Marley ARMA™ Rigid Conduit Systems

1) PRODUCT SPECIFICATION

Marley ARMA rigid conduit and fittings are manufactured from selected PVC resin and impact modifiers. Marley ARMA Rigid Conduit and fittings are manufactured in accordance with AS/NZS 61386.21 and carry the Bureau Veritas Licence Number 2755.

Marley ARMA conduit is classified as Heavy Duty (4431) for resistance to compression and impact forces at temperatures -15 to 60˚C.

Marley ARMA fittings are also Heavy Duty rated.

WEATHER DURABILITY

Marley ARMA Above Ground Conduit (Grey):

Has been developed to meet the durability and weather performance of the New Zealand Building Code B2. Marley ARMA Above Ground Conduit is manufactured to meet the requirements of AS/NZS 61386.21. It is also UV stabilised to meet the conduit suitability requirements for AS/NZS 5033 (Installation and safety requirements for photovoltaic (PV) arrays).

Marley ARMA Below Ground Conduit (Orange):

Uses the same weatherable impact modifier as Marley ARMA Above Ground Conduit but is not recommended for long term exposure to UV radiation. It does meet the durability requirements of New Zealand Building Code B2 for interior or concealed applications.

RESISTANCE TO BURNING

Marley ARMA Rigid Conduit systems is classified by AS/NZS 61386.21 as being a 'non-flame propagating' conduit.

CHEMICAL RESISTANCE

Marley ARMA Rigid Conduit Systems are highly resistant to common corroding agents such as acids and alkalis however they should not be used if likely to be exposed to solvents such as ketones, esters, aromatic and chlorinated hydrocarbons.

RESISTANCE TO EXPANDED POLYSTYRENE INSULATION (EPS)

Marley ARMA Rigid Conduit systems is suitable for use in contact with EPS insulation and building panels. The phenomenon of plasticizer migration that can occur when PVC insulated cables are in contact with EPS does not occur with Marley ARMA Rigid Conduit systems, and the conduit provides a suitable protection between the cable and the EPS.

2) DESIGN DETAILS

TEMPERATURE AND EXPANSION

It is recommended that the continuous service temperature does not exceed +60°C or fall below -15°C.

PVC has a relatively high co-efficient of thermal linear expansion and allowance should be made for this. It is recommended that a minimum of 0.7mm movement per metre of length per 10°C change in temperature should be provided for. Long runs require flexible couplings on each standard length, especially if the run is likely to be subjected to wide temperature variations. Failure to provide for this can result in pipes buckling and/or joints breaking. To ensure that the flexible coupling functions correctly, saddles should be fixed not more than 150mm either side of the coupling.

Saddles should not be tightened to the extent as to prevent longitudinal movement of the pipe. Where there are wide temperature variations conduit clips are recommended, with the true expansion being calculated to ensure adequate movement is allowed for.

CHANGE IN TEMPERATURE °C	CHANGE IN LENGTH OF 4 METRE LENGTH (mm)
15	4.2
20	5.6
25	7.0
30	8.4
35	9.8
40	11.2

Example 1: Using the above table for an example of a 12 metre run installed in a roof space during winter with an ambient temperature of 2°C and an expected summer ambient temperature of 27°C.

- Allow for 25°C change in temperature.
- Therefore with a 25°C change in temperature, the change in pipe length will be 7.0mm for a 4m length of conduit.
- 7.0mm x 3 lengths of conduit = 21.0mm potential change in length.

IP CLASSIFICATION

The IP rating (or International Protection Rating, also referred to as Ingress Protection Rating) consists of the letters IP followed by two digits. It is defined by IEC 60529 and classifies the degree of protection against the intrusion of a solid object (eg hands, fingers, screwdriver and dust) as the first numeral and protection against water as the second numeral.

PROTECTION AGAINST INGRESS OF SOLID OBJECT		PROTECTION AGAINST HARMFUL INGRESS OF WATER	
	REQUIREMENTS		PRESCRIPTIONS
0	No protection	0	No protection
1	Full penetration of 50mm diameter sphere not allowed. Contact with hazardous parts not permitted	1	Protected against vertically falling drops of water. Limited ingress permitted
2	Full penetration of 12.5mm diameter sphere not allowed. The jointed test finger shall have adequate clearance from hazardous parts	2	Protected against vertically falling drops of water with enclosure tilted 15° from the vertical. Limited ingress permitted
3	The access probe of 2.5mm diameter shall not penetrate	3	Protected against sprays to 60° from the vertical. Limited ingress permitted
4	The access probe of 1mm diameter shall not penetrate	4	Protected against water splashed from all directions. Limited ingress permitted
5	Limited ingress of dust permitted	5	Protected against jets of water. Limited ingress permitted
6	Totally protected against ingress of dust	6	Protected against strong jets of water. Limited ingress permitted
		7	Protected against the effects of immersion between 15cm and 1m
		8	Protected against long periods of immersion under pressure

As per AS/NZS 3000 Appendix G

IP ratings are often specified for projects and it is important to know that generally any IP rating higher than the one specified will be sufficient for the application. For example, if IP56 is specified you could use IP66, but not IP65 (as the 2nd numeral indicating water protection is too low).

A fully solvent cemented Marley ARMA Rigid Conduit System will provide an IP rating of 67. A full list of the IP ratings for various Marley ARMA Rigid Conduit Systems are shown in the table to the right.

MARLEY ARMA RIGID CONDUIT SYSTEM	IP RATING
Fully solvent cemented Marley ARMA Rigid Conduit System	IP67
Marley ARMA Access Pit 250mmx250mm (1SD4469)	IP67
Marley ARMA circular junction boxes (screwed lid solvent cemented or with 'o'rings)	IP66
Marley ARMA Enclosure Boxes (with gaskets)	IP55
Marley ARMA circular junction boxes & inspection fittings (screwed lid without solvent cement or 'o' rings)	IP53

CABLE CARRYING CAPACITY

The maximum amount of cables that may be enclosed in a conduit shall be an amount which permits installation of the cable without damage, as per NZECP 28 clause 5.6. The number of cables that can be installed in a circular conduit is determined by the ratios of the cross sectional areas of the enclosure and the cable, as follows:

$$\textbf{Number of cables} = \frac{\text{Internal cross-section of enclosure}}{\text{Cross-sectional area of cable}} \times \text{space factor}$$

The space factor as per AS/NZS 3000 Appendix C6 recognises the reduction of space available from the circular geometry of the cables and enclosures.

NUMBER OF CABLES	SPACE FACTOR
FOR ONE CABLE IN ENCLOSURE	0.5
FOR TWO CABLES IN ENCLOSURE	0.33
FOR THREE OR MORE CABLES IN ENCLOSURE	0.4

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MINIMUM INTERNAL CROSS SECTIONAL AREA OF ENCLOSURE (mm^2)

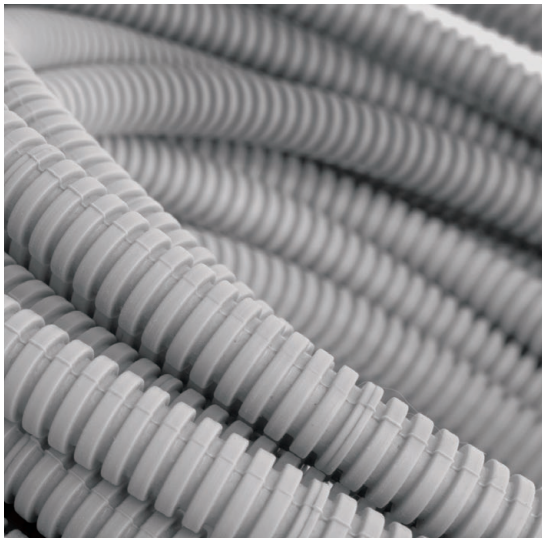
NOMINAL SIZE	MEAN OD (mm)	HEAVY DUTY AREA
20	19.7 - 20.0	189
25	24.7 - 25.0	330
32	31.7 - 32.0	568
40	39.7 - 40.0	924
50	49.7 - 50.0	1486

Refer next page for reference tables to determine the max. number of cables allowable in a conduit by cable type.

The following tables show examples of the maximum number of cables that may be used in Marley ARMA rigid conduit by cable type. The number of cables does not consider the effects the grouping of cables may have on temperature rise, voltage drop or current carrying capacity and reference should be made to AS/NZS 3008 for de-rating factors. This maximum number is based on short runs of conduit free of obstructions with minimal changes in direction. Where this is not the case the number of cables should be reduced or the conduit size increased to ensure that the maximum pulling tension is not exceeded.

GUIDE TO THE MAXIMUM NUMBER OF SINGLE-CORE SHEATHED CABLES INSTALLED IN CONDUIT

CABLE SIZE (mm^2)	HEAVY DUTY uPVC CONDUIT				
PVC/PVC V90	20	25	32	40	50
1	6	10	17	28	45
1.5	5	8	14	23	38
2.5	3	6	11	17	28
4	2	4	7	12	20
6	1	3	6	10	17
10	1	2	4	7	11
16	1	1	3	5	8
XLPE/PVC	20	25	32	40	50
25	0	1	1	3	5
35	0	1	1	2	4
50	0	1	1	1	3
70	0	0	1	1	2
95	0	0	1	1	1
120	0	0	0	1	1
150	0	0	0	1	1
185	0	0	0	0	1
240	0	0	0	0	1
300	0	0	0	0	1



GUIDE TO THE MAXIMUM NUMBER OF TWO-CORE AND EARTH CABLES INSTALLED IN CONDUIT

CABLE SIZE (mm^2)	HEAVY DUTY uPVC CONDUIT				
PVC/PVC V90	20	25	32	40	50
1.5	1	1	2	4	7
2.5	1	1	1	3	6
4	0	1	1	2	4
6	0	1	1	2	4
PVC/PVC V75	20	25	32	40	50
10	0	0	1	1	2
16	0	0	1	1	1
25	0	0	0	1	1
PVC/PVC V90 FLAT	20	25	32	40	50
1	1	3	5	9	15
1.5	1	3	5	9	14
2.5	1	1	3	6	10
4	1	1	2	4	7
6	1	1	2	3	6
10	0	1	1	2	4
16	0	0	1	1	2

GUIDE TO THE MAXIMUM NUMBER OF FOUR-CORE AND EARTH CABLES INSTALLED IN CONDUIT

CABLE SIZE (mm^2)	HEAVY DUTY uPVC CONDUIT				
PVC/PVC V90	20	25	32	40	50
1.5	1	1	1	3	5
2.5	0	1	1	2	4
4	0	1	1	1	3
6	0	0	1	1	2
PVC/PVC V75	20	25	32	40	50
10	0	0	0	1	1
16	0	0	0	1	1
25	0	0	0	0	1
35					

3) INSTALLATION DETAILS

FIXING

Where conduits are to be surface mounted, ensure you secure it to the building fabric with the correct size saddles or conduit clips using zinc plated or stainless steel screws into wood or masonry anchors. Galvanised or stainless steel screws may be preferred in exterior or corrosive environments while galvanized nails may be used for securing saddles in most interior applications.

When conduit is being installed on a horizontal plane, it is recommended that saddles be fixed at intervals not exceeding 600mm and 1000mm in a vertical plane. Allow provision for expansion and contraction where required. (See page 17 for temperature & expansion details)

Where conduits are to be embedded in concrete the conduit should be secured from being displaced during pouring and vibrating by securing to the formwork or reinforcing.

BENDING

Marley ARMA Rigid Conduit can be bent in sizes 20 and 25mm. This is achieved by:

1. Inserting the correct size of bending spring.
2. Heating the conduit by briskly rubbing the area to be bent with a piece of cloth.
3. It is advisable to bend slightly beyond the angle required and then ease back to the desired position. This relieves stress and reduces the tendency for the conduit to straighten after bending.

There is a risk of kinking and damage to the bending spring if the conduit is bent too fast. Having completed the bend it should not be forced backwards as this can result in damage to both the conduit and the bending spring.

The recommended minimum radius for all diameters is not less than 6 times the conduit diameter. This will result in a swept bend that is more easily formed and less likely to kink or have a reduction in bore.

In addition, reference should also be made to the cable manufacturers recommendations regarding the maximum radius that the cable in use can be bent to.

CONDUIT OD (mm)	MINIMUM BEND RADIUS (mm)
20	120
25	150
32	200

UNDERGROUND WIRING SYSTEMS

The selection of the correct size and classification of conduit for the application is important in order to comply with the appropriate regulations and standards.

Marley ARMA Rigid Conduit Systems are suitable for use in underground installations and industrial applications where compression and impact resistance is required. They are not recommended where they are likely to be subjected to severe mechanical abuse.

Marley ARMA Rigid Conduit is rated and only ranged as Heavy Duty conduit.

Medium Duty Conduit is not ranged due to the increased labour cost and time incurred with installing additional mechanical protection.

In order to comply with AS/NZS 3000 Australian/New Zealand Wiring Rules the following guidelines apply:

Category A: underground wiring systems may use heavy duty conduit without further mechanical protection.

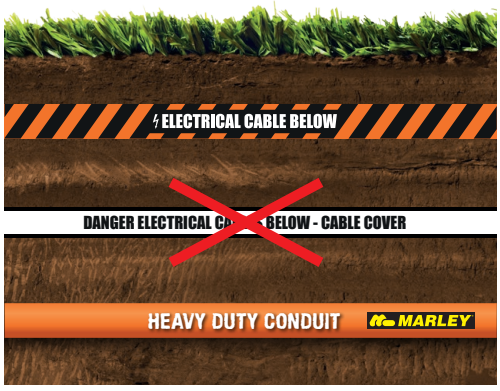
Category B: underground wiring systems may use medium duty conduit with additional mechanical protection.

This additional mechanical protection shall:

1. Be placed not more than 75mm above the wiring system.
2. Be not less than 150mm wide.
3. Overlap the system by at least 40mm on each side.
4. Consist of one or a combination of the following :
   - Precast concrete slabs having a thickness not less than 40mm and a classification of not less than grade 20 in accordance with AS 3600 or NZS 3104
   - Concrete slabs cast on-site having a thickness of not less than 100mm
   - A continuous concrete pour having a thickness of not less than 75mm
   - Fibrous cement slabs having a thickness of not less than 12mm
   - Bricks manufactured specifically for the protection of electric cables
   - Polymeric cable cover strip complying with AS 4702
   - Other materials that offer the same degree of protection afforded by the materials in above items.

Refer to clause 3.11.4.3 of AS/NZS 3000 for additional mechanical protection requirements.

There is a requirement to identify underground wiring with orange marker tape complying with AS/NZS 2648.1 laid approximately 50% of the depth of cover above the wiring system.



ENCLOSURE BOXES

Marley ARMA enclosure boxes have been developed to meet the durability and weather performance requirements of the New Zealand Building Code B2. In addition they are UV stabilised.

Features:

- Lids are fitted with nickel plated screws. They are located within the gasketed area to ensure a continuing seal.
- Supplied with neoprene washers for sealing of mounting screws.
- Lightweight compared to metal enclosures.
- Larger high lid versions include zintec gear plate.
- Machining is easy with normal tools. Punching, drilling, filing, sawing and even ultrasonic welding are easily achieved.
- Rated to IP55 when installed according to Marley recommended installation instructions.

FLEXIBLE CONDUIT

SUPA FLEXIBLE CONDUIT

Marley SUPA is manufactured from polypropylene (PP).

TEMPERATURE

It is suitable for applications where the temperature does not exceed +60°C or fall below -5°C.

WEATHER DURABILITY

It meets the requirements of the NZ Building Code Approved Document B2 Clause B2.3 for use within buildings and in wall applications.

DUTY RATING

Marley SUPA is rated as a very light duty flexible conduit.

SUPA KEY DIMENSIONS (mm)

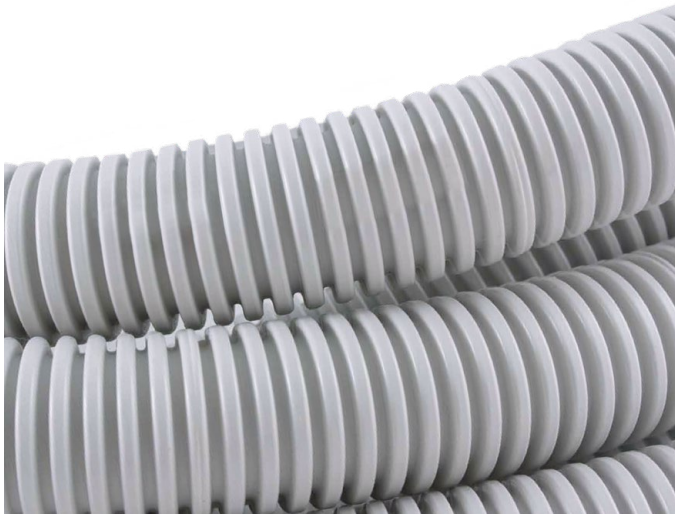
NOMINAL OD	MEAN OD	MINIMUM ID
20	19.85	14.1
25	24.75	18.3

CABLE CARRYING CAPACITY

The following tables show examples of maximum number of cables that may be used in conduit by cable type. The number of cables does not consider the effects the grouping of cables may have on temperature rise, voltage drop or current carrying capacity and reference should be made to AS/NZS 3008 for de-rating factors. This maximum number is based on short runs of conduit free of obstructions with minimal changes in direction. Where this is not the case the number of cables should be reduced or the conduit size increased to ensure that the maximum pulling tension is not exceeded.

GUIDE TO THE MAXIMUM NUMBER OF SINGLE-CORE SHEATHED CABLES INSTALLED IN FLEXIBLE CONDUIT

CABLE SIZE (mm^2)	SUPA FLEXIBLE CONDUIT			
PVC/PVC V90	20	25	32	40
1	4	7	14	23
1.5	3	6	11	19
2.5	2	4	8	14
4	1	3	6	10
6	1	2	5	8
10	1	1	3	5
16	1	1	2	4



GUIDE TO THE MAXIMUM NUMBER OF TWO-CORE AND EARTH SHEATHED CABLES INSTALLED IN FLEXIBLE CONDUIT

CABLE SIZE (mm^2)	SUPA FLEXIBLE CONDUIT			
PVC/PVC V90	20	25	32	40
1.5	1	1	1	3
2.5	0	1	1	3
4	0	1	1	2
6	0	0	1	1
PVC/PVC V75				
10	0	0	1	1
16	0	0	0	1
25	0	0	0	1
PVC/PVC V90 FLAT				
1	1	2	4	7
1.5	1	2	4	7
2.5	1	1	3	5
4	0	1	1	3
6	0	1	1	3
10	0	1	1	1
16	0	0	1	1

GUIDE TO THE MAXIMUM NUMBER OF FOUR-CORE AND EARTH SHEATHED CABLES INSTALLED IN FLEXIBLE CONDUIT

CABLE SIZE (mm^2)	SUPA FLEXIBLE CONDUIT			
PVC/PVC V90	20	25	32	40
1.5	0	1	1	2
2.5	0	0	1	1
4	0	0	1	1
6	0	0	1	1

INSTALLATION

Marley SUPA is designed for use only in above ground applications.

Fixing

Where conduits are to be surface mounted, secure to the building fabric with the correct size saddles or conduit clips using zinc plated or stainless steel screws into wood or masonry anchors. Galvanised or stainless steel screws may be preferred in exterior or corrosive environments while galvanized nails may be used for securing saddles in most interior applications.

Where it is being used in a horizontal plane it is recommend that saddles be fixed at intervals not exceeding 500mm and 1000mm in a vertical plane. Allow provision for expansion and contraction where required.

Joining

Marley SUPA cannot be joined with PVC solvent cement.
Use a conduit gland, plain to screw adaptor, or specialised silicon.

EASI FLEXIBLE CONDUIT

Marley EASI flexible conduit is manufactured from unplasticised polyvinyl chloride (uPVC).

TEMPERATURE

Marley EASI is suitable for applications where the temperature does not exceed +60°C or fall below -5°C.

WEATHER DURABILITY

It meets the requirements of the New Zealand Building Code Approved Document B2 Clause B2.3 for use within buildings and in wall applications.

DUTY RATING

Marley EASI is rated as medium duty in accordance with AS/NZS 2053.

EASI KEY DIMENSIONS (mm)

NOMINAL OD	MEAN OD	MINIMUM ID
20	19.85	14.1
25	24.75	18.3
32	31.75	24.3
40	39.7	31.2
50	49.8	39.6

CABLE CARRYING CAPACITY

The following tables show examples of maximum number of cables that may be used in conduit by cable type. The number of cables does not consider the effects the grouping of cables may have on temperature rise, voltage drop or current carrying capacity and reference should be made to AS/NZS 3008 for de-rating factors. This maximum number is based on short runs of conduit free of obstructions with minimal changes in direction. Where this is not the case the number of cables should be reduced or the conduit size increased to ensure that the maximum pulling tension is not exceeded.

GUIDE TO THE MAXIMUM NUMBER OF SINGLE-CORE SHEATHED CABLES INSTALLED IN FLEXIBLE CONDUIT

CABLE SIZE (mm^2)	EASI FLEXIBLE CONDUIT			
PVC/PVC V90	20	25	32	40
1	4	7	14	23
1.5	3	6	11	19
2.5	2	4	8	14
4	1	3	6	10
6	1	2	5	8
10	1	1	3	5
16	1	1	2	4

GUIDE TO THE MAXIMUM NUMBER OF TWO-CORE AND EARTH SHEATHED CABLES INSTALLED IN FLEXIBLE CONDUIT

CABLE SIZE (mm^2)	EASI FLEXIBLE CONDUIT			
PVC/PVC V90	20	25	32	40
1.5	1	1	1	3
2.5	0	1	1	3
4	0	1	1	2
6	0	0	1	1
PVC/PVC V75				
10	0	0	1	1
16	0	0	0	1
25	0	0	0	1
PVC/PVC V90 FLAT				
1	1	2	4	7
1.5	1	2	4	7
2.5	1	1	3	5
4	0	1	1	3
6	0	1	1	3
10	0	1	1	1
16	0	0	1	1

GUIDE TO THE MAXIMUM NUMBER OF FOUR-CORE AND EARTH SHEATHED CABLES INSTALLED IN FLEXIBLE CONDUIT

CABLE SIZE (mm^2)	EASI FLEXIBLE CONDUIT			
PVC/PVC V90	20	25	32	40
1.5	0	1	1	2
2.5	0	0	1	1
4	0	0	1	1
6	0	0	1	1

INSTALLATION OF EASI FLEXIBLE CONDUIT

Although it is designed for use above ground it can also be used in buried applications. Please refer to the wiring installation standard AS/NZS 3000 for guidance.

Fixing

Where conduits are to be surface mounted, secure to the building fabric with the correct size saddles or conduit clips using zinc plated or stainless steel screws into wood or masonry anchors. Galvanised or stainless steel screws may be preferred in exterior or corrosive environments while galvanized nails may be used for securing saddles in most interior applications.

Where being used in a horizontal plane it is recommend that saddles be fixed at intervals not exceeding 600mm and 1000mm in a vertical plane. Allow provision for expansion and contraction where required.

Where conduits are to be embedded in concrete the conduit should be secured from being displaced during pouring and vibrating by securing to the formwork or reinforcing.

SOLA FLEXIBLE CONDUIT

Marley SOLA flexible conduit is manufactured from unplasticised polyvinyl chloride (uPVC).

TEMPERATURE

Marley SOLA is suitable for applications where the temperature does not exceed +60°C or fall below -5°C.

WEATHER DURABILITY

It meets the requirements of the New Zealand Building Code Approved Document B2 Clause B2.3 for use within buildings and in wall applications. Marley SOLA conduit is suitable for external use.

DUTY RATING

Marley SOLA is rated heavy duty in accordance with AS/NZS 2053 and is suitable for use in photovoltaic installations in accordance with AS/NZS 5033.

SOLA KEY DIMENSIONS (mm)

NOMINAL OD	MEAN OD	MINIMUM ID
20	19.85	12.7
25	24.75	16.5
32	31.75	22.0

INSTALLATION OF SOLA FLEXIBLE CONDUIT

Although it is designed for use above ground it can also be used in buried applications. Please refer to the wiring installation standard AS/NZS 3000 for guidance.

Fixing

Where conduits are to be surface mounted, secure to the building fabric with the correct size saddles or conduit clips using zinc plated or stainless steel screws into wood or masonry anchors. Galvanised or stainless steel screws may be preferred in exterior or corrosive environments while galvanized nails may be used for securing saddles in most interior applications.

Where being used in a horizontal plane it is recommend that saddles be fixed at intervals not exceeding 600mm and 1000mm in a vertical plane. Allow provision for expansion and contraction where required.

Where conduits are to be embedded in concrete the conduit should be secured from being displaced during pouring and vibrating by securing to the formwork or reinforcing.