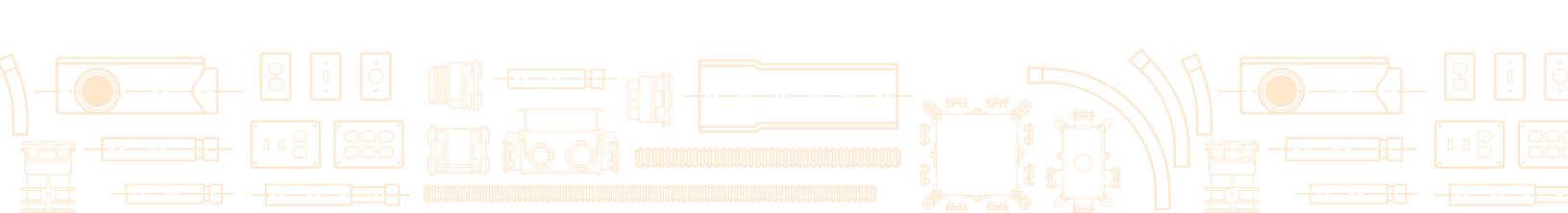


# Duct (DB2/ES2) Pipe & Fittings

For usage in both direct burial and concrete encased applications for power utilities, street lighting and communication distribution systems.





# ROYAL Electrical Solutions

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This comprehensive brochure was created with engineers, contractors, electricians and utilities in mind. It includes applications, benefits, design and installation guidelines for our high quality duct pipe and fittings. There is a complete section devoted to our fittings that includes dimensions, product codes and drawings for each fitting we offer. We hope that you find this manual useful in designing your next conduit system.



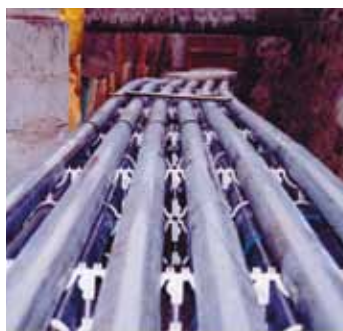
# Duct (DB2/ES2) Pipe & Fittings

For usage in both direct burial and concrete encased applications.

## Product Description & Applications

Royal Building Products, Electrical Solutions manufactures a complete line of non-metallic duct pipe and fittings. We produce two types of duct for direct burial and concrete applications for power utility primaries and secondaries, street lighting and communication distribution systems:

- Solid Wall Duct (DB2/ES2)
- Split Wall Duct (DB2/ES2)



Our duct products are available in 50 to 150mm (2- to 6-inch) diameters and 3- and 6-metre (10- to 20-foot) lengths with solvent weld bell ends.

## Standards and Codes

Royal Electrical Solutions Duct pipe and fittings are certified to the CSA Standard C22.2 No. 211.1. All duct and fittings shall be installed according to the Canadian Electrical Code (CEC) Part I, Rules 12-1150 - 12-1166.



C22.2 No. 211.1

## Features and Benefits

### Saves Labour

Royal Electrical Solutions Duct is simple to cut and join. No special tools are required for cutting or bending. The lighter weight also makes it easier to move and handle.

## Easy Wire Pulls

The smooth interior surface reduces friction when pulling conductors and wires through long runs and 90° bends. A large pull-rope and wire-pulling lubricant should be used to facilitate the pulling of wires.

## Corrosion Resistant

As a non-metallic, PVC product, there is no risk of corrosion when exposed to soil conditions, or electrochemical and galvanic environments.

## High Tensile and Impact Strengths

Our Duct provides high tensile and impact strengths even in cold weather.

## Direct Burial

Royal Electrical Solutions Duct can be used for direct burial, and requires no additional protection when installed according to the Canadian Electrical Code (CEC). Note: Safety guidelines should be followed with trenching and backfilling operations.

## A Choice of Fittings

We produce a full range of quality fittings to ensure fast, reliable installations.

## Cutting and Joining

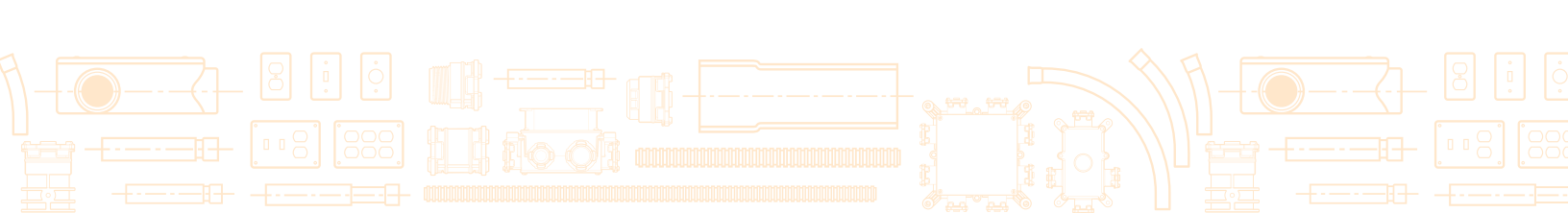
### Cutting

Royal Electrical Solutions Duct can easily be cut with a hacksaw or fine-toothed hand saw. To ensure a square cut, use a mitre box or saw guide. Deburr the cut end using a knife or file.

### Joining – Solvent Cementing

Solvent cement joins are used to connect lengths of duct and fittings. These joints are strong, permanent and leak-proof. Royal Electrical Solutions EcoVoc solvent cement should be used on all connections.





### Solvent cementing procedures are as follows:

1. Deburr the inside and outside diameters of the spigot end of the duct.
2. Remove all dirt and moisture from the outside of the spigot and the inside of the socket.
3. Before applying the cement, push the spigot into the socket to ensure they fit together properly.
4. Apply solvent cement to the outside of the spigot and the inside of the socket.
5. Push the spigot into the socket until it bottoms. Twist it a ¼ turn to ensure that the solvent is spread around the entire joint.
6. Hold together for a few seconds until a joint is created.

Solvent cemented joints may appear to set immediately, but it can take up to 24 hours for the joint to completely cure.

When installing duct in cold weather, a primer should be applied before the EcoVoc solvent cement. Keep the primer and solvent cement warm to prevent them from thickening.

**Note:** EcoVoc solvent cement has a shelf life of 24 months if stored unopened at 22°C (72°F). Check the bottom of the can for the date of manufacture before using.

Number of Joints per Can				
Pipe Size mm (in)	½ Pint (250ml)	Pint (500ml)	Quart (1/L)	Gallon (4/L)
50 (2)	17	35	70	280
75 (3)	15	30	60	240
90 (3½)	13	25	50	200
100 (4)	10	20	40	160
125 (5)	8	15	30	120
150 (6)	5	10	20	80

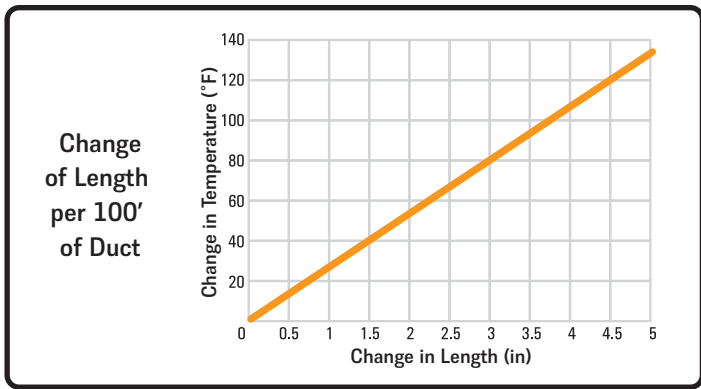
### Expansion and Contraction

Royal Electrical Solutions Duct expands and contracts with extreme variations in temperature. Therefore it is important to allow extra duct footage for contraction at each tie-in when the duct temperature is higher than the surrounding soil temperature. Also allow for expansion when the surrounding soil temperature is higher than the duct temperature. When backfilling, start at the tie-in point and work to the end of the duct run.



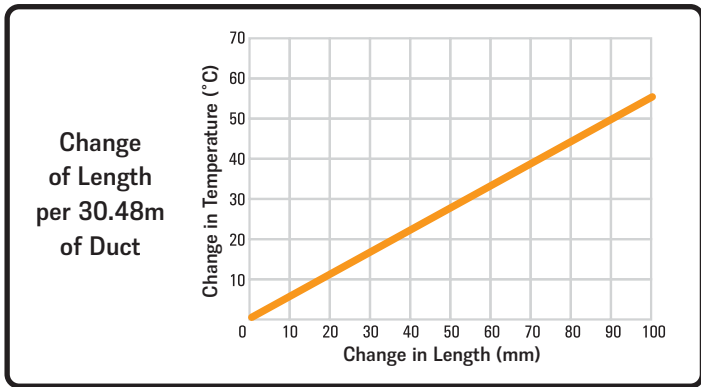
### Expansion Joints - Temperature Change

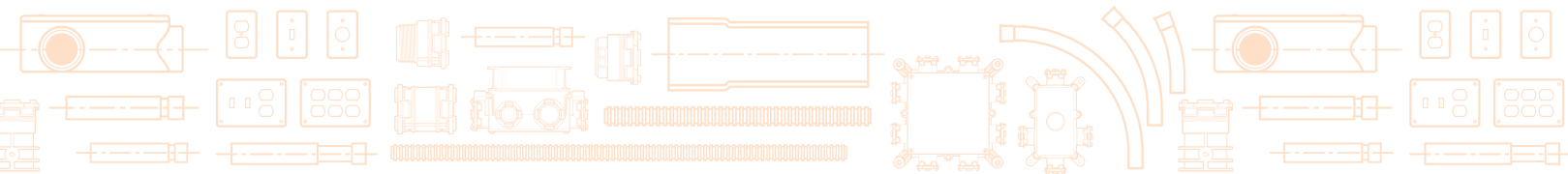
Use expansion joints if the duct will be permanently exposed (e.g. bridge crossings). Typically the PVC duct will contract or expand 10 mm (¾-inch) per 30.48 metres (100 feet) of duct for every 5.5°C (10°F) of temperature change.



### Thermal Expansion

The co-efficient of thermal expansion for Royal PVC duct is  $5.4 \times 10^{-5}$  mm/mm/°C ( $3.0 \times 10^{-5}$  in/in/°F). To calculate the expansion and contraction of a buried or encased system, use 50% of the thermal expansion coefficient.





## Installation Guidelines – Direct Burial

### Trench Bottom

The trench bottom should be firm and graded to support the duct bank. Remove all lumps, ridges, depressions and stones on the trench bottom to prevent point loads on the duct.

When installing a duct bank in rock or shale, excavate an additional 75mm (3-inches) below the desired depth. Place and compact with 75mm (3-inches) of backfill to create a uniform, level bedding surface.

When soil conditions are poor, such as marshy or swampy areas, test for soil strength. It may be necessary to remove some of the soil and replace it with crushed stone or gravel. Alternatively you may lay down timbers or a concrete base to create an even bedding surface that will support the duct.



Direct Burial Application.

### First Tier

Place the first tier of duct in the trench, then backfill and tamp around it. Remove any wood combs used for spacing during installation as the backfill is being placed and tamped.

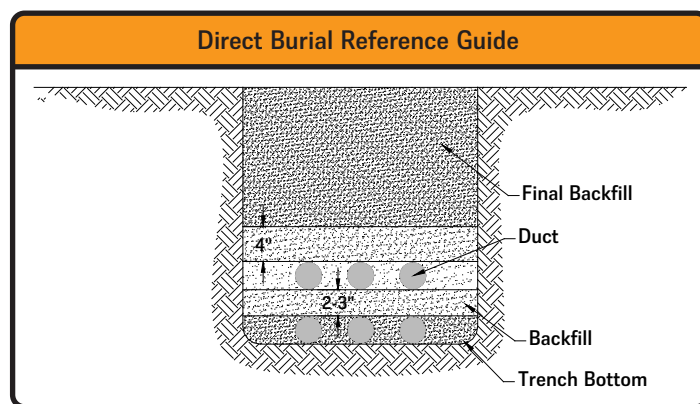
Backfill should not contain any stones larger than 10 mm (3/8-inch). Tamp the backfill around ducts to provide maximum supporting strength. Backfill over the duct to the required thickness and tamp with a hand tamper. The thickness of backfill between tiers of duct is determined in the design process. Typically it ranges from 50 to 75 mm (2- to 3-inch). Refer to the project design specifications for details.

### Additional Tiers

Place the next tier on top of the first using the procedure outlined above. Repeat until the required number of tiers is reached.

### Final Backfill

Once the final tier of duct is placed, place a 100mm (4-inch) thick lift of backfill over the duct banks: stones should be no larger than 10mm (3/8-inch). Tamping this layer is optional. Refer to the design specifications for each installation. Then place backfill in 100 to 300mm (4- to 12-inch) lifts, compacted with a hand or pneumatic tamper to specified compaction. Apply 300mm (12-inches) of backfill over the duct. At this point the backfill can have some stones in it.



### Notes:

Spacers should not be used with duct when it is being direct buried, as they create point supports, not the continuous bedding support required. Duct should not be direct buried in road crossing applications. Consult the project engineer regarding installing duct in road crossing applications.

## Installation Guidelines – Concrete Encased I: Concrete Encased (With Spacers)

### Trench Bottom

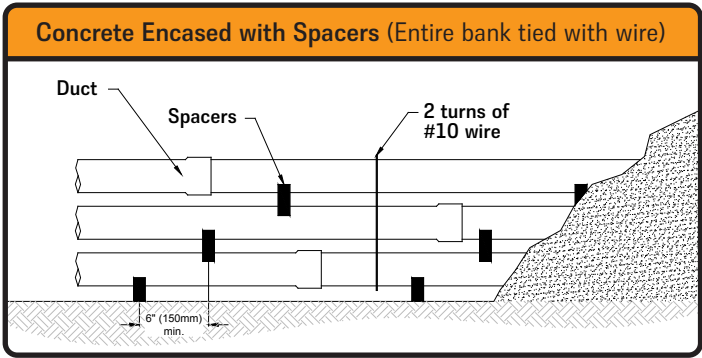
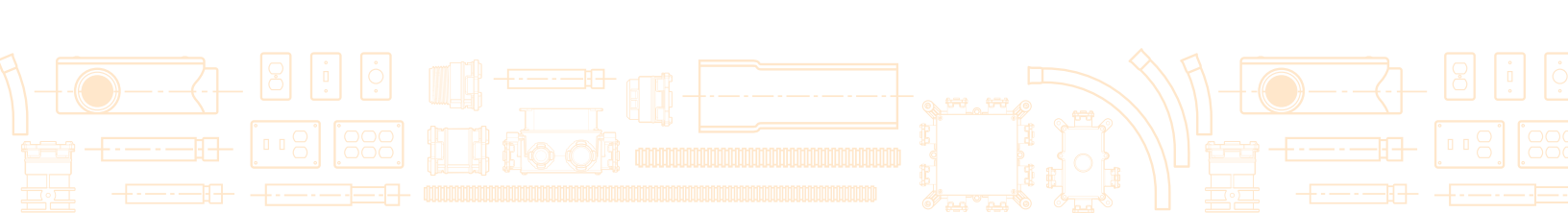
Dig the trench slightly wider than the width of the duct bank. The trench bottom should be firm and graded to support the duct banks. Pour a 75mm (3-inch) thick, graded and smoothed concrete foundation.

### Separation of Spacers

When it is essential for spacing to be even horizontally and vertically in the duct bank, use MonoBloc or Vertical Lock spacers to provide the separation required between runs of duct.

### First Tier

Place spacers on the trench bottom and lay the first tier of duct before the concrete foundation has taken its initial set. Place the next layers of spacers and duct on top of the first. Continue in this manner until you reach the required number of ducts. Use wire to tie the entire bank of ducts together.



Stagger the spacers on each tier (see drawing on the next page). Each MonoBloc spacer should be placed approximately every 2.4 metres (8 feet). Vertical Lock spacers require a spacing of 1.7 metres (5.5 feet).

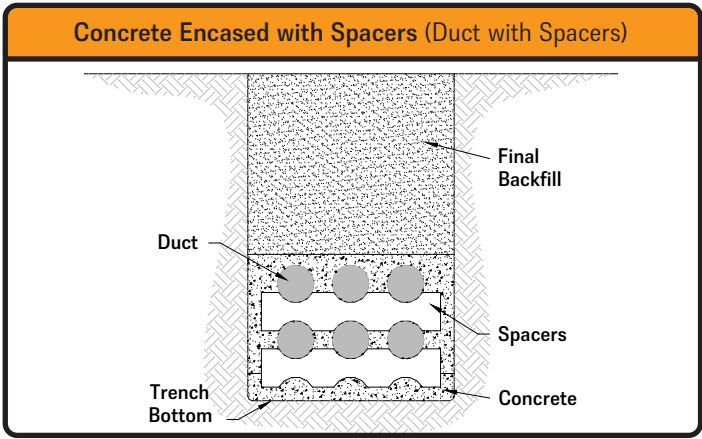
**Pouring the Concrete and Backfill**

Use caution when pouring the concrete. Do not allow a large mass of concrete to fall on the duct. Use a plank or board to direct the concrete down the sides of the duct bank to the bottom of the trench. The concrete will flow into the centre of the duct bank and fill up all void spaces. To ensure all voids are eliminated, work a long, flat slicing bar or spatula up and down the vertical rows of duct.

Backfill with excavated soil once the concrete has set.

**Pressure Grouting**

When using pressure grouting to encase duct in concrete, use extreme caution. Excessive pressure and/or high temperatures during pressure grouting can cause the ducts to collapse.



**II: Concrete Encased Tier by Tier (without spacers)**  
**Trench Bottom**

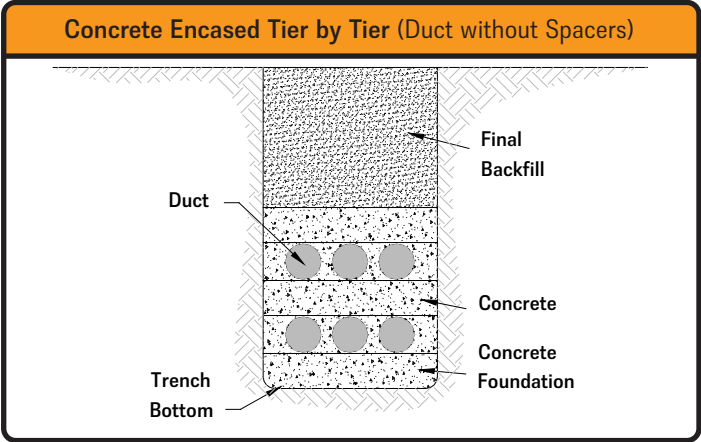
Dig the trench slightly wider than the width of the duct bank. The trench bottom should be firm and graded to support the duct banks. Pour a 75mm (3-inch) thick, graded and smoothed concrete foundation.

**First Tier**

Lay the first tier of duct on the concrete foundation. They should be spaced with 2 wood combs per duct length. Pour the concrete on the first tier until it is level with the top of the combs. Remove the combs and fill any voids with concrete. Tamp the concrete to achieve an even surface. Repeat this procedure for each tier of duct being installed.

If the concrete is allowed to set before the next tier is placed, the concrete will be stronger and denser and the alignment of the duct will be straighter. However, the concrete is more likely to heave and separate in frost conditions. A satisfactory bond between layers of concrete can be achieved if successive tiers of duct are laid before the concrete has set and the dry concrete is tamped.

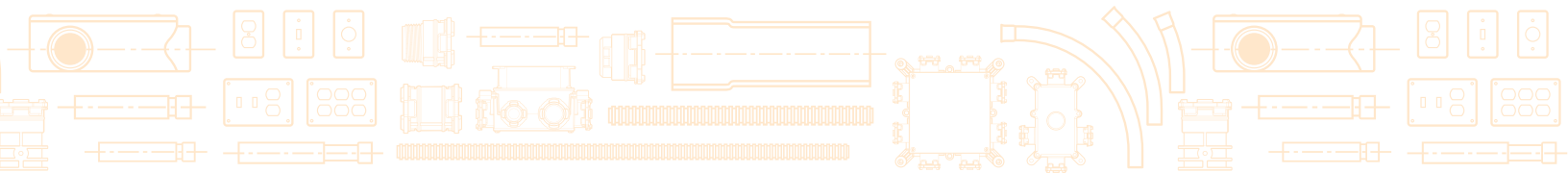
Once the duct bank is constructed, backfill with excavated soil.



**Field Bending**

Duct has some flexibility that allows for bending in the field for minor changes in elevation and direction. The table below shows the allowable offset for bending duct.

Allowable Offset		
Pipe Size mm (in)	Max. Allowable Offset For 10' Length mm (in)	Max. Allowable Offset For 20' Length mm (in)
50 (2)	508 (20)	2,007 (79)
75 (3)	356 (14)	1,422 (56)
90 (3½)	305 (12)	1,245 (49)
100 (4)	279 (11)	1,092 (43)
125 (5)	178 (7)	889 (35)
150 (6)	178 (7)	737 (29)



## Fittings – Spacers and Push-fit Couplings

Royal Building Products, Electrical Solutions offers a complete line of fittings for use with our duct pipe, including sweep bends, plugs, couplings, end bells, caps and adapters.

### Spacers

Our product offerings include two styles of placers: Vertical Lock and MonoBloc. Vertical Lock spacers allow for any number of ways in each duct bank.



Cost-effective, flexible and durable, MonoBloc spacers simplify the installation of duct banks. They can be used as both base and intermediate spacers, but cannot be more than 4 ways in each row. They are also available in a wide range of sizes and configurations. Since they are constructed from HDPE (high density polyethylene), they resist corrosion and deterioration.



### Polyethylene Push-Fit Couplings

These couplings are used to rapidly assemble cut lengths of duct pipe being encased in concrete. To install these couplings, push the spigot end of the duct into the coupling socket. Place a piece of wood on the end of the coupling, and hammer lightly until the end of the duct butts up against the inside shoulder of the fitting.

**Note:** Polyethylene push-fit couplings are not watertight and are only recommended for use with Duct encased in concrete.

## Dimensions

### CSA DB2/ES2

Nominal Size in (mm)	Avg. Outside Diameter in (mm)	Avg. Inside Diameter in (mm)	Avg. Wall Thickness in (mm)	Approx. Weight lb/100ft (kg/m)
2 (50)	2.250 (57)	2.090 (53)	0.080 (2)	34 (0.506)
3 (75)	3.250 (83)	3.056 (78)	0.097 (2)	60 (0.893)
3½ (90)	3.730 (95)	3.522 (89)	0.104 (3)	80 (1.190)
4 (100)	4.216 (107)	3.978 (101)	0.119 (3)	96 (1.429)
5 (125)	5.299 (135)	4.989 (127)	0.155 (4)	155 (2.307)
6 (150)	6.275 (159)	5.949 (151)	0.163 (4)	216 (3.214)

### CSA DB2/ES2 - Split Duct

Split duct can be used to install duct around existing cables and to repair damaged duct without cutting and splicing the cables.

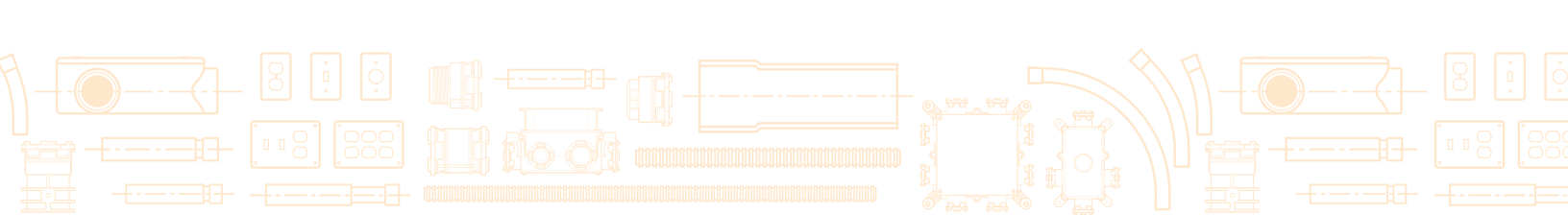
Nominal Size in (mm)	Avg. Outside Diameter in (mm)	Avg. Inside Diameter in (mm)	Approx. Weight lb/100ft (kg/m)
2 (50)	2.250 (57)	2.090 (53)	71 (1.06)
3 (75)	3.250 (83)	3.056 (78)	148 (2.20)
3½ (90)	3.730 (95)	3.522 (89)	178 (2.65)
4 (100)	4.216 (107)	3.978 (101)	211 (3.14)
5 (125)	5.299 (135)	4.989 (127)	285 (4.24)

## Rigid PVC Conduit, Duct & ENT PVC Solvent Cement and Primer - Low VOC/Premium Grade Clear

### Why use Low VOC Solvent Cements and Primers?

Solvent Cement and Primer products contain hazardous chemicals and volatile organic compounds (VOC's), which emit smog-forming chemicals that can be harmful to users or installers and to our environment. Most of these products pollute indoor and outdoor air quality causing respiratory and eye irritation. Substituting with a Low VOC Solvent Cement and a Primer reduces the VOC emissions and improves the air quality.

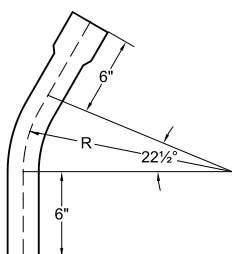




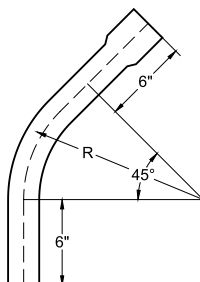
## Bends

### Bends (22.5°, 45°, 90°)

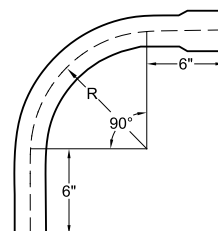
22.5°



45°



90°

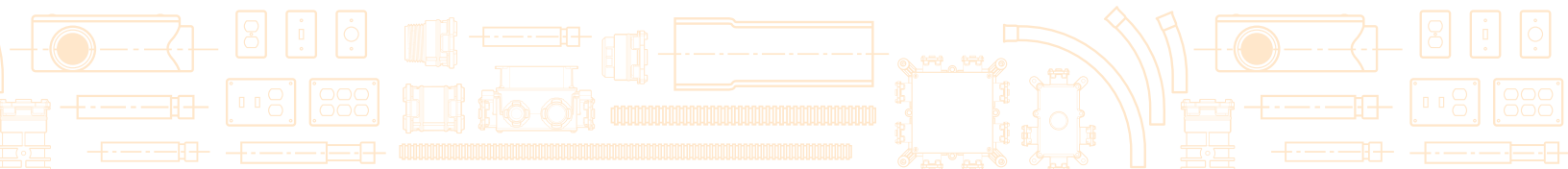


### Available Sizes of Bends

Nominal Pipe Size in (mm)	Radius of Bend in (mm)			
	24 (610)	36 (915)	42 (1,070)	60 (1,525)
2 (50)	22½°, 45°, 90°	22½°, 45°, 90°	-	-
3 (75)	22½°, 45°, 90°	22½°, 45°, 90°	-	-
3½ (90)	22½°, 45°, 90°	22½°, 45°, 90°	-	-
4 (100)	22½°, 45°, 90°	22½°, 45°, 90°	-	22½°, 45°, 90°
5 (125)	-	-	22½°, 45°, 90°	-
6 (150)	-	-	-	22½°, 45°, 90°

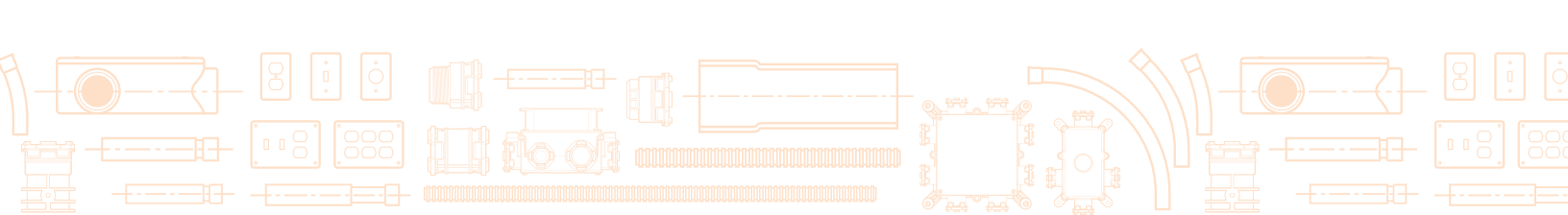
### Laying In Length of Bends Including 6" (150mm) Tangents

Angle	Radius of Bend in (mm)			
	24 (610)	36 (915)	42 (1,070)	60 (1,525)
2 (50)	22½°, 45°, 90°	22½°, 45°, 90°	-	-
3 (75)	22½°, 45°, 90°	22½°, 45°, 90°	-	-
3½ (90)	22½°, 45°, 90°	22½°, 45°, 90°	-	-










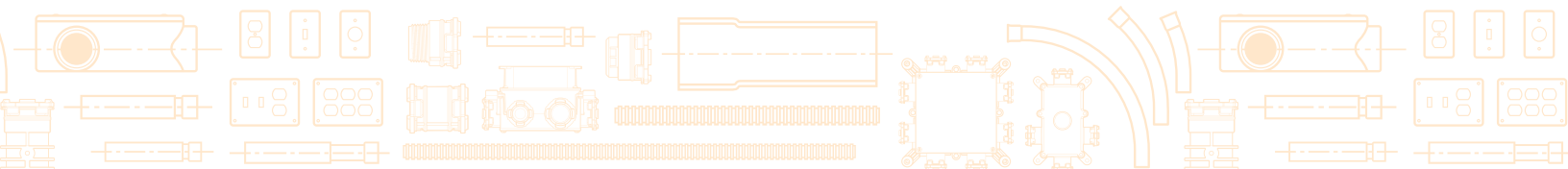
## Duct Fittings

Description	Product Number	UPC Number	Size	Carton Quantity
90° Long Sweep Bend 	90B2x24	41410	2 x 24	100
	90B2x36	41416	2 x 36	100
	90B2x60	41422	2 x 60	100
	90B3x24	41464	3 x 24	100
	90B3x36	41476	3 x 36	100
	90B3x60	41494	3 x 60	100
	90B35x24	41647	3½ x 24	70
	90B35x36	41650	3½ x 36	70
	90B35x60	41653	3½ x 60	70
	90B4x24	41560	4 x 24	70
	90B4x36	41566	4 x 36	70
	90B4x60	41584	4 x 60	70
	90B5x42	41608	5 x 42	20
	90B5x60	41614	5 x 60	20
	90B6x60	41638	6 x 60	15
45° Long Sweep Bend 	45B2x24	41392	2 x 24	100
	45B2x36	41398	2 x 36	100
	45B3x24	41434	3 x 24	100
	45B3x36	41440	3 x 36	100
	45B35x36	41452	3½ x 36	70
	45B4x24	41530	4 x 24	70
	45B4x36	41536	4 x 36	70
	45B4x60	41548	4 x 60	70
	45B5x42	41602	5 x 42	35
	45B6x60	41626	6 x 60	20
22½° Long Sweep Bend 	22B3x24	41428	3 x 24	-
	22B3x36	41429	3 x 36	-
	22B4x36	41512	4 x 36	-
	22B5x42	41590	5 x 42	-
Universal Plug (With pulling eye) 	PLUG02	42010	2	176
	PLUG03	42016	3	200
	PLUG04	42028	4	180
	PLUG05	42040	5	100
	PLUG06	42026	6	90
Tapered Poly Plug (With pulling eye) 	DRP02	41914	2	100
	DRP03	41920	3	100
	DRP035	41926	3½	100
	DRP04	41932	4	100
	DRP05	41938	5	50
	DRP06	41944	6	35
Reducing Coupling 	RC3x2	41860	3 x 2	25
	RC4x2	41872	4 x 2	20
	RC4x3	41878	4 x 3	20
	RC4x35	41884	4 x 3½	20
	RC5x4	41890	5 x 4	20
	RC6x4	41896	6 x 4	25




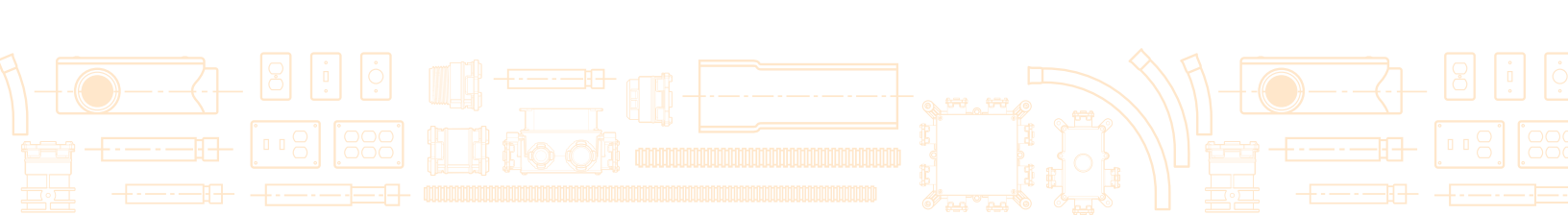
## Duct Fittings

Description	Product Number	UPC Number	Size	Carton Quantity
Push Fit Poly Coupling 	PFC02	41782	2	200
	PFC03	41788	3	100
	PFC035	41794	3½	150
	PFC04	41800	4	100
	PFC05	41812	5	50
	PFC06	41818	6	35
Push Fit Poly 5° Coupling 	PFC503	41824	3	100
	PFC5035	41827	3½	90
	PFC504	41830	4	100
	PFC505	41836	5	45
Solvent Weld PVC Coupling 	SWC02	42232	2	25
	SWC02L	42234	2 LONG	25
	SWC03	42238	3	50
	SWC03L	42239	3 LONG	50
	SWC035	42244	3½	50
	SWC04	42250	4	40
	SWC04L	42253	4 LONG	40
	SWC05	42256	5	25
Solvent Weld PVC 5° Coupling 	SWC502	42274	2	-
	SWC503	42280	3	-
	SWC5035	42286	3½	-
	SWC504	42292	4	40
	SWC504L	42293	4 LONG	40
	SWC505	42304	5	20
	SWC506	42310	6	-
Bell End 	BEL02	41260	2	50
	BEL03	41266	3	60
	BEL035	41272	3½	20
	BEL04	41278	4	60
	BEL05	41284	5	30
	BEL06	41290	6	60
Cap 	CAP02	41296	2	25
	CAP03	41302	3	20
	CAP035	41308	3½	25
	CAP04	41314	4	50
	CAP05	41320	5	10
	CAP06	41326	6	10
Terminator - Bell End Fitting (With Knockout Plug) 	TERM35	41982	3½	-
	TERM04 (w/holes)	41986	4	60





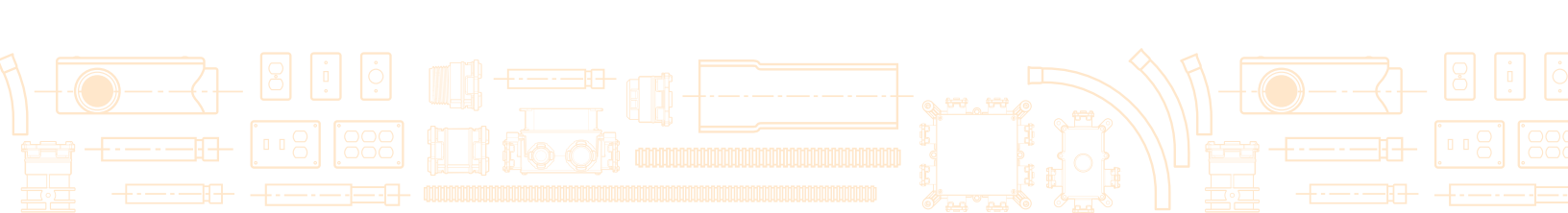
## Duct Fittings

Description	Product Number	UPC Number	Size	Carton Quantity
Female Adapter 	FEMA02	41350	2	25
	FEMA03	41356	3	25
	FEMA035	41362	3½	-
	FEMA04	41368	4	20
	FEMA05	41374	5	-
	FEMA06	41380	6	-
Expansion Joint 	EXPJ02	41332	2	-
	EXPJ03	41338	3	-
	EXPJ035	41345	3½	-
	EXPJ04	41344	4	-
Adapter to A.C. or Fiber Type 1 	ADAP35	41996	3½	-
	ADAP04	41998	4	25
Rigid PVC Conduit Adapter 	ARIG02	41200	2	25
	ARIG03	41206	3	30
	ARIG03L	41207	3 LONG	30
	ARIG035	41214	3½	50
	ARIG04	41218	4	40
	ARIG04L	41219	4 LONG	40
	ARIG05	41236	5	20
	ARIG06	41248	6	12
Reducing Adapter Duct to Rigid PVC Conduit 	ARIG3X2	41212	3 x 2	15
	ARIG3X2L	41213	3 x 2 LONG	15
	ARIG4X2	41224	4 x 2	40
	ARIG4X3	41230	4 x 3	15
Split Y (Wyes) 	SPLY02	41965	2	-
	SPLY03	41968	3	AS
	SPLY035	41969	3½	REQUIRED
	SPLY04	41974	4	-



## Duct Fittings

Description	Product Number	UPC Number	Size	Carton Quantity
Intermediate Vertical Lock Spacer 	IS2015	42136	2 x 1½	350
	IS2020	42142	2 x 2	300
	IS2030	42148	2 x 3	200
	IS3015	42154	3 x 1½	225
	IS3020	42160	3 x 2	200
	IS3030	42166	3 x 3	125
	IS4010	42172	4 x 1	200
	RIS4015*	41902	4 x 1½	140
	RIS4020*	41908	4 x 2	125
	IS4030	42190	4 x 3	90
	IS5015	42196	5 x 1½	100
	IS5020	42202	5 x 2	100
	IS5030	42208	5 x 3	80
	IS6015	42214	6 x 1½	100
	IS6020	42220	6 x 2	90
	IS6030	42226	6 x 3	70
* FOR DB2/PVC				
Base Vertical Lock Spacer 	BS2015	42052	2 x 1½	250
	BS2020	42058	2 x 2	225
	BS2030	42062	2 x 3	200
	BS3015	42070	3 x 1½	175
	BS3020	42076	3 x 2	155
	BS3030	42082	3 x 3	150
	BS4010	42084	4 x 1	175
	RBS4015*	41848	4 x 1½	140
	RBS4020*	41854	4 x 2	140
	BS4030	42094	4 x 3	120
	BS5015	42100	5 x 1½	120
	BS5020	42106	5 x 2	120
	BS5030	42112	5 x 3	100
	BS6015	42118	6 x 1½	100
	BS6020	42114	6 x 2	100
	BS6030	42130	6 x 3	95
* FOR DB2/PVC				

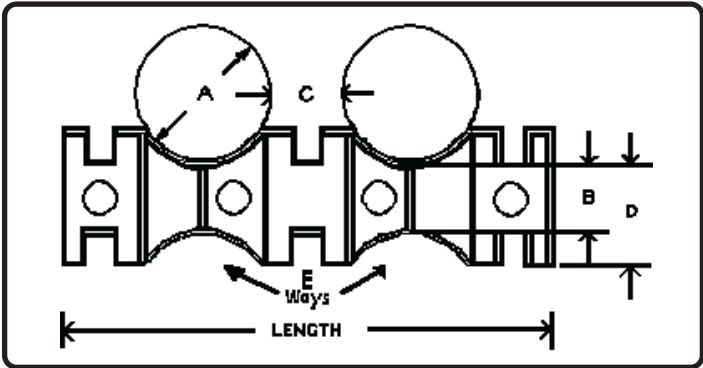


### MonoBloc Spacers

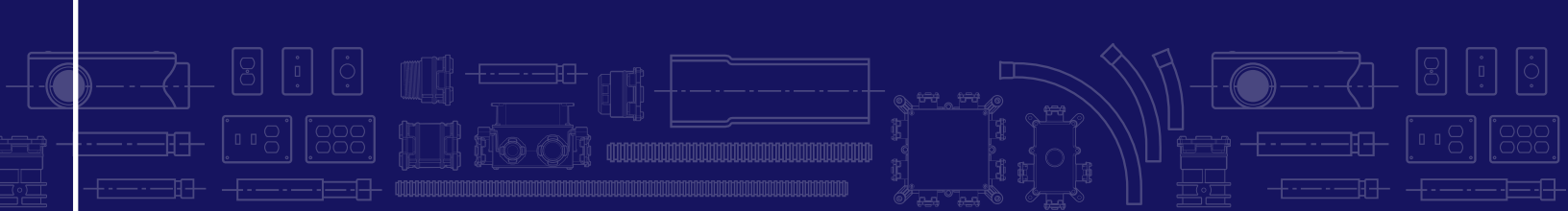
Description		Product Number	Length (inches)	Quantity Per Bundle	Quantity Per Pallet
3½" x 1" x 1" x 2"	2-Way	DMB351122	12.5	25	1,100
3½" x 1" x 1" x 2"	3-Way	DMB351123	16.9	25	800
3½" x 1" x 1" x 2"	4-Way	DMB351124	21.5	25	800
4" x 2" x 2" x 3"	2-Way	DMB42232	14.3	25	600
4" x 2" x 2" x 3"	3-Way	DMB42233	20.5	25	400
4" x 2" x 2" x 3"	4-Way	DMB42234	27.0	25	400
4" x 3" x 3" x 3"	2-Way I	DMB43332	15.0	25	400
4" x 3" x 3" x 3"	2-Way B	DMB43332B	15.0	25	400
4½" x 2" x 2" x 3"	2-Way	DMB452232	15.5	25	500
4½" x 2" x 2" x 3"	3-Way	DMB452233	22.2	25	400

Table Selection (in inches)

Nominal Pipe Size (A) mm (in)	Vertical Spacing (B) in (mm)	Horizontal Spacing (C) mm (in)	Ground Clearance (D) mm (in)	Number of Ways
88 (3½)	25 (1)	25 (1)	50 (2)	2, 3 or 4
100 (4)	50 (2)	50 (2)	75 (3)	2, 3 or 4
100 (4)	75 (3)	75 (3)	75 (3)	2
113 (4)	50 (2)	50 (2)	75 (3)	2 or 3



This comprehensive brochure was created with engineers, contractors, electricians and utilities in mind. It includes applications, benefits, design and installation guidelines for our high quality rigid PVC conduit and fittings. There is a complete section devoted to our fittings that includes dimensions, product codes and drawings for each fitting we offer. We hope that you find this manual useful in designing your next conduit system.



Our various pipe and fittings solutions have been manufactured to meet the needs of our customers and their applications. Contact one of the below Sales Centres for more information:

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#### Connect Telecommunications Solutions Inc.

650 Rupert St | Waterloo, ON | N2V 2R8  
Toll Free: 1-877-900-7996

Phone: 519.748.4411 Fax: 519.748.0466  
[customerservice@connect-telcom.com](mailto:customerservice@connect-telcom.com)  
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