SEPARATION TECHNOLOGIES

ION EXCHANGE RESINS

DUOLITE C 20

ENGINEERING DATA SHEET
(HCl, Counter- current regeneration)

Auchtel

Duolite C 20 is strong acid Cation Exchange Resin. These data provide information to calculate the sodium leakage and operating capacity of Duolite C 20 used with reverse flow (counter current) regeneration with hydrochloric acid.
The properties of Duolite C 20 are described in the Product Data Sheet.

$$Cap = Cap_0 \times A \times B \times C \times D \times E$$

SODIUM LEAKAGE

With counter current regeneration, the average sodium leakage is always very low (less than 100 ppb as Na when regenerated with HCl) so that in industrial applications a treated water conductivity of about 1 mS / cm or lower can be obtained in most cases.

OPERATING CAPACITY

The operating capacity of Duolite C 20 with hydrochloric acid regeneration is obtained by multiplying the basic capacity value from Table 1 by the correction factors A to E from Tables 3 to 7 overleaf.

TABLE 1 : Basic Capacity versus HCl Regenerant Level (Reverse Flow Regeneration)

HCl g/L	Capacity eq / L (Cap_0)
30	0.80
40	1.03
50	1.15
60	1.24
70	1.32
80	1.39
90	1.44
100	1.49
120	1.57

TABLE 2 : Suggested Operating Conditions

Maximum operating temperature.....	120^0c
Minimum bed depth	1000 mm **
Service flow rate	5 to 40 BV* / hr
Maximum linear velocity	50 m / hr
Regenerant	HCl
Level	30 to 120 g /L
Flow rate	2 to 5 BV/ hr (minimum contact time 30 minutes)
Concentration	4% to 8 %
Slow rinse	Minimum 2 BV at regeneration flow rate
Fast rinse	Same as service flow rate.

* 1 BV (Bed Volume) = 1 m^3 solution per m^3 resin
** For selection of lower bed depth contact Auchtel representative

Influent Limitations

Free chlorine - Nil

TABLE 3 : Capacity Correction Factor A Versus Sodium to Total Cations ratio.

% Na	Factor A
0	0.92
10	0.93
20	0.94
30	0.95
40	0.96
50	0.98
60	0.99
70	1.00
80	1.01
90	1.03
100	1.04

TABLE 4 : Capacity Correction Factor B versus Alkalinity to Total Anions Ratio.

% Alk	Factor B
0	0.94
25	0.97
50	1.00
75	1.02
99	1.03

TABLE 5 : Capacity Correction Factor C versus Resin Bed Depth.

Bed Depth mm	Factor C
900	0.94
1200	0.96
1500	1.00
1800	1.04
2000	1.07
2500	1.10

TABLE 6 : Capacity Correction Factor D versus water Temperature

^{0}C	0	50	99% Na
5	0.95	0.89	0.84
10	0.98	0.96	0.94
15	1.00	1.00	1.00
20	1.02	1.03	1.04
25	1.03	1.05	1.08
>30	1.04	1.07	1.11

TABLE 7 : Capacity Correction Factor E versus Run Length (Production Time)

Run Time (hours)	0	50	99% Alk
5	0.92	0.95	0.97
8	0.94	0.96	0.98
10	0.96	0.97	0.99
20	0.98	0.99	1.00
> 25	0.99	1.00	1.00

SAFE USE INFORMATION

A material Safety Data Sheet is available for each product. To obtain a copy contact your Auchtel representative. Ion exchange resins and polymeric adsorbants, as produced, contain manufacturing by-products. the user must determine the extent to which these by-products must be removed for any particular use and to establish methods to ensure that the appropriate level of purity is achieved for that use. The user must ensure compliance with all prudent safety standards and regulatory requirements governing the application. Except where otherwise stated, Auchtel does recommend its ion exchange resins or polymeric adsorbants as suitable or appropriately pure for any particular use. Consult your Auchtel technical representative for further information.

CAUTION

Acidic and basic regenerant solutions are corrosive and should be handled in manner that will prevent eye and skin contact. Nitric acid and other strong oxidizing agents can cause explosive type reactions when mixed with Ion Exchange Resins.Proper design of process equipment to prevent rapid buildup of pressure is necessary if use of an oxidizing agent such as nitric acid is contemplated. Before using strong oxidizing agents in contact with Ion Exchange Resins, consult sources knowledgeable in the handling of these materials.

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SEPARATION TECHNOLOGIES

ION EXCHANGE RESINS

DUOLITE C 20

ENGINEERING DATA SHEET
(H_2SO_4 counter current regeneration)

Duolite C 20 is strong acid Cation Exchange Resin. These data provide information to calculate the sodium leakage and operating capacityof Duolite C 20 used with reverse flow (counter current) regeneration with sulphuric acid.
The properties of Duolite C 20 are described in the Product Data Sheet.

SODIUM LEAKAGE

The average sodium leakage can be read directly from Table 1. In counter current regeneration, the leakage is always very low so that in industrial applications a treated water conductivity of about 1mS/ cm or lower can be obtained in most cases.

TABLE 1 : Average Sodium Leakage versus H_2SO_4 Regenerant Level

H_2SO_4 g / L	Leakage ppm Na
40	0.12
50	0.07
60	0.05
70	0.04
80	0.03

OPERATING CAPACITY

The operating capacity of Duolite C 20 with sulphuric acid regeneration is obtained by multiplying the basic capacity value from Table 2 by the correction factors A to E from Tables 4 to 8 overleaf.

$$Cap = Cap_0 \times A \times B \times C \times D \times E$$

TABLE 2 : Basic Capacity versus H_2SO_4 Regenerant Level

H_2SO_4 g / L	Capacity eq / L (Cap_0)
40	0.65
50	0.73
60	0.79
70	0.85
80	0.90
90	0.94
100	0.98
120	1.05
140	1.10
160	1.15

TABLE 3 : Suggested Operating Conditions

Maximum operating temperature	120^0C
Minimum bed depth	1000 mm **
Service flow rate	5 to 40 BV* / hr
Maximum linear velocity	50 m / hr
Regenerant	H_2SO_4
Level	40 to 160 g / L
Flow rate	2 to 10 BV/ hr (minimum contact time:30 minutes)
Concentration	0.7 to 6 % according to Ca content
Slow rinse	Minmum 2 BV at regeneration flow rate
Fast rinse	Same as service flow rate.

* 1 BV (Bed Volume) = 1 m^3 solution per m^3 resin
** For selection of lower bed depth contact Auchtel representative

Influent Limitations

Free chlorine - Nil

TABLE 4 : Capacity Correction Factor A Versus Sodium to Total Cations Ratio.

% Na	Factor A
0	0.74
10	0.81
20	0.86
30	0.91
40	0.96
50	1.00
60	1.04
70	1.07
80	1.10
90	1.13
100	1.15

TABLE 5 : Capacity Correction Factor B versus Alkalinity to Total Anions Ratio.

% Alk	Factor B
0	0.92
25	0.96
50	1.00
75	1.04
99	1.07

TABLE 6 : Capacity Correction Factor C versus Resin Bed Depth.

Bed Depth mm	Factor C
900	0.94
1200	0.96
1500	1.00
1800	1.04
2000	1.07
2500	1.10

TABLE 7 : Capacity Correction Factor D versus water Temperature

^{0}C	0	50	99% Na
5	0.95	0.89	0.84
10	0.98	0.96	0.94
15	1.00	1.00	1.00
20	1.02	1.03	1.04
25	1.03	1.05	1.08
>30	1.04	1.07	1.11

TABLE 8 : Capacity Correction Factor E versus Run Length (Production Time)

Run Time (hours)	0	50	99% Alk
5	0.92	0.95	0.97
8	0.94	0.96	0.98
10	0.96	0.97	0.99
20	0.98	0.99	1.00
> 25	0.99	1.00	1.00

SAFE USE INFORMATION

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SEPARATION TECHNOLOGIES

ION EXCHANGE RESINS

DUOLITE C 20

ENGINEERING DATA SHEET
(HCl, Co - current regeneration)

Auchtel

Duolite C 20 is strong acid Cation Exchange Resin. These data provide information to calculate the sodium leakage and operating capacity of Duolite C 20 used with coflow regeneration with hydrochloric acid.The properties of Duolite C 20 are described in the Product Data Sheet.

Note: *Na*+ leakage values are expressed as a percentage of the Equivalent Mineral Acidity(EMA)Value obtained in meq/ L must be converted to mg / L as Na^+.

Influent Limitations

Free chlorine - Nil

TABLE 1 : Basic Sodium Leakage versus HCl Regenerant Level

HCl g / L	Leakage % EMA ($Leak_o$)
50	3.9
60	3.0
70	2.5
80	2.0
100	1.5
120	1.2
150	0.9

SODIUM LEAKAGE

The average sodium leakage is obtained by multiplying the basic leakage value from Table 1 by the correction factor A from Table 2.

$$Leak = Leak_o \times A$$

TABLE 2 : Leakage Correction Factor A versus Sodium to Total Cations Ratio.

% Na	Factor A
10	0.15
20	0.30
30	0.50
40	0.75
50	1.00
60	1.30
70	1.70
80	2.20
90	2.80
100	3.60

TABLE 3 : Suggested Operating Conditions

Maximum operating temperature. ___	120^0 c
Minimum bed depth _____	700 mm
Service flow rate _____	5 to 40 BV* / hr
Maximum linear velocity _____	50 m / hr
Regenerant _____	HCl
Level _____	50 to 150 g / L
Flow rate _____	2 to 5 BV/ hr (minimum contact time : 30 minutes)
Concentration _____	4% to 8%
Slow rinse _____	Minimum 2 BV at regeneration flow rate
Fast rinse _____	Same as service flow rate.

* 1 BV (Bed Volume) = 1 m^3 solution per m^3 resin

OPERATING CAPACITY

The operating capacity of Duolite C 20 with hydrochloric acid regeneration is obtained by multiplying basic capacity value from Table 4 by the correction Factors B to E from Tables 5 to 8.

$$Cap = Cap_O \times B \times C \times D \times E$$

TABLE 4 : Basic Capacity versus HCl Regenerant level (Co-current regeneration)

HCl g / L	Capacity eq / L (Cap_O)
50	0.92
60	1.02
70	1.10
80	1.17
90	1.23
100	1.28
120	1.37
150	1.47

TABLE 5 : Capacity Correction Factor B versus Sodium to Total Cations Ratio.

% Na	Factor B
0	1.00
10	0.98
20	0.97
30	0.98
40	1.00
50	1.02
60	1.03
70	1.05
80	1.09
90	1.12
100	1.16

TABLE 6 : Capacity Correction Factor C versus Alkalinity to Total Anions Ratio.

% Alk	Factor C
0	0.95
25	0.97
50	1.00
75	1.03
99	1.05

TABLE 7 : Capacity Correction Factor D versus Water Temperature.

Temperature ^{o}C	0	50	99% Na
5	0.95	0.89	0.84
10	0.98	0.96	0.94
15	1.00	1.00	1.00
20	1.02	1.03	1.04
25	1.03	1.05	1.08
>30	1.04	1.07	1.11

TABLE 8 : Capacity Correction Factor E versus Run Length (Production Time)

Run Time (hours)	0	50	99% Alk
5	0.92	0.95	0.97
8	0.94	0.96	0.98
10	0.96	0.97	0.99
20	0.98	0.99	1.00
> 25	0.99	1.00	1.00

SAFE USE INFORMATION

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SEPARATION TECHNOLOGIES

ION EXCHANGE RESINS

DUOLITE C 20

ENGINEERING DATA SHEET
(H_2SO_4 co - current regeneration)

Auchtel

Duolite C 20 is strong acid Cation Exchange Resin. These data provide information to calculate the sodium leakage and operating capacity of Duolite C 20 used with co-current regeneration with sulphric acid.The properties of Duolite C 20 are described in the Product Data Sheet.

SODIUM LEAKAGE

The average sodium leakage is obtained by multiplying the basic leakage value from Table 1 by the correction factors A & B from Tables 2. & 3

Note: *Na+* leakage values are expressed as a percentage of the Equivalent Mineral Acidity(EMA)Value obtained in meq/ L must be converted to mg / L as Na^+.

TABLE 1 : Basic Sodium Leakage versus H_2SO_4 Regenerant Level

H_2SO_4 g / L	Na^+ Leakage % EMA ($Leak_O$)
60	11.7
70	10.4
80	9.2
100	7.2
120	5.7
140	4.5
160	3.5
200	2.2
240	1.4

$$Leak = Leak_O \times A \times B$$

Influent Limitations

Free chlorine - Nil

TABLE 2 : Leakage Correction Factor A versus Alkalinity to Total Anions Ratio

% Alk	Factor A
0	0.65
20	0.77
40	0.91
60	1.08
80	1.28
99	1.52

TABLE 3 : Leakage Correction Factor B versus Sodium to Total Cations Ratio.

% Na	Factor B
10	0.06
20	0.17
30	0.52
40	0.66
50	0.74
60	1.00
70	1.23
80	1.58
90	1.91

TABLE 3 : Suggested Operating Conditions

Maximum operating temperature	120^0C
Minimum bed depth	700 mm
Service flow rate	5 to 40 BV* / h
Maximum linear velocity	50 m / h
Regenerant	H_2SO_4 in stepped concentrations.
Level	60 to 240 g / L
Flow rate	2 to 10 BV/ h (minimum contact time 30 minutes)
Concentration	0.7 to 6% according to Ca content
Slow rinse	Minimum 2 BV at regeneration flow rate
Fast rinse	Same as service flow rate.

* 1 BV (Bed Volume) = 1 m^3 solution per m^3 resin

OPERATING CAPACITY

The operating capacity of Duolite C 20 with sulphuric acid regeneration is obtained by multiplying basic capacity value from Table 5 by the correction factors C to F from Tables 6 to 9.

$$Cap = Cap_O \times C \times D \times E \times F$$

TABLE 6 : Capacity Correction Factor C versus Alkalinity to Total Anions Ratio.

% Alk	Factor C
0	0.92
25	0.96
50	1.00
75	1.04
99	1.07

TABLE 5 : Basic Capacity versus H_2SO_4 regenerant level and Sodium to Total Cations Ratio (co-current regeneration)

H_2SO_4 g / L	Capacity eq / L (Cap_O)				
% Na	0	25	50	75	100
60	0.53	0.56	0.62	0.71	0.85
70	0.57	0.61	0.69	0.79	0.94
80	0.60	0.66	0.75	0.87	1.02
100	0.65	0.73	0.85	0.99	1.15
120	0.69	0.78	0.92	1.09	1.26
140	0.71	0.81	0.97	1.16	1.35
160	0.73	0.83	1.00	1.21	1.42
200	0.76	0.86	1.04	1.28	1.54
240	0.80	0.92	1.10	1.34	1.66

TABLE 7 : Capacity Correction Factor D versus Magnesium to Hardness Ratio, Sodium to Total Cations Ratio and Alkalinity to Total Anions Ratio.

Mg / TH %	0% Na			50 % Na			80% Na		
	0	50	99% Alk	0	50	99% Alk	0	50	99% Alk
0	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
20	1.11	1.09	1.07	1.05	1.04	1.03	1.02	1.02	1.01
40	1.22	1.18	1.14	1.11	1.09	1.07	1.04	1.04	1.03
60	1.33	1.27	1.21	1.16	1.13	1.10	1.07	1.05	1.04
80	1.44	1.36	1.28	1.22	1.18	1.14	1.09	1.07	1.06
100	1.55	1.45	1.35	1.27	1.22	1.17	1.11	1.09	1.07

TABLE 8 : Capacity Correction Factor E versus Run Length.(prod.time)

Run time (hours)	0	50	99% Alk
5	0.92	0.95	0.97
8	0.94	0.96	0.98
10	0.96	0.97	0.99
20	0.98	0.99	1.00
> 25	0.99	1.00	1.00

TABLE 9 : Capacity Correction Factor F versus Water Temperature.

Temperature °C	0	50	99% Na
5	0.93	0.86	0.79
10	0.96	0.93	0.90
15	0.98	0.97	0.96
20	1.00	1.00	1.00
25	1.01	1.02	1.03
> 30	1.02	1.04	1.06

SAFE USE INFORMATION

A material Safety Data Sheet is available for each product. To obtain a copy contact your Auchtel representative.

CAUTION

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SEPARATION TECHNOLOGIES

ION EXCHANGE RESINS

DUOLITE C 20

ENGINEERING DATA SHEET (SOFTENING)

Auchtel

Duolite C 20 is strong acid Cation Exchange Resin. These data provide information to calculate the hardness leakage and operating capacity of Duolite C -20 used for water softening with Co-flow regeneration. The properties of Duolite C-20 are described in the Product Data Sheet.

HARDNESS LEAKAGE

The average hardness leakage is obtained by multiplying the basic leakage value from Table 1 by the correction factors A and B from Tables 2 & 3.

$$Leak = Leak_0 \times A \times B$$

TABLE 2 : Leakage Correction Factor A versus Total Dissolved Solids Concentration.

TDS meq / L	Factor A
< 10	1.0
15	1.9
20	3.0
30	5.8
40	9.1

Table 1 : Basic Hardness Leakage versus NaCl Regenerant Level.

NaCl g / L	Leakage meq / L ($Leak_0$)
50	0.099
75	0.050
100	0.037
125	0.027
150	0.015
200	0.001
250	0.001

TABLE 3 : Leakage Correction Factor B versus Sodium to Total Cations Ratio.

Na %	Factor B
< 5	1.0
10	1.3
20	1.6
30	1.9
50	2.5
70	3.1
90	3.7

TABLE 4 : Suggested Operating Conditions

Maximum operating temperature	____	120^0c
Minimum bed depth	_____	700 mm
Service flow rate	_____	5 to 40 BV */ hr
Maximum linear velocity	_____	50 m / hr
Regenerant	_____	NaCl
Level	_____	50 to 250 g/L
Flow rate	_____	2 to 8 BV/ hr (minimum contact time 30 minutes)
Concentration	_____	8% to 12%
Slow rinse	_____	Minimum 2 BV at regeneration flow rate
Fast rinse	_____	Same as service flow rate.

* 1 BV (Bed Volume) = 1 m^3 solution per m^3 resin

OPERATING CAPACITY

The operating capacity of Duolite C 20 in water softening is obtained by multiplying the basic capacity value from Table 5 by the correction factor C to F from Tables 6 to 9.

$$Cap = Cap_0 \times C \times D \times E \times F$$

TABLE 5 : Basic capacity versus NaCl regenerant level (co-current regeneraion)

NaCl g / L	Capacity eq / L (Cap_0)
50	0.70
60	0.80
80	1.01
100	1.12
120	1.22
150	1.38
200	1.52
250	1.60

TABLE 6 : Capacity Correction Factor C versus Sodium Concentration

Na meq / L	Factor C
< 5	1.00
10	0.98
20	0.95
30	0.92
40	0.88

TABLE 7 : Capacity Correction Factor D versus Hardness Concentration

TH meq / L	Factor D
< 5	1.00
10	0.97
20	0.92
30	0.87
40	0.82

TABLE 8 : Capacity Correction Factor E versus Regenerant Concentration.

Na Cl %	Factor E
8	0.95
10	0.97
> 12	1.00

TABLE 9 : Capacity Correction Factor F versus Flow Rate in production.

BV / hr	Factor F
5	1.04
10	1.02
15	1.00
20	0.99
30	0.97
40	0.96

SAFE HANDLING INFORMATION

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