.

TheMULTIduct™shouldthenbeencapsulatedinarecommendedminimumof200mmconcretesurroundin ordertoprotectitfromfiredamage.Theprojectengineershouldspecifythegradeandultimatelythethickness of this concrete.



Assembly Methods

Joining MULTIduct™

MULTIduct™ units are joined by a socket and spigot joint (this socket can also be gasket sealed). There are two ways of securing the joint:

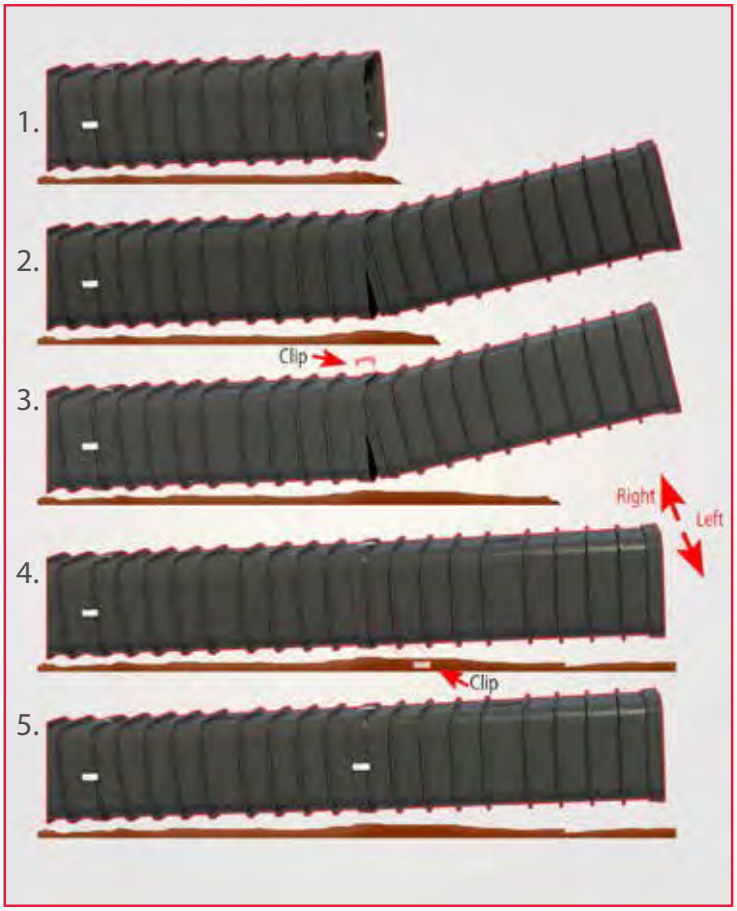
- Spring steel clips on each face of the MULTIduct™
- A push fit (Clipless)

These joints allow for pre-assembly of several sections for longer lengths and provide joint integrity during construction and subsequent backfill consolidation.

MULTIduct™ assembly normally originates from a terminal point, such as an access chamber, with the socket end facing the direction of lay. An alternative method is to start at a mid point in the run with a double socket unit and proceed in both directions. Prior to assembly, the socket and spigot ends should be checked to see that they are free of dirt or other foreign material and that the spigot ends have a properly seated gasket if they are being used.

Assembly procedure in the trench

1. Raise the socket end by approximately 100mm.
2. Insert the spigot end of the next section into the raised socket end. If a gasket is being used, ensure it is properly located. **NB – Gasket cannot be used on the push fit system.**
3. Raise the free end of this next section to close the top of the joint and;
   - If the **clip fix system** is used: Place a clip on the top side of the joint.
   - If the **push fit system** is used: Push down on the free end to also close the bottom of the joint.
4. If the **clip fix system** is used: Push down on the free end until the bottom of the joint is fully seated. The side clips can now be placed by moving the free end of the length toward each side as the clip is placed. The bottom clip can be placed in the same manner by pushing down on the free end or sliding the clip around from the side. NB - A hammer may be useful to knock each clip into place.
   If the **push fit system** is used: Push the entire length home until the 'pips' click home into the corresponding hole in the socket end.
5. Lower the MULTIduct™ into the trench ready for the next length to be fitted and repeat steps 1 to 4.



Assembly Methods

Standard Steel Clip Assembly Method


1.

2.

3.

4.

Sealed MULTIduct™ Assembly Method


1.

2.

3.

4.

5.

- Placegasketontheendofthespigot,placingthefineribbedsideofthegaskettothefaceoftheendoftheunit.
- Apply lubricant lightly around the gasket surface.
- Place spigot end inside socket and secure with a clip on each face.

Push-Fit MULTIduct™ Assembly Method


1.

2.

3.

Assembly procedure above the trench

MULTIduct™maybepre-assembledin longerthanunitlengthsabovethetrench asconstructionallowsit.Pre-assemblyis accomplishedinthesamemannerasin thetrenchandthenthewholeunitcan be lowered into the trench as one.

Multiple banks

MULTIduct™ can be installed in single 4, 6 or 9 way formations or stacked to provide multiple duct banks.

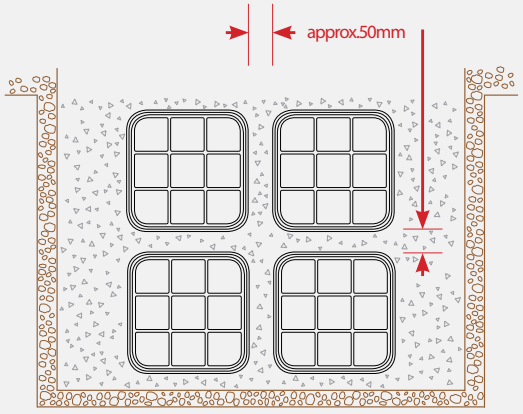
As individual sections or multiples are joined together in the trench, care should be taken to maintain the proper alignment and that the formation follows as smooth a course as possible. Both straight and curved runs should be checked to ensure that no joint is deflected more than 2 degrees. Mitres should be used wherever necessary to relieve joints which are deflected beyond the 2 degree limit. A final check of alignment should always precede initial backfilling.

Multiple MULTIduct™ Banks

For buried installations, CUBIS recommends separating horizontal and vertical banks with a minimum of 50mm of granular material.

The granular material should be adequately compacted to ensure that voids are eliminated.

MULTIduct™ units can be stacked as high as required.



Example showing recommended separation using granular material.

Bends & Breakouts

Curves and Grade Changes

The flexibility of the MULTIduct™ joint will allow for slight changes of grade and direction without the use of mitres. Changes which are greater than 2 degrees per joint, either in straight runs or curves, must be accomplished by the use of mitre units. Each mitre allows a direction change of 3 degrees per 305mm and will permit the construction of radii as small as 6 metres. Generally, the joints should be maintained as square as is practical.

Procedures for installation of 'Y' laterals

When installations require removal of one or more cable(s) from an individual bore in the 4, 6 or 9 way MULTIduct™ the use of a 'Y' piece will make the job a simple procedure. Various lateral adapters are available depending on the bore and direction involved (see page 12).

To install a 'Y' follow the following steps;

1. Remove two re-enforcing ribs from the outside of the MULTIduct™ where the fitting will be located.
2. Carefully position the template provided with the fitting onto the MULTIduct™ and mark the ellipse shape over the bore being broken out from. In addition the template shows where the four fixing bolts are located - mark these too.
3. Use a small hand or electric saw to cut through the MULTIduct™ in the shape of the marking. Then drill out the four marked hole locations where the fixing bolts will pass through.
4. Clean away all residue, shaving and birs from the cuts and drill holes made.
5. Pass the four coach bolts provided through the four drilled fixing holes from the inside of the MULTIduct™. The rounded head of the bolt will be on the inside of the bore.
6. Apply a silicone bead around the outside edge of the ellipse hole and the four bolts sticking up through the MULTIduct™ wall.
7. Position the 'Y' fitting over the hole and move into place whilst carefully pushing the four fixing bolts through their corresponding holes.
8. Place a washer and nut on each thread and tighten the 'Y' fitting into place, taking care not to over tighten.

Note: Use extreme caution when cutting into occupied duct to avoid damage to cable.

Termination

Termination at access chambers

Accesschamberentrypointscanbepre-fittedatproductionifusingSTAKKAbox™orMONObox™forconstruction. In addition we can also fit a socket or spigot end to make connection even simpler.

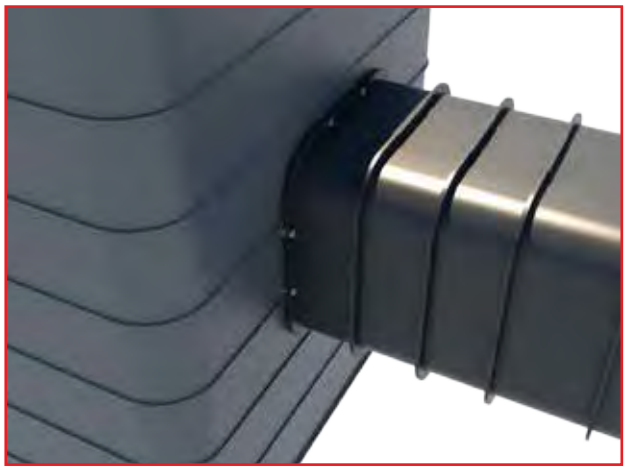
MULTIduct™ entry can just as easily be done on site by following these steps:

1. Whentheentrypointisknown,bringtheMULTIduct™uptotheoutsideofthechamberandmark around it on the outside of the chamber wall.

2. Using a 114mm Holesaw, cut a hole in each corner where marked.

3. Usingasmallhandsawcutthestraightlinemarkedwhichjoinsthecornersup.Thiswillleaveahole perfectly matched to the MULTIduct™.

4. PasstheMULTIduct™throughthepreparedholeandeitheruseare-enforcingribtofixtothechamber wallwithselftappingscrewsorsimplyapplyexpandingfoamorsiliconesealantaroundanygaps between the duct and the chamber.



Backfilling & Cabling

After a final check for proper alignment of the installed MULTIduct™, suitable fill should be hand placed on each side of the duct run approximately every 10 metres to help prevent movement during mechanical backfilling.

Initial Backfill

This should consist of free flowing granular material of mixed particle size, free of large stones, lumps and clods, silt, silty clay, clay lumps, organic soils, frozen earth or debris. The initial backfill material should be placed in layers on either side of the run to provide even, void free support.

Mechanical or other compaction to reach a given soil density may be necessary when using free-flowing granular materials. This is dependent upon the job site, local ordinance, road construction, track construction or other applicable requirements. The initial backfill material should be placed in the trench until it covers the top duct run by at least 80mm. This is to protect the MULTIduct™ from any large objects which may be included in the final backfill.

Final Backfill

This can proceed with remaining trench spoils provided that the materials used and the extent of their compaction satisfy road construction, local ordinances or other applicable requirements. To protect the MULTIduct™ from possible concentrated loading and to ensure stable trench fill conditions, care should be taken to provide backfill which is free of large rocks, boulders, organic soils, stumps, frozen clods, roots and other foreign debris.

Cabling

Mandrelling

Using a standard test mandrel for the applicable bore pass through any two bores laying in diagonally opposite corners of each multi-bore duct run.

Rodding can be carried out in lengths of up to 200 metres using standard COBRAs. Due to the low co-efficient of friction on the internal wall of MULTIduct™ and the fact that it lays much straighter than conventional round ducts, longer lengths are also possible. The limiting factor will be the available rod lengths.

Blowing

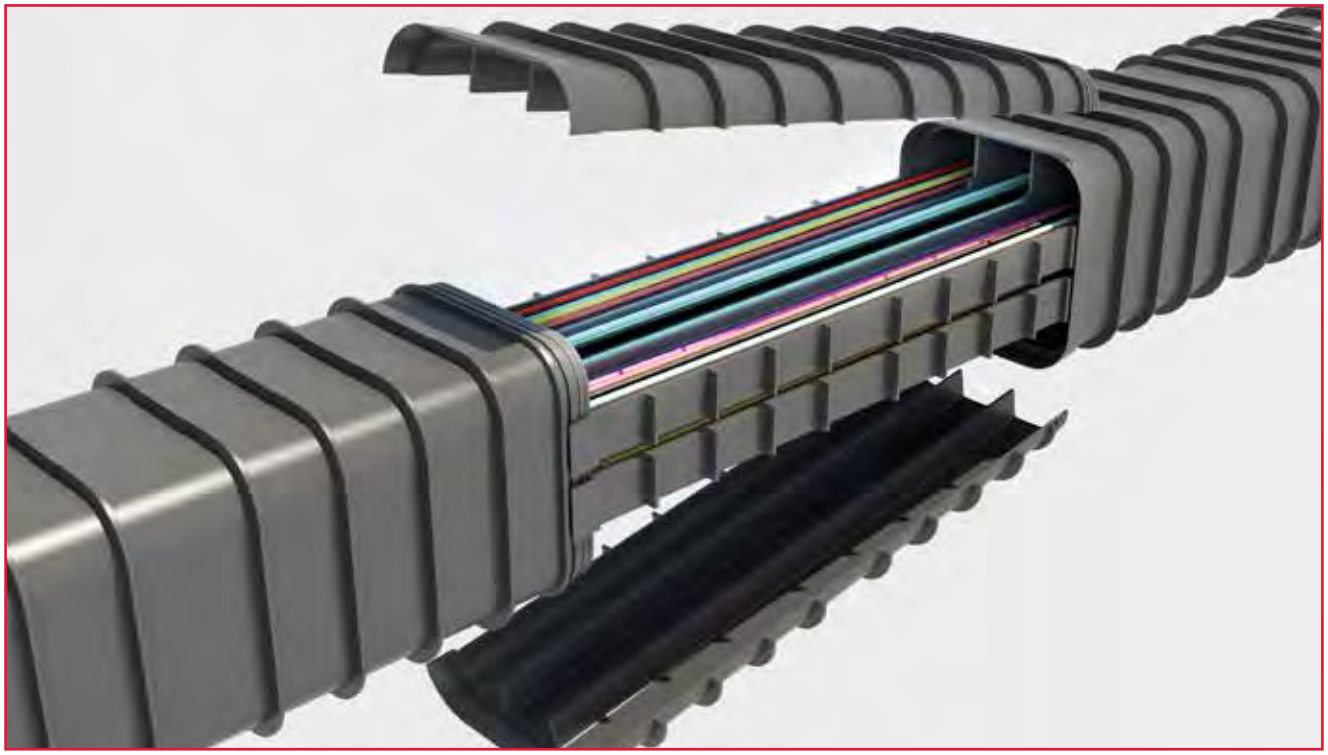
Blowing cables is possible when using specialist equipment. Distances of 250m have been achieved on previous installations.

Maintenance

Repairing a Damaged Cable

Shouldit becomenecessarytorepairdamagedorfaultycablewithinarun,thedamagedareamustbe carefullyexcavatedtoapointextendingseveralductsectionsoneithersideofthedamagedarea.The MULTIduct™shouldthenberemovedfromaroundthispointinsuchawayastoavoidfurtherdamageto cables.

Aftercablerepairsaremade,aspecialsplitrepairkitisusedasareplacementfortheMULTIduct™which hasbeenremoved.Thisisdonebyfirstinsertingthehorizontalcabledividersandthenbandingtheouter sectionsaroundtherun.Theseamsmustthenbesealedwithducttape,theentireunitbandedtightlyand then concrete encased for at least 600mm beyond each end of the repaired section.



Available Repair Kits

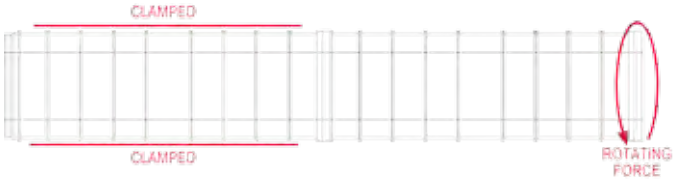
Product Code	Description
DUDMD4-400SPLIT-BKDK00000	4 Way Split Repair Kit
DUDMD4-4XLSPLIT-BKDK00000	4 Way (160mm) Split Repair Kit
DUDMD6-600SPLIT-BKDK00000	6 Way Split Repair Kit
DUDMD9-900SPLIT-BKDK00000	9 Way Split Repair Kit

Product Testing

Testing Summaries

Torque Testing

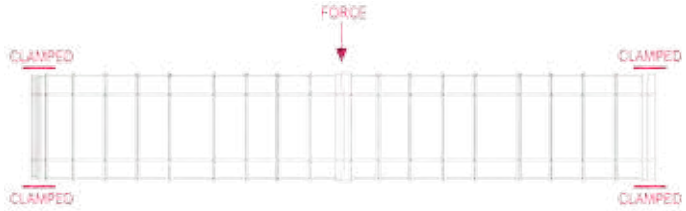
Testing what?:	The minimum **torsional force** required for the coupling mechanism (spring clips) of two MULTIduct™ units to fail. One section of MULTIduct™ is held fixed while the other is rotated. Failure point is when either the coupling breaks or the sections separate.
Conclusion:	Minimum torque required for the joint to fail was **513kN per mm.**
What this shows:	The force required to separate a single coupling by rotation.



Torque Testing

Lateral / Bending Load Testing

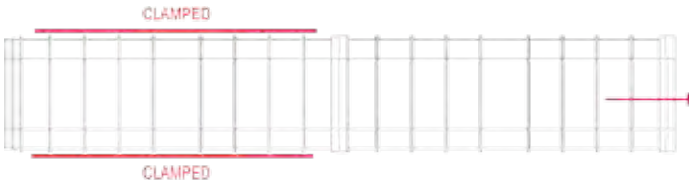
Testing what?:	The minimum **lateral force** required for the coupling mechanism (spring clips) of two MULTIduct™ units to fail. Two jointed sections of MULTIduct™ are clamped at the ends and a force applied on the coupling. Failure point is when either the coupling breaks or the sections separate.
Conclusion:	Minimum bending capacity of the joint was **2.7kN** when supported over the length of nearly two units and applying a load equivalent to a UDL.
What this shows:	The force required to pop open a single coupling.



Lateral/bending load testing

Tension Load Testing

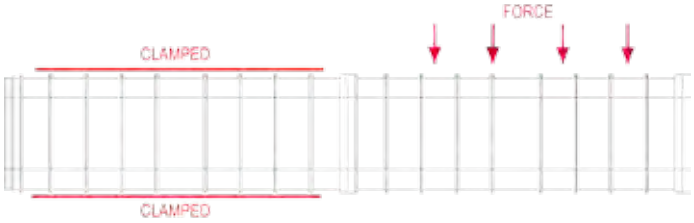
Testing what?:	The minimum **tensile force** required for the coupling mechanism (spring clips) of two MULTIduct™ units to fail. One section of MULTIduct™ is clamped and a force is applied to remove the second section along the direction of the MULTIduct™. Failure point when the sections separate.
Conclusion:	Minimum tensile capacity of the joint was **4.9kN**. The minimum tensile capacity of the **Push-Fit joint was 3.69kN.**
What this shows:	The force required to pull a single coupling apart.



Tension Load Testing

Shear Load Testing

Testing what?:	The minimum **shear force** required for the coupling mechanism (spring clips) of two MULTIduct™ units to fail. One section of MULTIduct™ is clamped while a force is applied evenly across the entire length of the second section perpendicular to the line of the MULTIduct™. Failure point is when the coupling breaks or the sections separate.
Conclusion:	Minimum shear capacity of the joint was **13.5kN**.
What this shows:	The force required to separate a single coupling when a force is applied perpendicular to the line of MULTIduct™.



Shear Load Testing

MULTIduct™ Load Capabilities

All MULTIduct™ units have been tested to find the load capabilities when subjected to continuous and point loads. On each test, the rig was fitted with a 50 tonne hydraulic jack and pneumatic power pack and a force was applied until the internal vertical walls buckled.

Continuous Load Test

Plate and Beam are used to evenly distribute the load.

Point Load Test

A 250mm diameter test piece is placed centrally on the unit. A piece of rubber matting is used to simulate a tyre.

Continuous Load Test Results

Product	Maximum Achieved Load (kN)
4 WAY (110mm)	65
4 WAY (160mm)	30
6 WAY (110mm) [3 high x 2 wide]	82
6 WAY (110mm) [2 high x 3 wide]	85
9 WAY(110mm)	168

Point Load Test Results

Product	Maximum Achieved Load (kN)
4 WAY (110mm)	28
4 WAY (160mm)	12
6 WAY (110mm) [3 high x 2 wide]	28
6 WAY (110mm) [2 high x 3 wide]	40
9 WAY(110mm)	52

Product in Use

Tunnels



Under Road Crossing



Buried Cable Route






Linear Routes



Bridge Crossings



Under Track Crossing



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