

**DEVELOPMENT
CONSTRUCTION
SPECIFICATION**

C224

**OPEN DRAINS
INCLUDING KERB & GUTTER (CHANNEL)**

Amendment Record for this Specification Part

This Specification is Council's edition of the AUS-SPEC generic specification part and includes Council's primary amendments.

Details are provided below outlining the clauses amended from the Council edition of this AUS-SPEC Specification Part. The clause numbering and context of each clause are preserved. New clauses are added towards the rear of the specification part as special requirements clauses. Project specific additional script is shown in the specification as italic font.

The amendment code indicated below is 'A' for additional script 'M' for modification to script and 'O' for omission of script. An additional code 'P' is included when the amendment is project specific.

Amendment Sequence No.	Key Topic addressed in amendment	Clause No.	Amendment Code	Author Initials	Amendment Date
<i>EXAMPLE 1</i>	<i>Provision for acceptance of nonconformance with deduction in Payment</i>	<i>XYZ.00</i>	<i>AP</i>	<i>KP</i>	<i>2/6/97</i>
A	No amendments				11/12/2013

SPECIFICATION C224 : OPEN DRAINS, INCLUDING KERB AND GUTTER

GENERAL

C224.01 SCOPE

1. The work to be executed under this Specification consists of the construction, lining and protection of all types of open drains including the construction of rock filled wire mattresses and gabions.
2. This Specification should be read in conjunction with the Specification for STORMWATER DRAINAGE - GENERAL, and other drainage Specifications as applicable:

C221	-	Pipe Drainage
C222	-	Precast Box Culverts
C223	-	Drainage Structures

C224.02 DEFINITION

1. Open drains are all drains other than pipe lines and box culverts and include catch drains, contour drains, diversion drains, table drains, batter drains, swales, channels, gutters and kerbs and gutters.

Definition

C224.03 REFERENCE DOCUMENTS

1. Documents referenced in this specification are listed in full below whilst being cited in the text in the abbreviated form or code indicated.

**Documents
Standards Test
Methods**

(a) Council Specifications

C220	-	Stormwater Drainage - General
C221	-	Pipe Drainage
C222	-	Precast Box Culverts
C271	-	Minor Concrete Works

(b) Australian Standards

AS 1141.22	-	Wet/dry strength variation
AS 1289.5.4.1	-	Compaction control test - Dry density ratio, moisture variation and moisture ratio
AS 1289.5.7.1	-	Compaction control test (rapid method)
AS 1650	-	Hot-dipped galvanised coatings on ferrous articles
AS 2876	-	Concrete kerbs and channels (gutters) - Manually or machine placed

(c) Other

AUSTROADS	-	Guide to Pavement Technology Part 4G: Geotextiles and Geogrids
		Soil & Water Management Plan

UNLINED OPEN DRAINS

C224.04 GENERAL

1. Unless shown otherwise on the Drawings, drains shall be of parabolic or trapezoidal cross section and shall not be less than 300mm deep and have a minimum waterway area of 0.2 square metres. **Shape**
2. Open drains shall be graded to ensure free flow of water and, shall not have a grade of less than 0.5 %. **Grade**
3. Where trees exceeding 1m in girth at 500mm above the ground, trees marked for preservation or rock outcrops occur in the line of a drain, the drain may be neatly diverted if approved by the Principal Certifying Authority. **Trees and Rock Outcrops**
4. Open drains shall be extended as necessary to lead the water clear of the work to natural drainage depressions, culverts, or pits connected to underground drainage systems. The drains shall follow existing watercourses and depressions in the natural surface, unless other locations are shown on the Drawings **Open Drains**
5. All work shall be undertaken in accordance with the requirements of the Specification for CONTROL OF EROSION AND SEDIMENTATION. **Control of Erosion**

C224.05 TYPES

1. Catch drains shall be provided above the tops of cuttings or along the toes of embankments where shown on the Drawings before construction of the adjacent roadway. The edges of catchdrains shall be positioned not be less than 2m from the tops of cuttings or the toes of embankments nor more than is necessary to maintain the fall of the drains. **Catch Drains**
2. Minor diversion and contour drains shall be constructed where shown on the Drawings or directed by the Principal Certifying Authority. Minor diversion drains shall have the same capacity as the nearest pipe culvert on the line of the drain unless otherwise approved by the Principal Certifying Authority. **Diversion & Contour Drains**
3. Table drains, swales and depressed medians shall be constructed to the line and level shown or calculated from the Drawings. Their construction is deemed to be part of earthworks. **Table Drains**
4. Inlet, outlet and diversion channels shall be excavated as shown on the Drawings and, unless indicated otherwise, shall extend to join the existing stream bed in a regular manner, avoiding disturbance in stream flow. The channel shall be excavated to the full width of the structure but the existing stream bed shall be preserved as far as possible outside the limits of the excavation. **Channels**

C224.06 CONSTRUCTION

1. Where the drawings permit the material excavated from drains to be placed on the lower sides of the drains and formed as banks, the material shall be compacted in accordance with AS 1289.5.4.1 to not less than 95% standard compactive effort. **Excavated Material**
2. The Contractor shall ensure that none of the activities associated with the work disturbs any watercourse. Any excavation below the level of the natural channel shall be backfilled with suitable material compacted to a density equal to and compatible with that existing naturally. **Contractor's Responsibility**

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| 3. | Any excess material shall be legally and responsibly disposed of by the Contractor. | <i>Excess Material</i> |
| 4. | Unlined drains and areas adjacent to open drains shall be revegetated immediately after the drains are complete. | <i>Revegetation</i> |

LINED OPEN DRAINS

C224.07 GENERAL

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| 1. | Lined open drains include concrete gutters/channels and kerb and gutter. | |
| 2. | Where shown on the Drawings, open drains shall be lined. Lining shall conform to the profile of the drain and shall be provided as soon as possible after forming the drain. | <i>Profile</i> |
| 3. | Before placing any lining material, the foundation material shall be shaped and compacted to form a firm base for the lining. Other than for kerb and gutter constructed on pavement courses, the relative compaction, as determined by AS 1289.5.7.1 or AS 1289.5.4.1 shall not be less than 95 per cent for standard compactive effort. | <i>Compaction of Foundations</i> |

C224.08 CONCRETE LINING

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| 1. | Concrete lining for open drains shall be cast-in-situ or sprayed concrete supplied and placed in accordance with the Specification for MINOR CONCRETE WORKS. In wet areas weepholes shall be provided in the concrete at intervals as determined by the Principal Certifying Authority. | <i>Method</i> |
| 2. | Contraction joints in concrete lining, consisting of narrow transverse and vertical grooves, 20mm deep, shall be formed neatly in the surface of the freshly placed concrete at intervals of 3m unless otherwise specified by the Principal Certifying Authority. Unless otherwise approved by the Principal Certifying Authority, expansion joints shall be placed at intervals not more than 15m and shall consist of preformed jointing material of bituminous fibreboard and shall be of sufficient depth to fill the joint. | <i>Jointing</i> |

C224.09 STONE PITCHING

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| 1. | Stone Pitching shall consist of sound durable rock not less than 100mm thick, properly bedded on approved loam or sand and mortared to present a uniform surface. The exposed surface of each stone or block shall be approximately flat and not less than 0.05 square metres in area. Spaces between adjacent stones or blocks shall not exceed 20mm in width. | <i>Rock Quality and Placing</i> |
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C224.10 BATTER DRAINS

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| 1. | Batter drains shall be constructed using either half round steel pipes or precast nestable concrete units as shown and detailed on the Drawings. | <i>Type</i> |
| 2. | The units shall be installed in carefully excavated and template controlled trench to produce an even rim line of +0 to -50 mm from the batter line at the underside of topsoil. | <i>Installation</i> |
| 3. | Any over excavation and undulations in the batter line shall be backfilled and both sides of the drain compacted over the full length to form a firm shoulder against the rim of the batter drain. | <i>Compaction</i> |

OPEN DRAINS

4. When topsoil is placed it shall be tapered over a width of 1m to zero thickness at the rim of the drain. Both sides of the drain shall then be turfed for minimum width of 600mm and pinned down as provided in the Specification for LANDSCAPING. **Topsoil and Turfing**

C224.12 KERB AND GUTTER (CHANNEL)

1. Kerb and/or gutters (channel) may be constructed in fixed forms, by extrusion or by slip forming, in accordance with AS 2876. **Method**
2. The foundation, concrete quality, curing and testing details shall be in accordance AS 2876. **Construction Details**
3. The top and face of the finished kerb and gutter shall be true to line and the top surface shall be of uniform width, free from humps, sags or other irregularities. **Finish**
4. The level at any point on the surface of the gutters shall be within ± 10 mm of design levels. When a straight edge 3m long is laid on top of or along the face of the kerb or on the surface of gutters, the surface shall not vary more than 5mm from the edge of the straight edge, except at kerb laybacks, grade changes or curves or at gully pits requiring gutter depression. **Tolerances**
5. Unless shown otherwise on the Drawings, contraction joints, shall be formed every 3m of gutter length for a minimum of 50 per cent of cross sectional area. The joint shall be tooled 20mm in depth to form a neat groove of 5mm minimum width. **Contraction Joints**
6. Unless shown otherwise on the Drawings, expansion joints, 10mm in width for the full depth of the kerb and gutter, shall be constructed at intervals not exceeding 15m and where the gutter abuts against gutter pits, retaining walls and overbridges. Expansion joints shall consist of a preformed jointing material. **Expansion Joints**
7. Where kerbs and/or gutters are cast adjacent with a concrete pavement the same type of contraction, construction and expansion joints specified in the concrete base shall be continued across the kerb and/or gutter. **Adjacent Concrete Pavement**
8. House stormwater outlets shall be provided and/or extended through the kerb for each house which drains to the kerb. **Stormwater Outlets**
9. Where shown on the Drawings or where directed by the Principal Certifying Authority, vehicular and pedestrian access ramps shall be provided which comply with the requirements for access for persons with disabilities. **Vehicular or Pedestrian Access**

ROCK FILLED WIRE MATTRESSES AND GABIONS

C224.13 GENERAL

1. Installation shall be in accordance with the manufacturer's instructions. A geotextile shall be placed between the wire cage and the material being protected. **Location and Geotextile**

C224.14 MATERIALS

1. For wire mattresses and gabions, the galvanising requirements for wire of circular cross section cited in this Clause as 'heavily galvanised', shall comply with the coating mass requirements for wire in AS 1650, type A wire.

(a) Gabions

1. The gabions shall be of the sizes shown on the Drawings and fabricated of woven heavily galvanised wire mesh and PVC coated where specified on the Drawings. Each gabion shall be divided by diaphragms into cells whose length shall not be greater than the width of the gabions plus 100mm. Gabions shall have a nominal mesh size of 80mm x 100mm and body wire shall be a minimum diameter of 2.7mm heavily galvanised with an additional thickness of 0.5mm PVC coating where specified on the Drawings. The minimum core diameters of heavily galvanised selvedge wire and lacing wire shall be 3.4mm and 2.2mm respectively.

Dimensions**(b) Wire Mattresses**

1. Unless specified otherwise, the wire mattresses shall be supplied in units having dimensions of 6m x 2m x 230mm, and shall be cut to suit areas as shown on the Drawings. The mattresses shall be divided by diaphragms into cells of length not exceeding 600mm. Unless otherwise specified, they shall be fabricated of woven heavily galvanised wire and PVC coated where specified on the Drawings..
2. Mattresses shall have a mesh size of 60mm x 80mm and body wire shall be a minimum diameter of 2.0mm heavily galvanised with an additional minimum thickness of 0.5mm PVC coating where specified on the Drawings. The minimum core diameters of heavily galvanised selvedge wire and lacing wire shall be 2.7mm and 2.2mm respectively.

***Mattress
Dimension******Wire
Dimensions*****(c) Geotextile**

1. A chemically and biologically stable geotextile with a minimum strength rating (G) of 1350 and minimum mass of 180 grams per square metre, in accordance with AUSTRROADS Guide to Pavement Technology Part 4G: Geotextiles and Geogrids, shall be used.
2. Samples, manufacturer's specification and instructions on installation shall be submitted to the Principal Certifying Authority seven days before the intended use of geotextile.

Type***Sample*****(d) Rock Fill Material**

1. The rock fill shall consist of clean hard rock with a minimum wet strength of 100 kilonewtons and a maximum wet/dry strength variation of 45 per cent as determined by AS 1141.22.
2. Rock fill for gabions shall have particle sizes between 100mm and 250mm and preferably not greater than 200mm. Rock fill material may be placed by hand or suitable mechanical device to ensure fill is tightly packed with a minimum of voids. Fill material shall be levelled off 25mm to 50mm above the top of the mesh to allow for settlement.
3. Rock fill for wire mattresses shall have particle sizes between 75mm and 150mm and preferably not greater than 125mm. When the mattress is on a slope, rock fill material shall be placed into the units starting from the low end. Units shall be filled slightly overfull to allow for settlement and to provide an even tight and smooth surface of the required contour.

Rock Quality***For Gabions******For Wire
Mattresses***

C224.15 ASSEMBLY AND ERECTION

1. Before laying out the gabions or wire mattresses, filter fabric shall be placed on the founding material. The edges of wire mattresses shall be firmly tied to galvanised star pickets driven a minimum of 900mm into the surrounding ground at 1m maximum intervals and the star pickets cut off level with the top of the mattress. The upstream edge of wire mattresses shall be folded down into a trench of minimum depth 300mm and filled with rock fill. This edge shall be tied to star pickets.

Procedure

LIMITS AND TOLERANCES

C224.16 SUMMARY OF LIMITS AND TOLERANCES

1. The limits and tolerances applicable to the various clauses in this Specification are summarised in Table C230.7 below.

Item	Activity	Tolerances	Spec Clause
1.	Open Drains - General		
	(a) Grading	Grade >1%	C224.04
	(b) Depth	>300mm	C224.04
	(c) Waterway Area	>0.2 sq m	C224.04
	(d) Catch Drain Location	>2m from top of cuttings or toes of embankments	C224.05
2.	Open Drains - Lining		
	(a) Compaction of Foundation	>95% (standard compaction)	C224.07
3.	Stone Pitching		
	(a) Rock Dimensions	>100mm thickness	C224.09
	(b) Exposed Surface Area	>0.05 sq m	C224.09
	(c) Spaces between Stones	<20mm width	C224.09
4.	Batter Drains		
	(a) Rim line	+0, -50 from batter line	C224.10
5.	Kerb and Gutter		
	(a) Level of gutter surface	Level $\leq \pm 10$ mm of design level	C224.12
	(b) Surface uniformity	Deviation of kerb and gutter surface from 3m straight edge ≤ 5 mm	C224.12
6.	Rock Fill for Gabions and Wire Mattresses		
	(a) Wet Strength	>100kN	C224.14d
	(b) Wet/Dry Strength variation	<45%	C224.14d
	(c) Particle size for Gabions	>100mm <250mm	C224.14d
	(d) Fill Level	>25mm <50mm above top of mesh	C224.14d
	(e) Particle size for Wire Mattresses	>75mm <150mm	C224.14d

OPEN DRAINS

Item	Activity	Tolerances	Spec Clause
7.	Erection of Wire Mattresses		
	(a) Star pickets for ties	Depth in ground >900mm Spacing <1m	C224.15
	(b) Trench Depth for upstream edge	Depth >300mm	C224.15

Table C224.1 - Summary of Limits and Tolerances

SPECIFICATION C224 - OPEN DRAINS, INCLUDING KERB AND GUTTER

CLAUSE	CONTENTS	PAGE
GENERAL		1
C224.01	SCOPE	1
C224.02	DEFINITION	1
C224.03	REFERENCE DOCUMENTS	1
UNLINED OPEN DRAINS		2
C224.04	GENERAL	2
C224.05	TYPES	2
C224.06	CONSTRUCTION	2
LINED OPEN DRAINS		3
C224.07	GENERAL	3
C224.08	CONCRETE LINING	3
C224.09	STONE PITCHING	3
C224.10	BATTER DRAINS	3
C224.12	KERB AND GUTTER (CHANNEL)	4
ROCK FILLED WIRE MATTRESSES AND GABIONS		4
C224.13	GENERAL	4
C224.14	MATERIALS	5
C224.15	ASSEMBLY AND ERECTION	6
LIMITS AND TOLERANCES		7
C224.16	SUMMARY OF LIMITS AND TOLERANCES	7