ABB MEASUREMENT & ANALYTICS | USER GUIDE | IM/2155 REV. G

2155

Cation exchange column

Measurement made easy

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2155
cation exchange column

For more information

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Electrical safety

This equipment complies with the requirements of CEI/IEC 61010-1:2001-2 'Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use'. If the equipment is used in a manner NOT specified by the Company, the protection provided by the equipment may be impaired.

Symbols

One or more of the following symbols may appear on the equipment labelling:

	Warning – refer to the manual for instructions
	Caution – risk of electric shock
	Protective earth (ground) terminal
	Earth (ground) terminal
	Direct current supply only
	Alternating current supply
	Both direct and alternating current supply
	The equipment is protected through double insulation

Information in this manual is intended only to assist our customers in the efficient operation of our equipment. Use of this manual for any other purpose is specifically prohibited and its contents are not to be reproduced in full or part without prior approval of the Technical Publications Department.

Health and safety

To ensure that our products are safe and without risk to health, the following points must be noted:

- The relevant sections of these instructions must be read carefully before proceeding.
- Warning labels on containers and packages must be observed.
- Installation, operation, maintenance and servicing must only be carried out by suitably trained personnel and in accordance with the information given.
- Normal safety precautions must be taken to avoid the possibility of an accident occurring when operating in conditions of high pressure and/or temperature.
- Chemicals must be stored away from heat, protected from temperature extremes and powders kept dry. Normal safe handling procedures must be used.
- When disposing of chemicals ensure that no two chemicals are mixed.

Safety advice concerning the use of the equipment described in this manual or any relevant hazard data sheets (where applicable) may be obtained from the Company address on the back cover, together with servicing and spares information.

Contents

1 Introduction

1.1 Description

The measurement of contaminants by using ion exchange columns has been established in the power industry for many years.

Alkaline chemicals such as Ammonia and Sodium Hydroxide are added routinely to the feed and boiler water to control corrosion by increasing the pH. The effect of this is a significant increase the conductivity of the water, thereby masking the conductivity of any contaminants.

To counter this increased conductivity, a sample is passed through the ion exchange column where the alkali is removed. After the sample has passed through the ion exchange column, the conductivity of the contaminants can be measured accurately. For example, corrosive anion contaminants such as chloride, carbonate and sulphate can be found.

Other similar systems include a conductivity measurement before the column in order to calculate the levels of pH and Ammonia.

1.2 Ion-Exchange

Ion exchange is the process where ions incorporated within a solid material (the ion exchange resin) are exchanged with ions in a solution. This can be used to purify or remove unwanted chemicals from the solution.

The resin has the appearance of smooth spherical beads usually between 0.5 and 1 mm (0.02 and 0.04 in.) in diameter. However, at the molecular level each bead has a skeleton-like structure that presents a large surface area to the solution. Feed water is passed through the clear acrylic column containing the resin beads.

Before use, the resin is pre-treated with a Hydrochloric acid solution to condition the resin into its hydrogen form. When put into service the resin exchanges these hydrogen ions with cations (positive ions) from the solution forming acid equivalents of the salts. For example:

Ammonia

$NH_4\ OH + RH <--> RNH_4 + H_2O$

Sodium Chloride

$RH + NaCl <--> RNa + HCl$

The above sodium reaction results in a three-fold increase in conductivity, therefore smaller levels of contaminants can be detected.

1.3 Ion Exchange Column Construction

The 2155 Cation Exchange Column is supplied as a single acrylic column with quick-release couplings end fittings and a resin pack.

Note. The connecting tubes and mounting clips are not supplied.

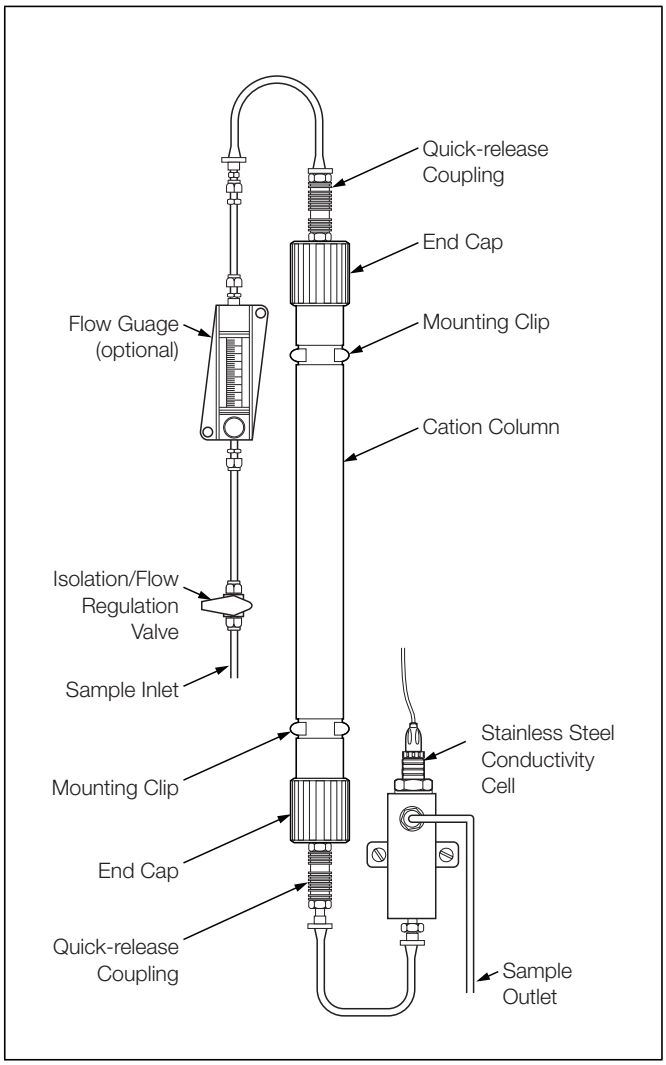

Fig. 1.1 Typical Cation Column Arrangement

2 Installation

2.1 Installation

The column is secured vertically by two mounting clips that are bolted to a suitable panel or wall (Fig. 2.1).

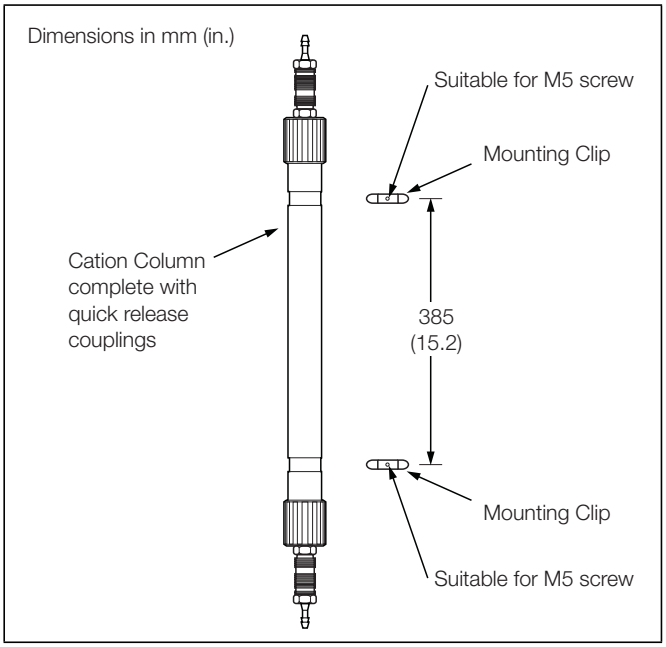

Fig. 2.1 Mounting Information

Conductivity cells are used in conjunction with conductivity transmitters mounted nearby. Different column/cell configurations are used to suit the application (Fig. 2.2).

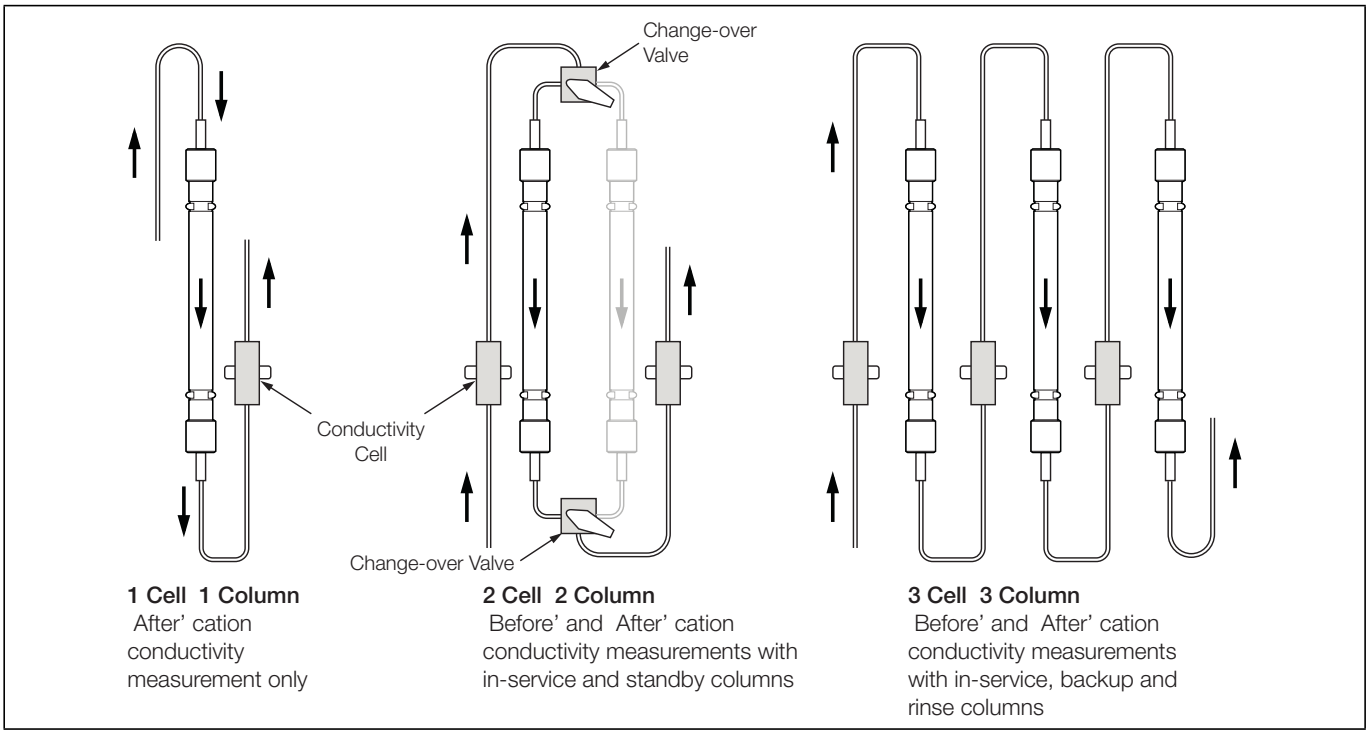

Fig. 2.2 Typical Cation Column Arrangement

3 OPERATION

3.1 Start-up and Operation

Note. Once the resin is added to the column, keep the column upright.

1. Remove the top end cap.
2. Empty a full resin pack (J/2155/500) into the column.
3. Replace the end cap.
4. Shake the column gently so that the resin settles.
5. Clip the column to the wall.
6. Attach the sample tubing to the end caps so that the direction of flow is downwards.
7. Open and adjust the sample flow regulator valves to achieve the recommended flow rate of 100 to 300 ml min^{-1}.

Note. It may take several hours before meaningful results are made due to small amounts of trapped air. This trapped air is dissolved slowly in a de-aerated sample.

4 MAINTENANCE

4.1 Maintenance

4.1.1 Regeneration

Eventually the hydrogen ions in the resin become depleted and the exchange process breaks down. The concentration of unwanted ions then rises at the outlet of the column; this is known as breakthrough.

Fortunately, the exchange process is reversible and resin can be regenerated to its original form by treatment with a solution rich in hydrogen ions, that is, an acid solution.

As the resin is exhausted, its colour changes from orange to dark red at a boundary that moves progressively down the column. When the boundary approaches the bottom of the column, the resin must be regenerated.

Exhausted resin can be processed in one of three ways:

- Disposed of and the column refilled with fresh resin.
- Removed, collected in a suitable container and regenerated when a reasonable volume of resin has been collected.
- Regenerated in situ – see Section 4.1.2

4.1.2 Procedure for Regeneration

1. Close the inlet valve (connected to the top of the column) or, in the case if a duty/standby column arrangement, switch the inlet and outlet valves to the standby column.
2. Remove the quick-release coupling from the top and bottom of the spent column.
3. Mark the top of the column and pull it from the mounting clips.
4. Fit a spare column if available.
5. Take the spent column, invert and support in a vertical position. Back-flush the column with demineralised water at 30 litres (6.6 gal) per minute for 10 minutes to remove particulate deposits.
6. From the top of the column pass 3.5 litres (0.77 gal) of 5% hydrochloric acid down the column over a period of between 10 to 30 minutes until the resin is restored to its original orange colour.
7. Flush the column by passing demineralised water down the column at approximately 3.5 litres (0.77 gal) per minute. This takes about 30 minutes to complete.
8. Return the column to service or, if putting in storage, ensure that it is filled with water and kept wet.

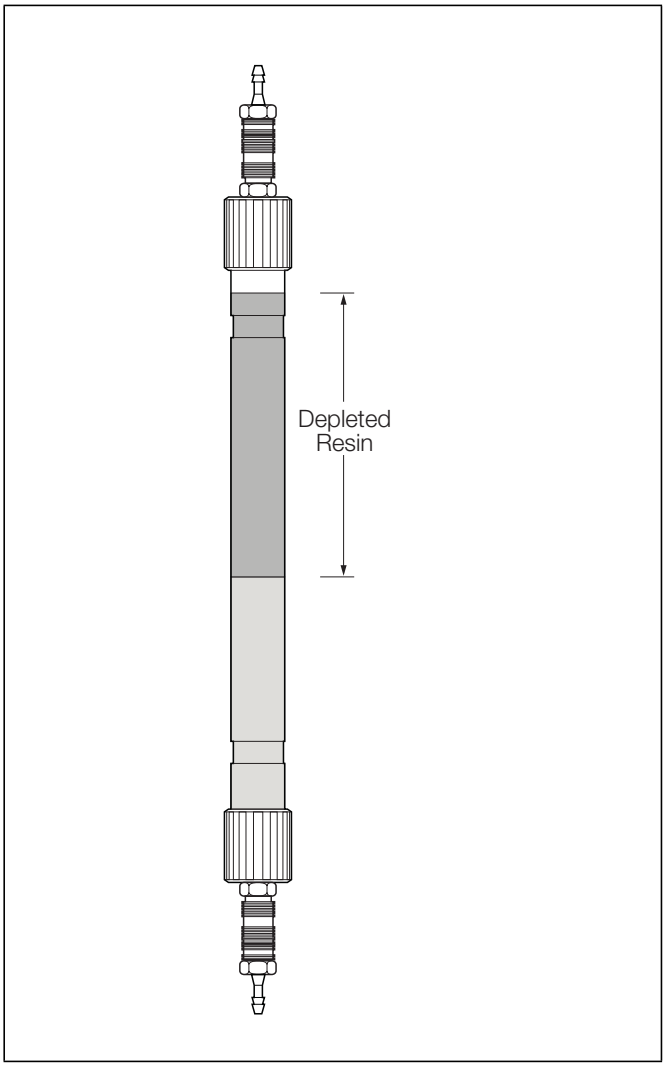

Fig. 4.1 Partially Depleted Column

5 SPECIFICATION

5.1 General

Maximum Flow rate:	400 ml min^{-1}
Minimum Flow Rate:	30 ml min^{-1}
Recommended Flow Rate:	100 to 300 ml min^{-1}
Max Temperature:	50 °C
Max Pressure:	3 $kgcm^{-1}$ / 3 bar / 45 psi
Ion Exchange ADH Resin:	Colour changes when exhausted from orange to dark red
Connection to Inlet:	6 mm (1/4 in.) ID
Connection to Outlet:	6 mm (1/4 in.) ID

5.2 Handling and Storage Conditions for Columns and Resin

Store between 5 ° and 50 °C (41 ° and 122 °F).

Avoid freezing.

Avoid de-hydration.

When handling the resin use of gloves and safety glasses is recommended.

Caution. Spilled resin beads can cause a slip hazard.

6 SPARES

6.1 Spares

Description	Part Number
Acrylic column – complete with 6 mm (1/4 in.) couplings and a resin pack	J/2155/403
Mounting clip	9390846
Resin pack	J/2155/500
Coupling (male quick release) 6 mm (1/4 in.)	J/0214/042
1/4 in. Self-sealing coupling	J/2141/150
Coupling (optional) (male quick release) 10 mm (3/8 in.)	9390308
O-Ring (small)	J/0211/176
Column end cap	J/2155/406
Moulded strainer	J/0214/044
O-ring (large)	J/0211/228

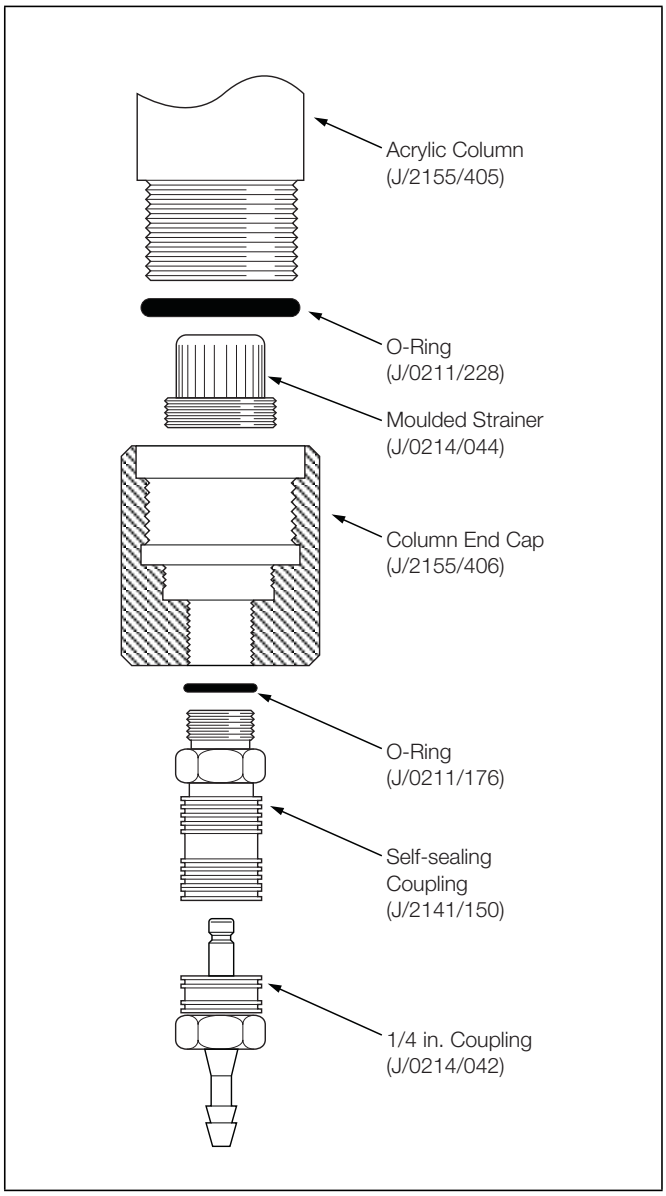

Fig. 6.1 End Cap Assembly

Notes

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