

**DEVELOPMENT
CONSTRUCTION
SPECIFICATION**

C230

**SUBSURFACE DRAINAGE
GENERAL**

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> |
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SPECIFICATION C230 : SUBSURFACE DRAINAGE - GENERAL**GENERAL****C230.01 INTRODUCTION**

1. This is the general specification common and applicable to all types of subsurface drainage and shall be read in conjunction with subsurface drainage specifications: **Purpose**

- C231 - Subsoil and Foundation Drains
- C232 - Pavement Drains
- C233 - Drainage Mats

as applicable to particular contracts.

C230.02 SCOPE

1. The work to be executed under this Specification consists of:
- (a) preparation for subsurface drainage construction;
 - (b) siting of subsurface drainage facilities;
 - (c) the supply of all materials associated with the provision of the subsurface drainage system;
 - (d) all activities and quality requirements associated with the supply, placement and compaction of filter material;
 - (e) the provision of a detailed record of all subsurface drain installations;
 - (f) the marking on the ground of the location of all subsurface drains.

C230.03 EXTENT OF WORK

1. Details of the work are shown on the Drawings. The requirements of this Contract are summarised as follows:-

(TO BE COMPLETED BY COMPILER)

- (a)
- (b)
- (c)
- (d)
- (e)
- (f)

C230.04 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
- C213 - Earthworks
- C271 - Minor Concrete Works

(b) Australian Standards

- AS 1141.11 - Particle size distribution by dry sieving.
- AS 1141.22 - Wet/dry strength variation.
- AS 1289.E5.1 - Determination of minimum and maximum dry density of a cohesionless material.
- AS 1477 - Unplasticised PVC (UPVC) pipes and fittings for pressure applications
- AS 2439.1 - Perforated drainage pipe and associated fittings
- AS 2758.1 - Aggregates and rock for engineering purposes - Concrete aggregates
- ASTM-D2434-68 Test method for permeability of granular soils (constant head)

C230.05 TEMPORARY DRAINAGE DURING CONSTRUCTION

1. All drainage works carried out by the Contractor shall comply with the Specification for CONTROL OF EROSION AND SEDIMENTATION.

**Erosion
Control**

2. The Contractor shall make adequate provision for runoff flows at subsurface drainage works under construction to avoid damage or nuisance due to scour, sedimentation, soil erosion, flooding, diversion of flow, damming, undermining, seepage, slumping or other adverse effects to the Works or surrounding areas and structures as a result of the Contractor's activities.

**Contractor's
Responsibility**

3. The Contractor's material and equipment shall be located clear of watercourses or secured so that they will not cause danger or damage in the event of large runoff flows.

**Location of
Equipment**

C230.06 SITING OF WORK

1. Before commencing construction of any subsurface drainage activity, the Contractor shall set out on site the position of the work to the location and levels shown on the Drawings, and shall present this set-out for inspection by the Superintendent.

Set-out

2. The Superintendent may amend the locations or designed levels or the lengths to suit actual site conditions. Any activity resulting from such amendments by the Superintendent shall be deemed to be included as part of the work covered by the Schedule of Rates. Should the Superintendent require a change to the conditions of installation an appropriate variation shall be ordered.

**Amendments
to Planned
Work**

3. Should the Contractor propose changes to the location, length, designed levels, conditions of installation or cover to suit the Contractor's construction procedures, the Contractor shall present the proposed set-out in addition to the designed set-out for consideration by the Superintendent. No changes shall be made unless the prior written approval of the Superintendent is obtained.

**Proposed
Changes by
Contractor**

C230.07 EXCAVATION

- | | |
|---|---|
| 1. In undertaking trench excavation the Contractor shall provide any shoring, sheet piling or other stabilisation of the sides necessary to comply with statutory requirements. | Safety |
| 2. Where public utilities exist in the vicinity of drainage works the Contractor shall obtain the approval of the relevant authority to the method of excavation before commencing excavation. | Approval by Public Utility Authorities |
| 3. Excavation by blasting, if permitted, shall be carried out to ensure that the peak particle velocity measured on the ground adjacent to any previously installed drainage structure does not exceed 25 millimetres per second. The Contractor shall comply with other requirements concerning blasting operations in the Specification for EARTHWORKS. | Blasting Operation |
| 4. Trenches shall be excavated to the line, grade, width and depth shown on the Drawings or as directed by the Superintendent. The bottom of the trench shall be constructed so that no localised ponding can occur. All loose material shall be removed by the Contractor. | Excavation Level |
| 5. Any material at the bottom of the trench or at foundation level which the Superintendent deems to be unsuitable shall be removed and disposed in accordance with the Specification for EARTHWORKS by the Contractor and replaced with backfill material in accordance with the requirements of this Specification. The bottom of the excavated trench or foundation, after any unsuitable material has been removed and replaced, shall be parallel with the specified level or grade of the pipe. | Unsuitable Material |
| 6. The excavated material shall be used in the construction of embankments backfilling or spoiled in accordance with the Specification for EARTHWORKS. | Spoil |

C230.08 BACKFILLING

- | | |
|--|---------------|
| 1. Backfilling shall be carried out in accordance with the requirements of the relevant subsurface drainage structures Specifications. | Detail |
|--|---------------|

C230.09 OUTLET STRUCTURES FOR SUBSURFACE DRAINAGE

- | | |
|---|-----------------------------------|
| 1. Subsurface drainage pipes shall be connected to discharge into gully pits or to outlet structures as shown on the Drawings or as directed by the Superintendent. | Discharge |
| 2. Outlets shall be spaced at a maximum interval of 150m. | Spacing |
| 3. Outlets, including those discharging into gully pits, shall be made rodent proof using galvanised wire netting in accordance with the Drawings. | Rodent Proof |
| 4. The outlet shall be located so that erosion of the adjacent areas does not occur or shall be protected by the placement of selected stone or similar treatment. | Erosion Control |
| 5. Outlet pipes from curtain drains shall be unslotted. At no point shall an outlet pipe be higher than the pipe at the end of the curtain drain. | Outlet Pipe |
| 6. All concrete used in the construction of outlet structures shall conform to the requirements of the Specification for MINOR CONCRETE WORKS. | Concrete Specification |

MATERIALS

C230.10 CORRUGATED PLASTIC PIPE

- 1. Corrugated plastic pipe shall be Class 1000 complying with AS2439.1 of 65mm or 100mm diameter unless otherwise indicated on the Drawings. All pipe shall be slotted except where shown on the Drawings. **Specification**
- 2. Joints, couplings, elbows, tees and caps shall also comply with AS2439.1 and only the manufacturer's recommended fittings shall be used. **Fittings**
- 3. The Contractor shall obtain from the Manufacturer a Test Certificate demonstrating compliance with AS2439.1. **Compliance**

C230.11 OTHER TYPES OF SUBSURFACE DRAINAGE

- 1. Where a Contractor wishes to use a subsurface drainage pipe other than corrugated plastic pipe, he shall submit full details of the type of pipe, certification from the manufacturer of its suitability and quality and written acceptance by the Council for its use in each particular application. Certification of the suitability of any pipe will address the crushing strength, flexural strength, jointing system and slotting details. **Submit for Approval**

C230.12 FILTER MATERIAL

(a) General

- 1. The types of filter material covered by this Specification shall include: **Types**
 - (a) Type A filter material for use in trench drains and Type B drainage mats
 - (b) Type B filter material for use in trench drains and Type B drainage mats
 - (c) Type C filter material comprising crushed rock for use in Type A drainage mats
 - (iv) Type D filter material comprising uncrushed river gravel for use in Type A drainage mats

- 2. All filter material shall consist of clean, hard, tough, durable particles.

(b) Type A Filter Material

- 1. Type A filter material shall be crushed rock complying with the following requirements: **Grading**

| TEST METHOD | PROPERTY | REQUIREMENT |
|-------------|---------------------------|------------------|
| AS 1141.11 | Material passing AS sieve | Per cent by mass |
| | 6.7mm | 100 |
| | 4.75mm | 85 to 100 |
| | 2.36mm | 0 to 40 |
| | 1.18mm | 0 to 5 |
| | 425um | 0 to 2 |

Table C230.1 - Type A Filter Material

(c) Type B Filter Material

1. Type B filter material shall be granular material complying with the following **Grading** grading requirements:

| TEST METHOD | PROPERTY | REQUIREMENT |
|-------------|---------------------------|------------------|
| AS 1141.11 | Material passing AS sieve | Per cent by mass |
| | 4.75mm | 100 |
| | 2.36mm | 95 to 100 |
| | 425um | 20 to 80 |
| | 300um | 0 to 30 |
| | 150um | 0 to 2 |
| | 75um | 0 to 0.1 |

Table C230.2 - Type B Filter Material

2. In addition to the above grading requirements, Type B filter material shall have a **Coefficient of Saturated Permeability**, when compacted to its maximum dry density as determined by AS 1289.E5.1 and then tested in accordance with Test Method ASTM-D2434-68, of at least 8 metres per day after three hours of flow.

3. Type B filter material shall not vary from its original grading as a result of **Grading Variation** compaction processes by more than the following amounts:

| AS Sieve | Variation From Grading Before Treatment (per cent of mass) |
|----------|--|
| 2.36mm | ± 3 |
| 1.18mm | ± 1 |
| 425um | ± 1 |
| 300um | ± 1 |
| 150um | ± 0.5 |
| 75um | ± 0.1 |

Table C230.3 - Type B Filter Material Variation

(d) Type C Filter Material

1. Type C filter material shall be crushed rock complying with the following **Grading** requirements:

| TEST METHOD | PROPERTY | REQUIREMENT |
|-------------|------------------------------------|-------------|
| AS 1141.11 | Maximum particle size | 37.5mm |
| | Maximum passing the 9.5mm AS Sieve | 5% by mass |

| | | |
|---|-------------------------------------|-------|
| AS 1141.22 | Maximum (D90:D10)* | 3 |
| | Minimum wet strength | 100kN |
| | Maximum 10% fines wet/dry variation | 30% |
| <p>NOTE: The D90 value shall be determined by sieving the material using 75mm, 53mm, 37.5mm, 26.5mm, 19mm, 13.2mm and 9.5mm AS sieves, as appropriate, and then plotting the results on a graph of AS sieve size v percentage passing. The plotted points shall be joined by straight lines and the D90 value shall be determined as the theoretical sieve size corresponding to 90 per cent passing.</p> <p>D10 denotes the theoretical size of a sieve through which 10 per cent of the material would pass and shall be determined from the same graph used to determine the D90 value.</p> | | |

Table C230.4 - Type C Filter Material

(e) Type D Filter Material

1. Type D filter material shall be uncrushed river gravel complying with the description of rounded aggregate in Table B1, Appendix B of AS2758.1 and the following requirements:

Grading

| TEST METHOD | PROPERTY | REQUIREMENT |
|-------------|-------------------------------------|-------------|
| AS 1141.11 | Maximum particle size | 75mm |
| | Maximum passing the 9.5mm AS sieve | 5% by mass |
| | Maximum (D90 : D10) | 3 |
| AS 1141.22 | Minimum wet strength | 100kN |
| | Maximum 10% fines wet/dry variation | 30% |

Table C230.5 - Type D Filter Material

C230.13 GEOTEXTILE

(a) General

1. The geotextile, other than seamless tubular filter fabric, shall consist of a needle punched felt which shall be manufactured from synthetic materials other than polyamide. It shall be bio-stable and resistant to attack by alkalis, acids, dry heat, steam, moisture, brine, mineral oil, petrol, diesel and detergents.

Properties

2. The geotextile shall be resistant to ultra-violet light. No geotextile shall be left exposed to sunlight during storage and construction for a period longer than a total of twenty-one days. If exposure in excess of twenty-one days does occur, the geotextile shall be tested and if its characteristics have deteriorated to or below 90 per cent of the

Ultra Violet Light Resistant

characteristics claimed by the manufacturer or the characteristics determined on unexposed geotextile, whichever is the better, it shall be removed and replaced with a geotextile complying with this Specification.

3. The geotextile shall be capable of retaining particles of particle size greater than 100 microns. **Particle Retention**

4. The minimum mass of geotextiles for different types of subsurface drainage shall be as follows: **Mass**

| TYPE OF SUBSURFACE DRAINAGE | MINIMUM MASS OF GEOTEXTILE (Grams per square metre) |
|---------------------------------|---|
| Trench Drains and Drainage Mats | 250 |
| Curtain Drains | 500 |

Table C230.6 - Geotextile Mass

5. In addition to the above requirements, geotextiles for curtain drains shall consist of either polyester, polypropylene or polyethylene. When subjected to a pressure of 200 kPa applied at right angles to the plane of the fabric and to a constant head of water no greater than 50 mm applied to the top edge of the fabric, geotextiles for curtain drains shall have a rate of water transmission not less than 20 litres per hour per metre width of fabric through a 300 mm length of the fabric. **Water Transmission Rate**

(b) Seamless Tubular Filter Fabric **Specification**

1. Seamless knitted tubular filter fabric shall be used to enclose all slotted pipes and shall be manufactured from either polypropylene or polyester. The fabric shall be free of imperfections in weave or yarn and have abrasion resistant and weave stability qualities such that it shall not form holes, ladder, deweave, tear or unravel more than 5mm from a cut end.

2. Fitting of the seamless tubular filter fabric shall be in accordance with the requirements of Annexure C230A. Filter fabric that is excessively stretched, torn or otherwise damaged during fitting of the fabric, storage, transportation or pipe laying will be removed and replaced so as to eliminate any damaged lengths. **Fitting**

RECORDING OF DRAINAGE

C230.14 RECORDING OF SUBSURFACE DRAINAGE INFORMATION

1. The Contractor shall keep a detailed record of all subsurface drainage pipes and the completed subsurface drainage systems shall be shown on the work-as-executed plans to be returned to the Superintendent upon completion of the Contract. **Work As Executed Plans**

2. In addition, the Contractor shall prepare a subsurface drainage information sheet or sheets at the completion of construction of each drain or drainage system and shall submit the subsurface drainage sheet or sheets to the Superintendent within five working days of the completion of the drain or drainage system. **Information Sheet**

3. The information to be included in the subsurface drainage information sheets shall include: **Detail**

Date of completion of drain construction:

Drain Number:

Type of Drain:

Pipe Size:

Pipe Type:

Filter Type:

Grade of Drain:

Locations of Cleanouts:

Locations of Outlets:

Geotextile-

| | |
|-------|--------|
| Sheet | Yes/No |
|-------|--------|

| | |
|--------------------------------|--------|
| Seamless Tubular Filter Fabric | Yes/No |
|--------------------------------|--------|

Response Time:

NOTE: Response Time shall be the time taken for water to travel from the inlet end of a drain or from a cleanout leading to a drain to the outlet end of the drain.

4. The costs associated with the preparation of Subsurface Drainage Sheets shall be borne by the Contractor.

Contractor's Costs

SPECIAL REQUIREMENTS

C230.15 RESERVED

C230.16 RESERVED

LIMITS AND TOLERANCES

C230.17 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. | Excavation by Blasting Peak particle velocity | ≤25mm/sec | C230.07 |
| 2. | Outlets Spacing | Max 150m | C230.09 |
| 3. | Filter Material | | |

| Item | Activity | Tolerances | Spec Clause |
|-------------|--|--|------------------------|
| | (a) Type A | Table C230.1 | C230.12 |
| | (b) Type B | Tables C230.2 and C230.3 | C230.12 |
| | (c) Type C | Table C230.4 | C230.12 |
| | (d) Type D | Table C230.5 | C230.12 |
| 4. | Geotextile | | |
| | (a) Exposure to sunlight | <21 days If >21 days deterioration not to exceed 10% of claimed characteristics | C230.13 |
| | (b) Curtain Drains Water Transmission | >20 litres/hr/m | C230.13 |

Table C230.7 - Table of Limits and Tolerances

MEASUREMENT AND PAYMENT

C230.18 PAY ITEMS

1. Payment shall be made for all activities associated with completing the work detailed in this Specification and the associated activity specific specification on a schedule of rates basis.
2. The Pay Items applicable to particular activities are listed in the Specifications for these activities.
3. Common to subsurface drainage works are Filter Material and Outlet Structures and payment for these items shall be made under this Specification.
4. A Lump Sum price for any of these items shall not be accepted.
5. If any item, for which a quantity of work is listed is not priced by the Contractor, it shall be understood that due allowance has been made in other items for the cost of the activity which has not been priced.
6. Erosion and sedimentation control measures are measured and paid in accordance with the Specification for CONTROL OF EROSION AND SEDIMENTATION.
7. Excavation and Geotextile material is measured and paid in accordance with the Specification applicable to the particular activity.
8. Unsuitable material removal is measured and paid in accordance with the Specification for EARTHWORKS.
9. Concrete work for outlet structures is measured and paid in accordance with this Specification and not in the Specification for MINOR CONCRETE WORKS.
10. 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.

Pay Item C230(a) FILTER MATERIAL TYPE 'A' BACKFILL

1. The unit of measurement shall be the compacted cubic metre.
2. The volume shall be computed from the actual length and depth of the trench multiplied by the design width of the trench.
3. The rate shall include the supply, placement and compaction of filter material and the "capping" of the trench where shown on the Drawings.
4. The schedule quantity is a provisional quantity.

Pay Item C230(b) FILTER MATERIAL TYPE 'B' BACKFILL

1. The unit of measurement shall be the compacted cubic metre.
2. The volume shall be computed from the actual length and depth of the trench multiplied by the design width of the trench.
3. The rate shall include the supply, placement and compaction of filter material and the "capping" of the trench where shown on the Drawings.
4. The schedule quantity is a provisional quantity.

Pay Item C230(c) FILTER MATERIAL TYPE 'C' BACKFILL

1. The unit of measurement shall be the compacted cubic metre.
2. The volume shall be computed from the actual length and depth of the trench multiplied by the design width of the trench.
3. The rate shall include the supply, placement and compaction of filter material and the "capping" of the trench where shown on the Drawings.
4. The schedule rate is a provisional quantity.

Pay Item C230(d) FILTER MATERIAL TYPE 'D' BACKFILL

1. The unit of measurement shall be the compacted cubic metre.
2. The volume shall be computed from the actual length and depth of the trench multiplied by the design width of the trench.
3. The rate shall include the supply, placement and compaction of filter material and the "capping" of the trench where shown on the Drawings.
4. The schedule quantity is a provisional quantity.

Pay Item C230 (e) OUTLET STRUCTURES FOR SUBSURFACE DRAINAGE PIPES

1. The unit of measurement shall be "each" outlet structure, excluding outlets into pits, provided in accordance with this Specification.
2. The schedule rate under this Pay Item shall include all the operations involved in the construction of the outlet including the forming of the structure, supply of concrete and, where directed by the Superintendent, the provision of erosion control measures.
3. The schedule quantity is a provisional quantity.

ANNEXURE C230A**SLOTTED PIPES FITTED WITH SEAMLESS TUBULAR FILTER FABRIC****1. PROCEDURE FOR FITTING SEAMLESS TUBULAR FILTER FABRIC TO SLOTTED PIPE**

Seamless tubular filter fabric shall be fitted to slotted pipe immediately before the slotted pipe is to be laid in its final position in the work.

The filter fabric shall be initially pulled over and onto a short length of smooth pipe of internal diameter between 20mm and 30mm greater than the external diameter of the slotted pipe to be enclosed by filter fabric. The short, larger diameter pipe shall be referred to as the 'mandrel'.

The pipe to be enclosed by the filter fabric shall be passed through the mandrel. The filter fabric shall be slipped on to the pipe as the pipe emerges from the mandrel leaving enough overhang of the filter fabric to make a suitable joint with the filter fabric on the adjacent pipe. The filter fabric shall be firmly held to the forward end of the pipe so that it can not slip back along the pipe.

The pipe shall be pulled right through the mandrel allowing the filter fabric to progressively slip over the pipe. The filter fabric shall be restrained from easily slipping off the mandrel thus ensuring the filter fabric is stretch fitted onto the pipe.

When the end of the pipe emerges from the mandrel, the filter fabric shall be clamped to that end of the pipe so that the filter fabric can not slip down the pipe. The filter fabric shall remain clamped to each end of the pipe to ensure the filter fabric remains stretch fitted onto the pipe when the pipe is placed in its final position in the drain.

The filter fabric shall be cut cleanly leaving enough overhang off the end of the pipe to make a fully covered joint with the filter fabric on the adjacent pipe when the pipes are installed in the drain.

2. PRECAUTIONS TO BE TAKEN WHEN USING SLOTTED PIPE FITTED WITH SEAMLESS TUBULAR FILTER FABRIC

Slotted pipe fitted with seamless tubular filter fabric shall not be dragged over the ground. If carried, the pipe shall be lifted clear of the ground and the filter fabric shall be protected from damage at all times.

Seamless tubular filter fabric which has been so damaged as to affect its filtering properties shall be removed from the pipe and replaced with undamaged filter fabric.

If at any time during the installation of a slotted pipe it is found that the enclosed filter fabric has become loose on the pipe it shall be restretched to its correct position. If restretching causes any damage to the filter fabric, the damaged filter fabric shall be removed from the pipe and replaced with undamaged filter fabric.

SPECIFICATION C230 - SUBSURFACE DRAINAGE-GENERAL

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ANNEXURE

C230A SLOTTED PIPES FITTED WITH SEAMLESS TUBULAR FILTER FABRIC