ABB MEASUREMENT & ANALYTICS | USER GUIDE | IM/9380 REV. D

9380/100
Ultrafilter

Measurement made easy

—
9380/100 ultrafilter

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Data Sheet 9380/100 Ultrafilter	DS/9380-EN

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.

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 Model 9380 Ultrafilter is a tubular filter capable of producing filtrate free of all suspended material down to 0.02µm, including bacteria, algal spores and colloidal material. The filter is recommended for use with ABB ion-selective and colorimetric analyzers in dirty water applications such as sewage, waste water, industrial effluent and river water monitoring. The cross flow design of the filter gives it self-cleaning properties which considerably reduces off-line maintenance and enables samples with high solids content to be handled. Previously, such samples could not be analyzed successfully without frequent analyzer cleaning.

1.2 Ultrafiltration

Ultrafiltration generally is the removal from solution of all suspended material down to ultra fine particle sizes. In practice, this includes the removal of microbiological material such as bacteria, algae and sewage final effluent particles, together with colloidal material, down to at least 0.02µm.

By removing biological material, ammonia stripping in the line after filtration is avoided, but build up of filtered material on a membrane surface / matrix can still allow stripping at the filtration point unless kept to an absolute minimum.

The cross flow design of the ABB Ultrafilter gives high linear sample flowrates across the membrane surface providing a self-cleaning action. Cleaning with water is very efficient at removing deposits on the surface of filter membranes and enables sample with high solids content to be handled.

Since the filter membrane is only 1µm thick, filtration takes place on the surface not within the membrane, maximizing the effectiveness of the self-cleaning action.

Satisfactory operation relies very significantly on adherence to minimum sample velocities and pressures. The more contaminated the sample (e.g. raw sewage or activated sludge), the more critical becomes pump performance and attention to regular maintenance.

1.3 Ultrafilter construction

The Ultrafilter comprises a tubular shell enclosing a second tube joined at each end such that a sealed annular space is formed. The inner tube consists of a filter element with a close fitting, semi-permeable membrane applied to the surface of a flexible porous polyester support material. The sample water flows through the inner tube longitudinally to the membrane at high pressure and velocity.

The membrane excludes all suspended solids with particle size greater than approximately 0.02µm. It can tolerate a pH range of 2 to 10 but can be damaged by some organic solvents. Membrane life depends upon the nature of the sample and varies for each application but can be up to 2 years under favorable conditions.

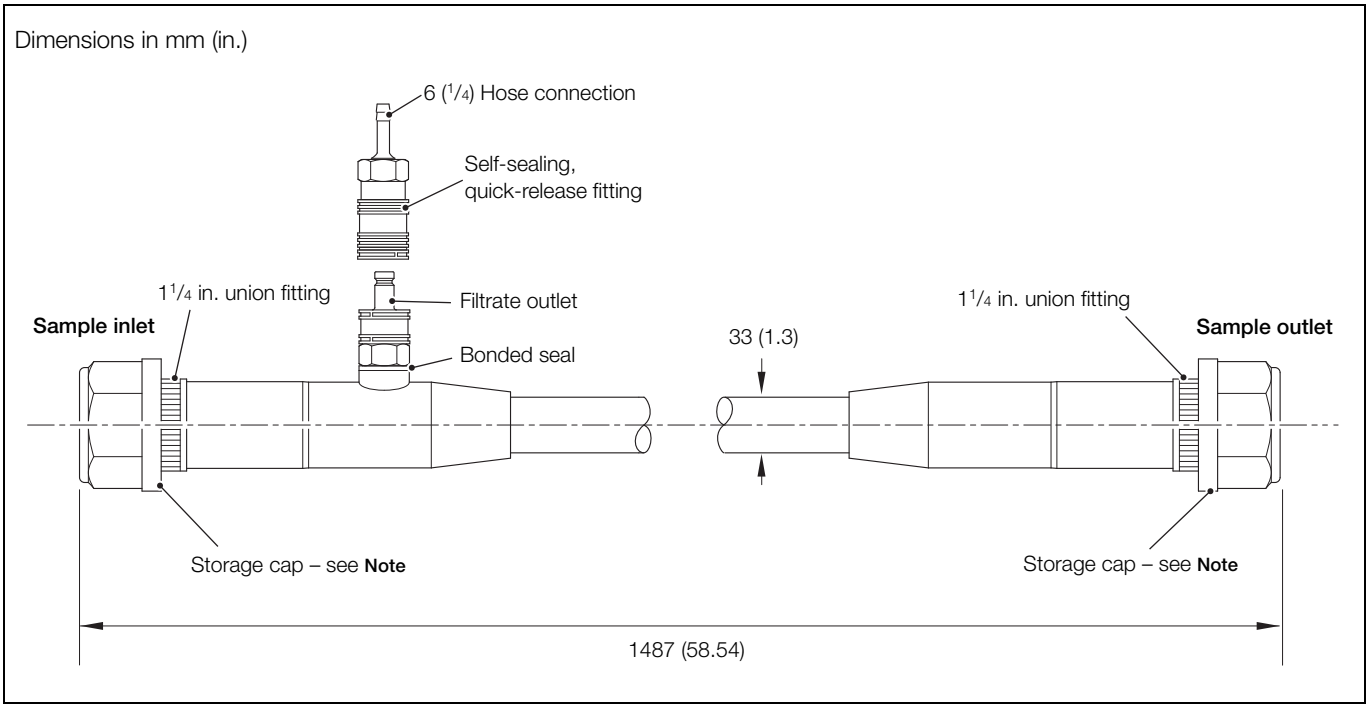


Fig. 1.1 Dimensions and fittings

Note. Do not discard the storage caps – they are needed for the cleaning procedure.

2 Installation

The Ultrafilter installation must be carefully designed to suit the specific circumstances that exist on site and to minimize routine maintenance.

A typical installation is shown in Fig. 2.1. This includes an optional dual filter arrangement (i.e. one in service and one in standby) and a two stage pumping system which is required when the sample has to be pumped over large distances or where the sample has to be lifted a long way up to the analyzer.

The final installation will be dependent on the specification of the pump(s) used. If the sample lift and pumping distances are within the specification of the filter re-circulation pump, the break tank and associated pump will not be required.

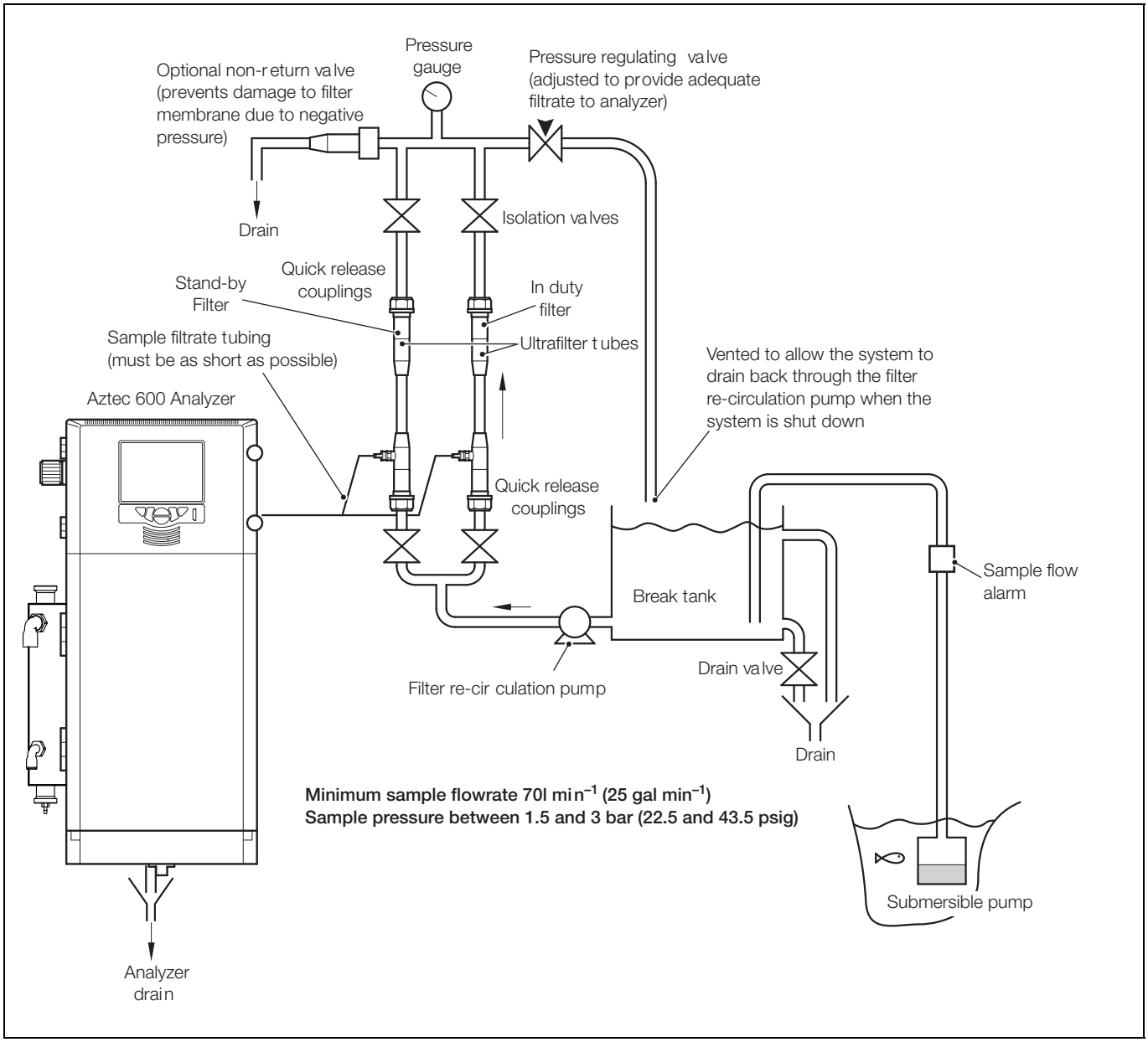


Fig. 2.1 Typical ultrafilter installation

When designing an Ultrafilter installation, the following instructions must be observed.

1. Mount the Ultrafilter vertically with the filtrate output at the bottom.
2. Ensure the sample flowrate is greater than 70 liters per minute. Self-cleaning is enhanced by higher flowrates.
3. It is essential to ensure the sample pressure is between 1.5 bar (22.5 psig) and 3.0 bar (43.5 psig).
4. The sample inlet and outlet pipe connections are 1¼ in. GF Union fittings. Obtain suitable imperial or metric union end and union nuts from GF to suit the sample pipework.

   Note. Union ends to fit PVC 1¼ in. ID pipe are contained in supplied spares kit, part No. 9380 150.

5. Use suitable pumps. The operating characteristics of a pump suitable for use with the Ultrafilter is shown in Fig. 2.2.
6. Keep sample pipework as short as possible and ensure it has an internal diameter of at least 30 mm (1¼ in.) throughout from the sample point to the Ultrafilter tube and down to drain. This reduces pressure losses and subsequent reduction in flowrate.
7. Ensure there are no restrictions in the pumped pipelines.
8. Use isolating ball valves in the pumped sample lines.
9. Keep the filtrate tube to the analyzer as short as possible. An internal diameter of 3 mm (⅛ in.) is recommended but should not be more that 6 mm (¼ in.) to minimize filtrate transfer delays.
10. In systems without a siphon break, fit a non-return valve (see Fig. 2.1) to avoid the possibility of creating a negative pressure when the sample pump is switched off and the system drains down. If the line pressure falls below atmospheric, the membrane will be pulled away from the inner support tube and damaged. The valve acts as an air bleed valve to equalize the pressure.
11. Adjust the filtrate flowrate by adjusting the pressure regulating valve on the outlet of the filter. As particulate matter builds up on the surface of the membrane, increase the pressure to maintain an adequate flow of filtrate to the analyzer. A pressure gauge is recommended in the line before the pressure regulating valve to assess the condition of the membrane.
12. Use spring clips to secure the system to a flat panel or wall to enable easy removal for routine maintenance.
13. When delivered, the Ultrafilter is coated with a glycerol solution to prevent the membrane from drying out. If it is to remain unused for any length of time, it must be cleaned and filled with fresh water.
14. Rinse out the filter tube with water prior to installation.

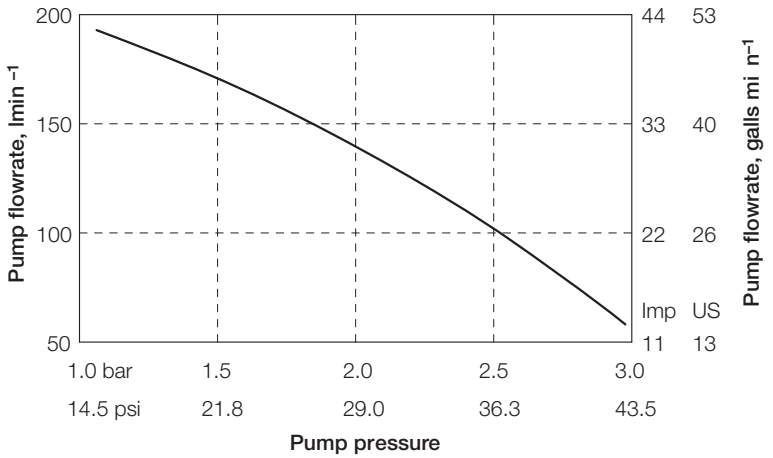


Fig. 2.2 Suitable pump operating characteristics

3 Startup and operation

1. Start the pump and ensure the sample is flowing through the filter system unobstructed. It essential to achieve the recommended pressure and flowrate characteristics. Running the Ultrafilter below the minimum sample flow rate will cause rapid build up of particulate matter on the membrane (caking).
2. Run the filtrate outlet to waste for 30 minutes before connection to the analyzer(s).
3. Gradually close the pressure regulating valve until filtrate flow commences. Continue closing the valve until the filtrate flow is sufficient to feed the analyzer(s) – see Fig. 3.1.
4. Regularly inspect the filtrate sample tube for signs of contamination or deterioration.

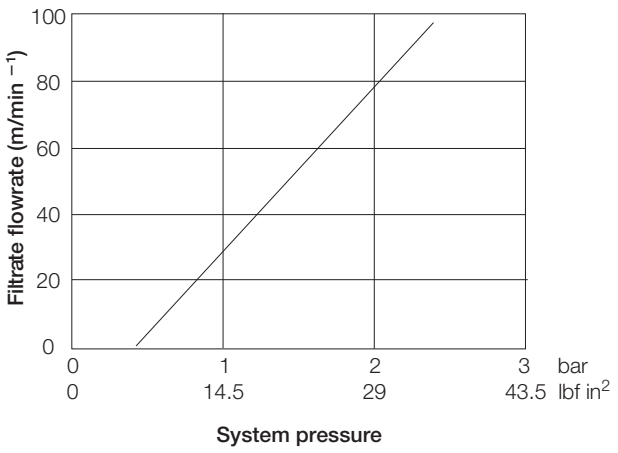


Fig. 3.1 Typical flowrate for a new filter at various sample pressures

4 Maintenance

4.1 Preparing a 500mg l^{-1} free chlorine solution

Warning.

- Concentrated sodium hypochlorite is a strong oxidizing agent and must be handled with care. Do not mix with other chemicals.
- The 500mg l^{-1} free chlorine solution is a weak solution but its vapors are very irritant, especially to the eyes and respiratory system. Care must be taken in its use. Allow plenty of ventilation and avoid breathing the vapors. Spillages must be diluted with water and splashes on the skin washed off immediately with plenty of water. If eye contamination occurs, irrigate thoroughly with water and obtain medical attention.

To prepare the solution, dilute 5 ml of concentrated sodium hypochlorite (containing approximately 10 % w/v available chlorine) and make up to 1000 ml with deionized water. The solution does not keep – make only enough for immediate requirements and discard any surplus after use.

4.2 Routine maintenance

Note. Remove ion-selective analyzer sensors for short term storage until all cleaning solutions have been flushed out of the pipework.

Because the Ultrafilter is used in a wide variety of applications where the nature of the sample can vary considerably, the following maintenance schedule is a general guide only. It will be necessary to amend the schedule to suit the particular installation and sample conditions.

In normal operation, filtrate flowrate reduces with time but this can be compensated for by increasing the pressure in the system by gradually closing the pressure regulating valve on the outlet of the filter. This procedure can be continued until one of the following limits is reached at which point the Ultrafilter will require cleaning:

1. Sample flowrate falls below 70 liters per minute.
2. Maximum pump outlet pressure is reached.
3. Maximum Ultrafilter operating pressure (5.9 bar (85 psig) is reached.

Where the Ultrafilter is being used in conjunction with ammonia analyzers, there is the added effect of ammonia stripping causing low or zero readings. This normally occurs as a result of a build-up of solids on the surface of the filter and the growth of biological material in the filtrate chamber in the filter body. This can occur even when the filtrate flowrate has not been adversely affected. The problem is overcome by routine sterilization of the Ultrafilter tube and the filtrate pipework to the analyzer.

4.2.1 Weekly maintenance

1. Check operation of pump(s).
2. Check filtrate flow to the analyzer and adjust the line pressure accordingly.
3. Check for any sample leaks.

4.2.2 Monthly cleaning

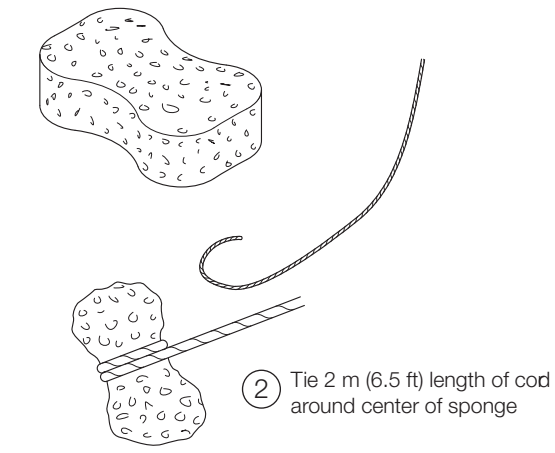
The following procedure will generally suffice to remove the majority of deposits and return the filter to normal operation, provided it is carried out on a regular basis and the filtrate flowrate is not severely impaired. To remove stubborn deposits, see Section 4.2.3.

1. Remove the Ultrafilter from the pipework.
2. Fit one of the storage caps supplied with the Ultrafilter to one end of the filter tube.
3. Rinse the tube several times with high purity water.
4. Fill the inner of the filter tube with a sodium hypochlorite solution (500 mgl^{-1} as free chlorine) – see Section 4.1, fit a storage cap to the open end of the tube and leave for 24 hours. This allows the solution to percolate the membrane and ensures complete sterilization of the filter.
5. Empty the tube, disposing of the solution safely, and rinse the tube thoroughly with clean water.
6. Refit the filter tube into the pipework and follow the start-up procedure described in Section 3.

4.2.3 Maintenance of the Ultrafilter tube to recover performance

This procedure is recommended where the filtrate flowrate from the Ultrafilter is severely impaired.

A pull-through sponge ball is required. This is easily fabricated from a suitably sized piece of sponge and length of cord – see Fig. 4.1.



Caution. If the sponge ball is too large, undue force will be required to pull it through the filter tube which will result in damage to the filter membrane.

Fig. 4.1 Preparing pull-through sponge ball

1. Remove the Ultrafilter from the pipework.
2. Thread the cord of a pull-through sponge ball (see Fig. 4.1) through the filter tube and pull the sponge through the entire length of the tube to remove any material on the surface on the filter membrane. Clean the sponge and repeat the process until the sponge appears clean.

   Caution. The filter membrane will be damaged if undue force is required to pull the sponge ball through the filter tube.

3. Rinse the tube several times with high purity water.
4. Fill the inner of the filter tube with a sodium hypochlorite solution (500 mgl^{-1} as free chlorine) – see Section 4.1, fit a storage cap to the open end of the tube and leave for 24 hours. This allows the solution to percolate the membrane and ensures complete sterilization of the filter.
5. Empty the tube, disposing of the solution safely, and rinse the tube thoroughly with clean water.

6. Thread the cord of a pull-through sponge (see Fig. 4.1) through the filter tube and pull the sponge through the entire length of the tube to remove any material on the surface on the filter membrane loosened by the cleaning solution. Clean the sponge and repeat the process until the sponge appears clean.

> **Caution.** The filter membrane will be damaged if undue force is required to pull the sponge ball through the filter tube.

7. Refit the filter tube into the pipework and follow the start-up procedure described in Section 3.

4.2.4 Removal of hardness scale build-up on the Ultrafilter membrane

1. Make up a 5 % citric acid solution.
2. Refer to Section 4.2.2 or 4.2.3 and clean the Ultrafilter.
3. Fill the Ultrafilter with the citric acid solution and leave for about 30 minutes.
4. Rinse the tube several times with high purity water.
5. Refit the filter tube into the pipework and follow the start-up procedure described in Section 3.

5 Specification

Housing body
PVC

Membrane
PVDF and Epoxy impregnated polyester and fiberglass

Operating pressure
1.5 to 3.0 bar at 38 °C (22.5 to 43.5 psig at 100.4 °F)

Maximum operating pressure
5.9 bar (85 psig)

Maximum operating temperature
49 °C (131.8 °F)

pH range at 49°C (131.8°F)
Continuous – 2.0 to 10.0

Short term – 1.5 to 10.5

Minimum flowrate
70 l min^{-1} (25 gal min^{-1})

End connections
$1^1/_4$ in. union bush fitting

Filtrate outlet
Connections

6 mm ($^1/_4$ in.) OD hose connection, quick release fitting

Filter tube dimensions
1.487 m (58.54 in.) long

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6 Spares

Description	Part number
Ultrafilter tube assembly	9280 100
Union end $1^1/_4$ in. UPVC*	0216 538
Union nut $1^1/_4$ in. UPVC*	0216 330
Union end O-ring*	0211 242
Self-sealing filtrate outlet (male)	0214 985
Filtrate outlet bonded seal	0225 592
Filtrate outlet quick release fitting	0214 986

* Supplied as part of Kit Part No. 9380 150.

> **Note.** The Ultrafilter uses GF union connections.

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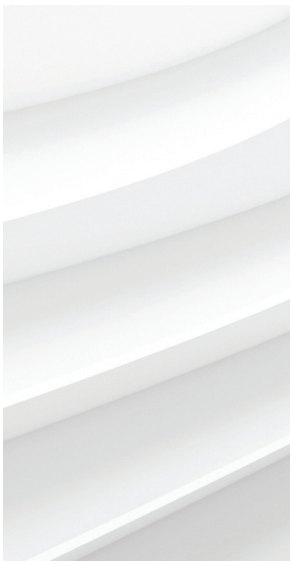

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