

**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>

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 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

C211	-	Control of Erosion and Sedimentation
C220	-	Stormwater Drainage - General
C221	-	Pipe Drainage
C222	-	Precast Box Culverts
C271	-	Minor Concrete Works
C273	-	Landscaping

(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 Geotextiles
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UNLINED OPEN DRAINS

C224.04 GENERAL

- | | |
|---|---|
| <p>1. Unless shown otherwise on the Drawings, drains shall be vee shaped or of trapezoidal cross section and shall not be less than 300mm deep and have a minimum waterway area of 0.2 square metres.</p> | <p>Shape</p> |
| <p>2. Open drains shall be graded to ensure free flow of water and, shall not have a grade of less than 1 per cent.</p> | <p>Grade</p> |
| <p>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 Superintendent.</p> | <p>Trees and
Rock Outcrops</p> |
| <p>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</p> | <p>Open Drains</p> |
| <p>5. All work shall be undertaken in accordance with the requirements of the Specification for CONTROL OF EROSION AND SEDIMENTATION.</p> | <p>Control of
Erosion</p> |

C224.05 TYPES

- | | |
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| <p>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.</p> | <p>Catch Drains</p> |
| <p>2. Minor diversion and contour drains shall be constructed where shown on the Drawings or directed by the Superintendent. Minor diversion drains shall have the same capacity as the nearest pipe culvert on the line of the drain unless otherwise approved by the Superintendent.</p> | <p>Diversion &
Contour
Drains</p> |
| <p>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.</p> | <p>Table Drains</p> |
| <p>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.</p> | <p>Channels</p> |

C224.06 CONSTRUCTION

- | | |
|--|---|
| <p>1. Material excavated from drains shall be placed on the lower sides of the drains and formed as banks with slopes not steeper than 4:1 on the cross section of the bank to increase the capacity of the drains. This material shall be compacted in accordance with AS 1289.5.4.1 and shall be not less than 95 per cent for standard compactive effort.</p> | <p>Excavated
Material</p> |
| <p>2. The Contractor shall ensure that none of the activities associated with the work disturbs any watercourse outside the site. 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.</p> | <p>Contractor's
Responsibility</p> |

3. Any excess material shall be legally and responsibly disposed of by the Contractor.

***Excess
Material***

4. Unlined drains and areas adjacent to open drains shall be revegetated immediately after the drains are complete, in accordance with the Specification for LANDSCAPING.

Revegetation

LINED OPEN DRAINS

C224.07 GENERAL

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.

Profile

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.

***Compaction of
Foundations***

C224.08 CONCRETE LINING

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 Superintendent.

Method

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 Superintendent. 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.

Jointing

C224.09 STONE PITCHING

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.

***Rock Quality
and Placing***

C224.10 BATTER DRAINS

1. Batter drains shall be constructed using either half round steel pipes or precast nestable concrete units as shown and detailed on the Drawings.

Type

2. The units shall be installed in carefully excavated and template controlled trench to produce an even rim line of +0 to -50 from the batter line at the underside of topsoil.

Installation

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.

Compaction

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

C224.11 PROPRIETARY PRODUCTS

1. Unless shown on the Drawings, proprietary products may only be used with the approval of the Superintendent. Where specified, they must be used strictly in accordance with the manufacturer's instructions.

Manufacturer's Instructions

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, 15mm 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 of bituminous fibreboard.

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. All house stormwater outlets shall be provided and/or extended through the kerb as shown on the Drawings.

Stormwater Outlets

9. Opposite all driveways, where shown on the Drawings or where directed by the Superintendent, barrier kerb shall be discontinued to provide for vehicular or pedestrian access. At such locations, kerb laybacks shall be constructed in accordance with the Drawings. Footpath crossovers shall be constructed to meet the laybacks as shown on the Drawings, or reinstated to match existing materials where not otherwise shown.

Vehicular or Pedestrian Access

ROCK FILLED WIRE MATTRESSES AND GABIONS

C224.13 GENERAL

1. Rock-filled wire mattresses and gabions shall be placed at the locations shown on the Drawings. Installation shall be in accordance with the manufacturer's instructions. A geotextile, as shown on the Drawings, 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 0.4mm 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..

**Mattress
Dimension**

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 0.4mm 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.

**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 AUSTROADS Guide to Geotextiles, shall be used.

Type

2. Samples, manufacturer's specification and instructions on installation shall be submitted to the Superintendent seven days before the intended use of geotextile.

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.

Rock Quality

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.

For Gabions

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.

**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

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

SPECIAL REQUIREMENTS

C224.17 RESERVED

C224.18 RESERVED

C224.19 RESERVED

MEASUREMENT AND PAYMENT

C224.20 PAY ITEMS

1. Payment shall be made for all activities associated with completing the work detailed in this Specification on a Schedule of Rates basis in accordance with Pay Items C224(a) to C224(h) inclusive.
2. If any item for which a quantity of work is listed in the Schedule of Rates has not been priced by the Contractor, it shall be understood that due allowance has been made in the prices of other items for the cost of the activity which has not been priced.
3. Erosion and sedimentation control measures are measured and paid in accordance with the Specification for CONTROL OF EROSION AND SEDIMENTATION.
4. Sprayed concrete lining of open drains is measured and paid in accordance with the Specification for MINOR CONCRETE WORKS.
5. Cast-in-situ lining of open drains is measured and paid in accordance with this Specification and not with the Specification for MINOR CONCRETE WORKS.
6. Miscellaneous minor concrete work not included in the pay items in this specification shall be in accordance with pay items described in the Specification for MINOR CONCRETE WORKS.
7. Topsoiling and turfing to sides of batter drains are measured and paid in accordance with the Specification for LANDSCAPING.

Pay Item C224(a) EXCAVATION - CATCH, CONTOUR AND MINOR DIVERSION DRAINS

1. The unit of measurement shall be the linear metre measured along the invert of the drain.
2. The placement and compaction of material excavated from the drains on the lower sides of the drains to form banks shall be included in the excavation rates.
3. The schedule rate for excavation shall allow for excavation of all types of material. Separate rates shall not be included for earth and rock.
4. Any temporary measures for the control of stormwater runoff shall be included in the rate for excavation.

Pay Item C224(b) EXCAVATION - INLET, OUTLET, AND DIVERSION CHANNELS

1. The unit of measurement shall be the cubic metre measured from cross sections on the drawings using the end area method, or as "each" where minor work is involved.
2. The disposal of surplus material shall be included in the excavation rates.
3. The schedule rate for excavation shall allow for excavation of all types of material. Separate rates shall not be included for earth and rock.
4. Any temporary measures for the control of stormwater runoff shall be included in the rate for excavation.

Pay Item C224(c) CONCRETE LINING OF OPEN DRAINS

1. The unit of measurement shall be the square metre of concrete in place.
2. The schedule rate under this Pay Item shall include all the operations involved in the surface preparation, supply and placing of concrete, jointing and curing.

Pay Item C224(d) STONE PITCHING OF OPEN DRAINS

1. The unit of measurement shall be the square metre of stone pitching in place.
2. The schedule rate under this Pay Item shall include all the operations in the surface preparation, supply of stone, placing, final trimming and mortar jointing.

Pay Item C224(e) BATTER DRAINS

1. The unit of measurement shall be linear metre along the length of the drain formed by batter drain units.
2. The schedule rate shall include supply of the units, excavation, installation, backfilling and compaction.

Pay Item C224(f) ROCK FILLED GABIONS

1. The unit of measurement shall be the cubic metre of rock filling.
2. The volume shall be taken from the Drawings with appropriate adjustments being made for any authorised changes.
3. The schedule rate shall include the supply and placement of geotextile material behind the gabions, the supply and assembly of the gabions, the supply and placing of the rock fill in the gabions.

Pay Item C224(g) ROCK FILLED WIRE MATTRESSES

1. The unit of measurement shall be the square metre of rock filled mattress complete.
2. The area shall be determined from the actual completed work and shall include the area folded into the trench.
3. The schedule rate shall include the supply and placement of geotextile material, star pickets and ties as specified, together with the supply and assembly of the wire mattresses and the supply and placing of the rock fill.

Pay Item C224(h) KERB AND/OR GUTTER (CHANNEL)

1. The unit of measurement shall be the linear metre measured along the length of the kerb and/or gutter.
2. The schedule rate shall include all operations involved in the forming, compaction of foundations, concreting, expansion and contraction joints, backfilling and compaction adjacent to the completed kerb.
3. Separate pay items shall be included for each type of kerb and/or gutter specified.

SPECIFICATION C224 - OPEN DRAINS, INCLUDING KERB AND GUTTER

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