

# Physical Properties of C & S Filter Coal (Anthracite)

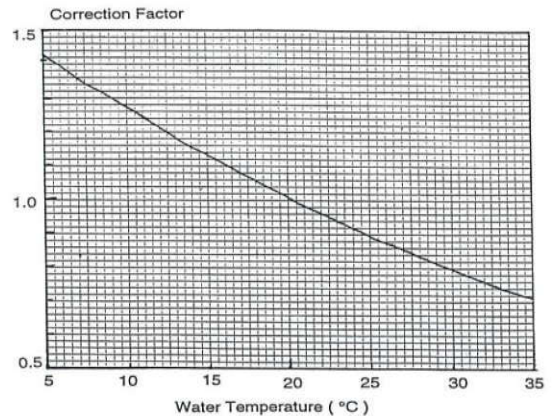
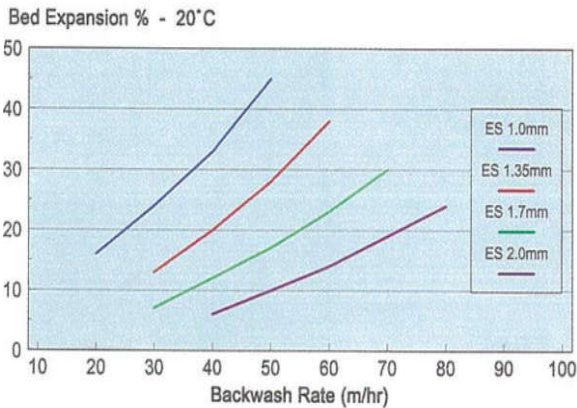
Effective Size	:	To client's requirement
Uniformly Coefficient	:	1.30 Standard; Available down to 1.20 at additional cost, and up to 1.40 at reduced cost
Acid Solubility	:	1% max to AWWA B100-89
Alkaline Solubility	:	1.5% max in 1% NaOH @ 88°C
Hardness	:	1. Hardgrove Grindability Index 2. Friability: 20% max for 15 minutes 25% max for 20 minutes As per Watson Hawksley (Asia) Test Method
Durability	:	Attrition loss of less than 0.35% per year recorded in full scale water treatment plant
Specific Gravity	:	1.45 to AS1289 C5.1



Warragamba Pilot Plant, Sydney Water

An independent NATA registered laboratory is available to test Effective Size, Uniformity Coefficient, Specific Gravity, Acid Solubility, Alkali Solubility and Hardgrove Grindability Index, and to perform any other tests required.

## Backwash Rates



Bed Expansion  
VS  
Backwash Rate  
at 20°C

Correction for Water Temperature

$$\frac{\text{Expansion at } T^{\circ}\text{C}}{\text{Expansion at } 20^{\circ}\text{C}} = 1.58e^{-0.0287T}$$

## Suggested Guide for Backwash Rates Dual Media

C & S Brand Australian Filter Coal at Temperature 20°C

Effective Size (mm)	Backwash Rate (m <sup>3</sup> /hr)
2.5	83-92
2.2	65-75
2.0	60-70
1.7	50-60
1.5	40-55
1.2	35-45
1.0	30-40

## Typical Analysis of C & S Brand Australian Coal

### Ultimate Analysis

Carbon	70.8 %
Hydrogen	4.1 %
Nitrogen	1.4 %
Sulphur (less sulphur in ash)	0.2 %
Oxygen by difference	7.8%
Phosphorus	0.004 %

### Ash Analysis

Ash 13.5% tolerance $\pm$ 1.0 %	58.1 %
SiO <sub>2</sub>	29.6 %
Al <sub>2</sub> O <sub>3</sub>	2.43 %
CaO	0.89 %
MgO	0.25 %
Na <sub>2</sub> O	0.96 %
K <sub>2</sub> O	1.38 %
TiO <sub>2</sub>	0.08 %
Mn <sub>3</sub> O <sub>4</sub>	0.68 %
SO <sub>3</sub>	0.143 %
P <sub>2</sub> O <sub>5</sub>	0.04 %
BaO	0.05 %
SrO	0.01 %
ZnO	0.009 %
Phosphorus (in coal)	0.03 %
Chlorine (ad)	

# Advantages of C & S Brand Filter Coal (Anthracite)

Although C & S Filter Coal is a unique product, it is very competitively priced in relation to other anthracite coal type media.

Prices are negotiable depending on quality and specifications

## Competitive Pricing

## Superior Particle Size Grading: Very Low Uniformity Coefficient and Minimal Fines Content

The very low uniformity coefficients of C & S Filter Coal, coupled with an angular particle shape and very low fines content result in maximum void space per cubic meter of media.

Our standard U.C. is 1.3, the lowest standard U.C. in the industry. We can supply an even lower U.C. if required, down to 1.2, at a slightly higher price than our standard grade. We also supply U.C.'s up to 1.4 at a slightly lower cost, but do not recommend values above 1.4.

The low fines content also increases void space, minimizes nuisance due to dust, and means that only a minimal amount needs to be over-ordered to allow for removal of fines by scraping during commissioning (typically 2% instead of up to 10% often used with other brands).

Our coal has a specific gravity of 1.45. Compared with American anthracite coals which have a higher SG, C & S Filter Coal requires a lower backwash rate for the same Effective Size.

This permits a saving in backwash pump capacity and reduces the quantity of backwash water required.

## Optimum Specific Gravity

## High Durability & Stability, with Established Track Record.

Of equal importance to the superior grading of C&S Filter Coal is its demonstrated ability to maintain its original properties over many years of service.

This was initially demonstrated in laboratory trials by large independent Australian Water authorities. High durability was established by many days of continuous backwashing in pilot columns to simulate years of use, and by the use of standard hardness tests, e.g. Watson-Hawksley Friability. (Method available on request)

More importantly, the monitoring of performance in full scale plants has confirmed that there has been virtually no change in Effective Size and Uniformity Coefficient and almost unmeasurable change in the volume of media within a filter, over an eight year monitoring period. (See letter from Hunter Water Corporation)

The media is chemically stable, and monitoring has confirmed that no substances has been detected in drinking water filtered through C&S Filter Coal that could be attributed to leaching from the media, and there is no detectable level of phenol.

C&S Filter Coal is widely used by most Australian water authorities and is by far the market leader in coal/ anthracite type filter media in Australia, with growing export markets. Established customers continue to purchase C&S Filter Coal for each new project.

## Wide Industry Acceptance

## High Product Consistency & Quality Control

Our product consistency begins with the raw material used, which is always taken from the same coal deposit. This deposit has been quite carefully selected for its ability to meet all of the criteria necessary in a top quality filter media.

Each step in the production process is closely monitored by qualified staff applying a strict and effective quality control system, which is certified to the international quality standard ISO9002 (Australian Standard AS9002).

Production testing for Effective Size and Uniformity Coefficient is carried out on every tenth cubic meter of media produced.

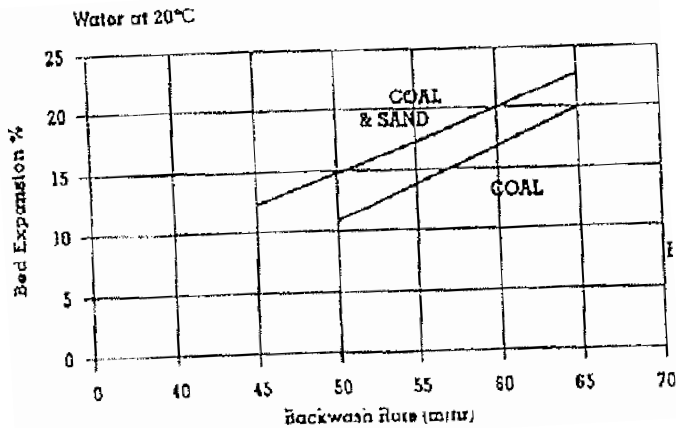
# Physical Analysis

Effective Size (mm)	Particle Size Distribution (mm)	Uniformity Coefficient
0.8-0.9	0.8-1.2	1.3 maximum
1.0-1.1	1.0-1.8	1.3 maximum
1.3-1.4	1.3-2.0	1.3 maximum
1.7 ± 0.05	1.6-2.6	1.3 maximum
2.0 ± 0.1	1.9-3.3	1.3 maximum
2.2 ± 0.1	2.0-4.0	1.3 maximum
4.2 ± 0.2	4.0-8.0	1.3 maximum

\* These are standard sizes. Effective Size and Uniformity Coefficient can be produced to any specification.  
 Particle Size ranging up to 20mm - 40mm. Uniformity Coefficient as low as 1.2 maximum.

Specific Gravity	:	1.4 to AS 1289C5.1
Acid Solubility	:	1% max to AWWA B100-89
Alkali Solubility	:	1.5% max in 1.0% NaOH at 88 °C
Bulk Density	:	660-720 kg/m <sup>3</sup> depending on E.S. & U.C
Hardness	:	Hardgrove Grindability Index 50 max to AS 1038 part 20
Attrition Loss	:	Averages 0.25% per annum in full scale Water Treatment Plant

## Backwash Rate VS Bed Expansion



		<b>Coal</b>	
ES	:	2.0mm	
UC	:	1.27	
Bed Depth	:	2000 mm	
		<b>Coal &amp; Sand</b>	
ES	:	1.68mm	ES : 0.75mm
UC	:	1.30	UC : 1.30
Bed Depth	:	1800 mm	Bed Depth : 200 mm

# C & S Brand Australian Filter Coal (Anthracite) Backwash Rates VS Bed Expansion

Backwash vs Bed Expansion C&S Brand Australian Filter Coal @ 20 C

