ANALYT MESSTECHNIK



OPERATING MANUAL

SKC Sioutas Personal Cascade Impactor

Loading, flow rate verification, sampling and cleaning of the four-stage SKC Sioutas Personal Cascade Impactor, which collects airborne particles in five size ranges from above 2.5 µm to below 0.25 µm at 9 L/min.

AMTC-MN-0034

Rev. 2 · October 2026

About this manual

The SKC Sioutas Personal Cascade Impactor sorts airborne particles by size while it samples. Four impaction stages, each with a 25 mm polytetrafluoroethylene (PTFE) filter, catch the particles above their cut-point of 2.5, 1.0, 0.5 and 0.25 µm; a 37 mm PTFE after-filter collects what passes the last stage. One sample therefore gives five size fractions, which the laboratory can weigh, analyse chemically or examine under the microscope.

This manual covers the impactor Cat. No. 225-370. It is reusable: before each sample you load fresh filters, after sampling you take them out for the laboratory and clean the impactor. The impactor, also known as the Personal Cascade Impactor Sampler (PCIS), was developed by Dr. Constantinos Sioutas of the University of Southern California in partnership with the Mickey Leland National Urban Air Toxics Research Center (NUATRC).

Read Product description (p. 7) first to know the parts and the pump it needs. Then work through Operation (p. 9) in order: taking the impactor apart, Loading the impactor (p. 10), Verifying the flow rate (p. 11) and Sampling (p. 12). Maintenance (p. 14) prepares the impactor for the next sample. Analyt-MTC supplies and supports the impactor; for questions and orders see Service, warranty and contacts (p. 17).

Keep this manual for the lifetime of the product. The current revision is on the product page at analyt-mtc.com.

Abbreviations

Abbreviation	Meaning
EPA	US Environmental Protection Agency
UL	Underwriters Laboratories

How this manual marks information

WARNING

A hazardous situation which, if not avoided, could result in death or serious injury.

Note

Information that helps understanding; never a hazard.

Document information

Title	SKC Sioutas Personal Cascade Impactor — Operating manual
Document number	AMTC-MN-0034
Revision	Rev. 2 — October 2026
Applies to	Sioutas Personal Cascade Impactor, Cat. No. 225-370
Language	English
Manufacturer	SKC Inc.

Revision history

Rev.	Date	Change
2	October 2026	Quality programme: new document type, number and identity pages.
1	October 2026	First issue.

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Contents

1 **Safety** 6
- Intended use 6
- Explosive atmospheres 6
- Loading the impactor and marking the samples 6

2 **Product description** 7
- How the impactor separates the particles 7
- Parts 7
- What is supplied 8
- Pump and use 8

3 **Operation** 9
- Removing the stages 9
- Opening the outlet plate 9
- Loading the impactor 10
  - Preparing the filters and the impactor 10
  - Inserting the after-filter 10
  - Loading the stages 11
  - Sampling with fewer stages 11
- Verifying the flow rate 11
  - Representative media 12
  - Verifying the flow 12
- Sampling 12
  - Taking the sample 12
  - Outdoor sampling 13
  - Unloading and sending the samples 13

4 **Maintenance** 14
- Cleaning the impactor 14
- Tips 14

5 **Specifications** 15
- Sampling 15
- Sample media 15
- Physical data 15
- References 15

6 **Ordering information** 16
- Impactor and pump 16
- Filters 16
- Accessories and spare parts 16

7 **Service, warranty and contacts** 17

Disposal 17

CHAPTER 1

Safety

Read the safety messages in this chapter before you use the Sioutas impactor. Each one also appears in the procedure where it applies. One concerns the Leland Legacy pump in explosive atmospheres; the others protect the sample.

Intended use

The Sioutas Cascade Impactor separates airborne particles into five size ranges and collects them on filters for gravimetric, chemical or microscopic analysis. Use it at a constant 9 L/min with the SKC Leland Legacy pump or another pump that holds this flow: worn by the worker in the breathing zone for personal sampling, or on a tripod or a suitable mounting for area sampling (see Pump and use (p. 8)).

Do not use it in any of these ways:

- the Leland Legacy pump in an explosive atmosphere: it is not UL Listed as intrinsically safe;
- outdoors at a wind speed of 5 mph or more, or with overloaded impactor plates (see Outdoor sampling (p. 13));
- a wire, needle or any other object used to clear an impaction slit.

Explosive atmospheres

WARNING

The Leland Legacy pump is not UL Listed as intrinsically safe. In a hazardous location, the pump can ignite an explosive atmosphere. Use the pump in non-explosive atmospheres only.

Loading the impactor and marking the samples

Note
Without the screen, the filter closes off the outlet. Check that the screen and the spacer ring (Figure 2) lie in the outlet plate before you put in the filter.

Note
The impactor works correctly only with both thumb nuts fully tightened. Tighten the thumb nuts in turn, a little at a time, until both are fully tight.

Note
Without a stage mark, the size fractions cannot be told apart. Mark on every sample container and on the chain-of-custody form which stage — A, B, C, D or after-filter — the filter came from.

CHAPTER 2

Product description

The impactor is a stack of four stages between an inlet plate and an outlet plate. Each stage removes the particles above its cut-point from the air stream; the after-filter in the outlet plate collects the finest particles. The cut-points hold only at 9 L/min.

How the impactor separates the particles

Each stage is a pair of plates: an accelerator plate with narrow impaction slits, and below it a collector plate that holds a 25 mm PTFE filter under a filter retainer. Particles above the cut-point of a stage are collected on its filter; the rest go on to the next stage, which has a lower cut-point. Particles below the 0.25 µm cut-point of stage D reach the 37 mm PTFE after-filter in the outlet plate.

The stages are lettered A to D from the inlet; each accelerator plate carries its letter.

Stages and size fractions at 9 L/min

Stage	50 % cut-point	Collects particles	Collection medium
A (inlet side)	2.5 µm	above 2.5 µm	25 mm PTFE filter, 0.5 µm
B	1.0 µm	1.0–2.5 µm	25 mm PTFE filter, 0.5 µm
C	0.50 µm	0.5–1.0 µm	25 mm PTFE filter, 0.5 µm
D	0.25 µm	0.25–0.5 µm	25 mm PTFE filter, 0.5 µm
After-filter (outlet plate)	—	below 0.25 µm	37 mm PTFE filter, 2.0 µm, with polymethylpentene (PMP) support ring

You can also sample with one, two or three stages only (see Sampling with fewer stages (p. 11)). The US EPA Environmental Technology Verification (ETV) programme has verified the performance of the impactor with the SKC Leland Legacy pump.

Parts

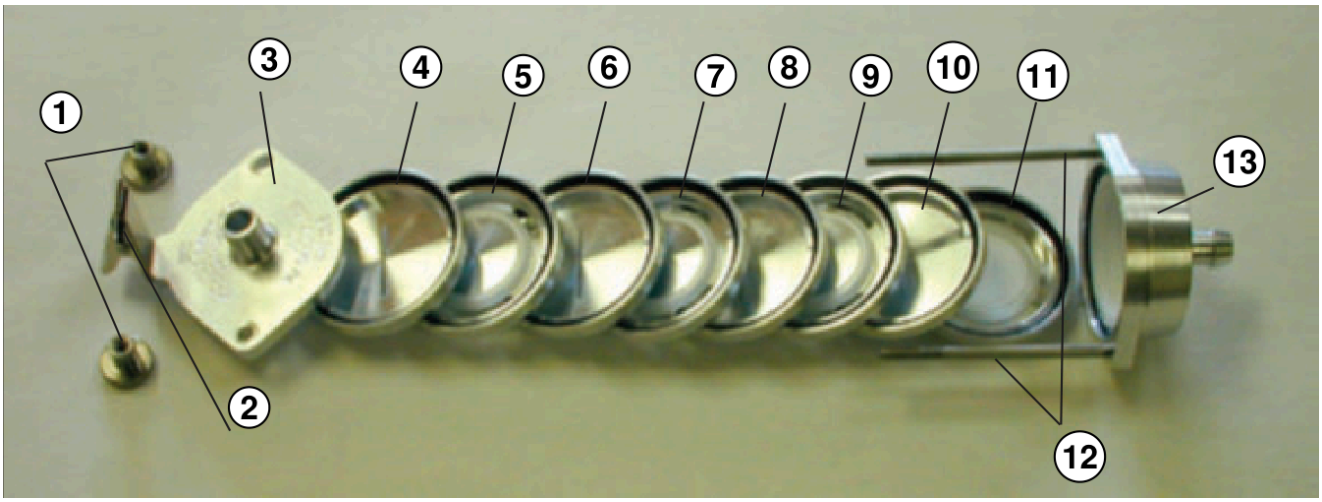


Figure 1. The impactor taken apart, inlet on the left.
1 Thumb nuts · **2** Clip · **3** Inlet plate · **4** Accelerator plate A · **5** Collector plate · **6** Accelerator plate B · **7** Collector plate · **8** Accelerator plate C · **9** Collector plate · **10** Accelerator plate D · **11** Collector plate · **12** Threaded studs · **13** Outlet plate and after-filter housing

The outlet plate holds the after-filter. Under the filter lie a screen and a spacer ring; the screen keeps the filter from closing off the outlet. A compression ring and an O-ring hold the filter in place.

The plates and stages are anodised, autoclavable aluminium. The O-rings are nitrile (Buna-N), the filter retainers acrylic and the compression ring PTFE.

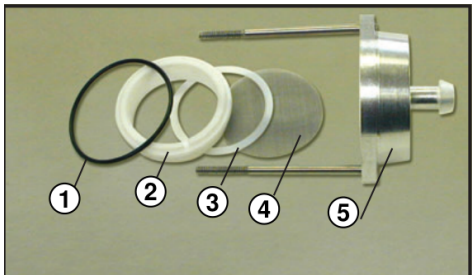


Figure 2. Outlet plate.
1 O-ring · **2** Compression ring · **3** Spacer ring · **4** Screen · **5** Outlet plate

What is supplied

The impactor arrives assembled; only the filter retainers come separately in the package. Filters are not supplied: for each sample you need four 25 mm stage filters and one 37 mm after-filter. For filters, forceps and the other accessories, see Ordering information (p. 16).

Pump and use

Use the SKC Leland Legacy sample pump (Cat. No. 100-3002) or any other pump that holds a constant 9 L/min. For personal sampling, clip the impactor to the worker's collar in the breathing zone and the pump to the belt. For area sampling, mount the impactor on a tripod or clip it in a suitable place. Outdoor ambient sampling is possible under the conditions in Outdoor sampling (p. 13).

Note
As particles build up on the after-filter, the pressure drop across the impactor rises. Use a flow-compensating pump, such as the Leland Legacy, that keeps the flow at 9 L/min against this rising resistance.

WARNING

The Leland Legacy pump is not UL Listed as intrinsically safe. In a hazardous location, the pump can ignite an explosive atmosphere. Use the pump in non-explosive atmospheres only.

CHAPTER 3

Operation

Operation runs from the assembled impactor to the samples for the laboratory: take the impactor apart; load it with weighed filters; verify the flow rate; take the sample; then unload the filters stage by stage and send them.

Take the impactor apart to load filters, to remove them after sampling and to clean it. Always work from the inlet to the outlet.

> **Note**
> Use forceps to put in or take out the stage filters, the after-filter and the filter retainers.

Removing the stages

1. Unscrew and remove the two thumb nuts.
2. Lift off the inlet plate.
3. Lift accelerator plate A and the collector plate under it off the stack together.
4. Separate accelerator plate A from its collector plate.
5. Repeat steps 3 and 4 for stages B, C and D.

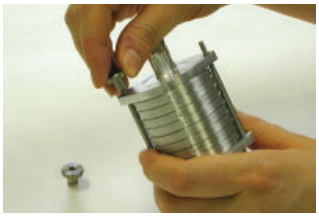


Figure 3. Remove the thumb nuts (step 1).



Figure 4. Lift off the inlet plate (step 2).



Figure 5. Lift off stage A (step 3).



Figure 6. Separate the plates (step 4).

Opening the outlet plate

To reach the after-filter, open the outlet plate once all four stages are off (see Figure 2).

6. Take the O-ring out of the outlet plate.
7. Take the compression ring out of the outlet plate. The after-filter, if fitted, is now free.



Figure 7. All four stages removed (step 5).



Figure 8. Take out the O-ring (step 6).



Figure 9. Take out the compression ring (step 7).

Loading the impactor

Load the impactor in a clean place with a clean, dry impactor and weighed filters. Assemble it in the opposite order to taking it apart: from the outlet to the inlet.

Preparing the filters and the impactor

- **Filters:** for each sample you need four 25 mm PTFE stage filters, 0.5 µm, unlaminated (Cat. No. 225-17-21), and one 37 mm PTFE after-filter, 2.0 µm, with PMP support ring (Cat. No. 225-1709). Condition and weigh them in a clean environment as your method prescribes, and record each weight as the pre-sample weight.
- **Impactor:** it must be clean, with no particles left from the last sample (see Maintenance (p. 14)).

> **Note**
> Handle every filter with forceps only, never with your fingers.

Inserting the after-filter

1. If they are still in place, take the O-ring and the compression ring out of the outlet plate (Opening the outlet plate (p. 9), steps 6 and 7).

   > **Note**
   > Without the screen, the filter closes off the outlet. Check that the screen and the spacer ring (Figure 2) lie in the outlet plate before you put in the filter.

2. Put the 37 mm after-filter in the outlet plate, then refit the compression ring and the O-ring.



Figure 10. O-ring and compression ring out (step 1).



Figure 11. After-filter in, rings refitted (step 2).

Loading the stages

Build the stack from stage D, next to the outlet, up to stage A.

3. Seat a collector plate on top of the outlet plate.
4. With forceps, lay a 25 mm filter in the collector plate.
5. With forceps, lay a filter retainer on the filter and press it down firmly until it sits snugly.
6. Place accelerator plate D on the collector plate, **O-ring side up**, and turn it until the letter D lines up with the mark.

> **Note**
> The impactor works correctly only with both thumb nuts fully tightened. Tighten the thumb nuts in turn, a little at a time, until both are fully tight.

7. Repeat steps 3 to 6 for stages C, B and A, in that order. Slide the inlet plate on and screw on the two thumb nuts.

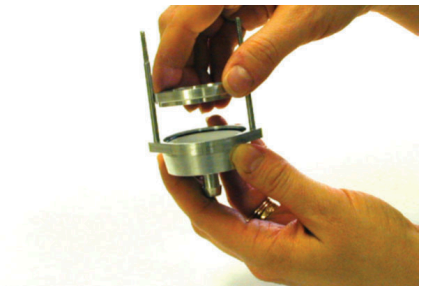


Figure 12. Collector plate on the outlet plate (step 3).

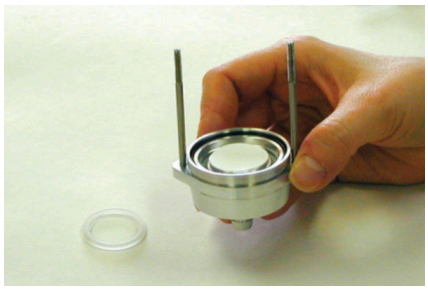


Figure 13. 25 mm filter in the collector plate (step 4).



Figure 14. Filter retainer on the filter (step 5).

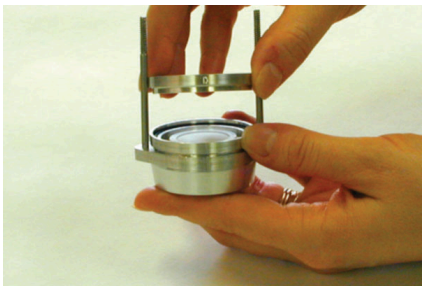


Figure 15. Accelerator plate D, letter D on the mark (step 6).

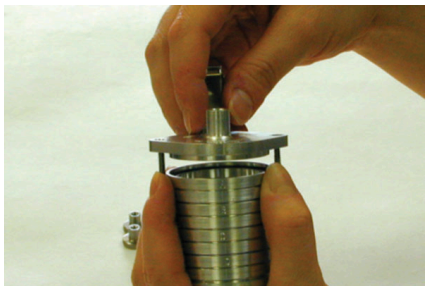


Figure 16. Inlet plate on, thumb nuts tightened (step 7).

Sampling with fewer stages

For one-, two- or three-stage sampling, place only the number of loaded stages you need — each an accelerator plate with its collector plate — on the outlet plate. Then refit the inlet plate, screw on and fully tighten the thumb nuts, verify the flow rate and sample as usual.

Verifying the flow rate

The cut-points of the four stages are only valid at 9 L/min. Verify the flow through the complete sampling train — flowmeter, impactor and pump — before you sample.

Representative media

Verify with the impactor assembled and a representative after-filter in the outlet plate: a filter of the same type as the sample filter, which you do not need to weigh. Representative filters in all four stages are allowed but not needed for a correct verification.

> **Note**
> The back pressure of PTFE filters can vary from filter to filter, even within one lot.

Verifying the flow

> **WARNING**
> The Leland Legacy pump is not UL Listed as intrinsically safe. In a hazardous location, the pump can ignite an explosive atmosphere. Use the pump in non-explosive atmospheres only.

1. With flexible tubing, connect the outlet of the impactor to the inlet of the pump — an SKC Leland Legacy or another pump that holds a constant 9 L/min.
2. Connect the inlet of the impactor to the outlet of a flowmeter that can verify a flow of 9 L/min.
3. Check that the flow through the sampling train is 9 L/min. Follow the operating instructions of the flowmeter and of the pump.

Then disconnect the flowmeter and replace the representative media with the weighed sample filters (see Taking the sample (p. 12)).

Sampling

Sample with fresh, weighed filters in the impactor you verified. Afterwards, take the filters out stage by stage and send them to the laboratory with a clear record of which stage each came from.

Taking the sample

1. After flow rate verification, take out the representative media and set them aside. Load new, preweighed filters (see Loading the impactor (p. 10)).
2. Clip the impactor to the worker's collar in the breathing zone and the pump to the belt, or set the impactor up in the area to be sampled. Connect the impactor outlet to the pump inlet.

   > **WARNING**
   > The Leland Legacy pump is not UL Listed as intrinsically safe. In a hazardous location, the pump can ignite an explosive atmosphere. Use the pump in non-explosive atmospheres only.

3. Switch the pump on. Record the start time and the other sample data you need.
4. When the sample time is up, switch the pump off and record the stop time.
5. Disconnect the pump and the tubing. Take the samples and the sampling records to the laboratory (see Unloading and sending the samples (p. 13)).



Figure 17. Impactor at the collar, pump at the belt.

Outdoor sampling

> **Note**
> The impactor can sample ambient outdoor air on two conditions:
>
> - the wind speed is below 5 mph;
> - the impactor plates are not overloaded.

The maximum particle load differs from stage to stage; it is given in Misra et al. (2002), reference 1 in References (p. 15).

Unloading and sending the samples

1. Take the stages apart as in Removing the stages (p. 9).

   > **Note**
   > Without a stage mark, the size fractions cannot be told apart. Mark on every sample container and on the chain-of-custody form which stage — A, B, C, D or after-filter — the filter came from.

2. With forceps, take out each filter for weighing and analysis. For an off-site laboratory, put each filter in a labelled, sealed container.
3. Pack and send the samples so that none is lost or contaminated on the way. Each filter holds one size fraction, which the laboratory can analyse gravimetrically, chemically or microscopically.

CHAPTER 4

Maintenance

Particles left in the impactor would end up in the next sample. Clean the impactor between samples, and check every accelerator plate for blocked slits before you load it again.

Cleaning the impactor

1. Take all stages apart (see Removing the stages (p. 9)) and remove any filters.
2. Remove the O-rings: set the head of a small flat-head screwdriver in the notch in the inner wall of the plate, and gently lift the O-ring up and out.

   Note
   Wash the filter retainers in water with detergent only.

3. Wash all parts except the filter retainers in water with detergent or in isopropyl alcohol. Wash the filter retainers in water with detergent only. An ultrasonic bath may be used.
4. Rinse all parts. Dry them thoroughly with compressed air if you have it; otherwise let them air-dry in a clean place.

   Note
   Never use a wire, needle or any other object to clear an impaction slit.

5. Hold each accelerator plate up to the light and check that none of its impaction slits is blocked. Blow a blocked slit clear with compressed air.

Tips

- To sample at several sites in a row, keep extra collector plates loaded and ready (replacement collector plates, Cat. No. P55016).
- Handle filters and filter retainers with forceps only (precision forceps, Cat. No. 225-13-1).
- Replacement O-rings, filter retainers and the PTFE spacer ring come as a set (Cat. No. P51917); see Ordering information (p. 16).

CHAPTER 5

Specifications

Sampling

Flow rate	9 L/min
50 % cut-points at 9 L/min	Stage A 2.5 µm · stage B 1.0 µm · stage C 0.50 µm · stage D 0.25 µm
Size fractions	Five: four stages and an after-filter (below 0.25 µm)
Sample pump	SKC Leland Legacy (Cat. No. 100-3002) or another pump that holds a constant 9 L/min
Maximum particle load	Varies per stage; see reference 1
Outdoor sampling	Wind speed below 5 mph; impactor plates not overloaded
Analysis	Size-fractionated gravimetric, chemical and microscopic analysis
Verification	Performance verified by the US EPA Environmental Technology Verification (ETV) programme with the Leland Legacy pump

Sample media

Stage filters	25 mm PTFE*, 0.5 µm pore size, unlaminated, without support pad (Cat. No. 225-17-21); four per sample
After-filter	37 mm PTFE*, 2.0 µm pore size, with PMP support ring (Cat. No. 225-1709)
After-filter operating temperature	464 °F (240 °C) maximum, set by the PMP support ring

* The back pressure of PTFE filters can vary within one lot.

Physical data

Materials	Inlet and outlet plates and stages: anodised, autoclavable aluminium · O-rings: nitrile (Buna-N) · filter retainers: acrylic · compression ring: PTFE
Inlet and outlet	Both 3/8 in outside diameter, 1/4 in inside diameter; for tubing of 3/8 in inside diameter
Dimensions	3.4 × 2.2 in (8.6 × 5.6 cm)
Weight	5.6 oz (159 g)

References

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2. Ono-Ogasawara, M., Myojo, T.: A Proposal of Method for Evaluating Airborne MWCNT Concentration. Industrial Health 49 (2011), pp. 726–734.
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4. Singh, M., Misra, C., Sioutas, C.: Field Evaluation of a Personal Cascade Impactor Sampler (PCIS). Atmospheric Environment 37 (2003), pp. 4781–4793.

CHAPTER 6

Ordering information

Order from Analyt-MTC with the order codes.

The impactor is supplied without filters: for each sample you need four 25 mm stage filters and one 37 mm after-filter.

Impactor and pump

Description	Order code
Sioutas Personal Cascade Impactor	225-370
Leland Legacy sample pump†, 5–15 L/min, with Li-ion battery pack, CE marked	100-3002

† For non-explosive atmospheres only; not UL Listed as intrinsically safe.

Filters

Description	Order code
Stage filters (collection substrate for the four stages), 25 mm PTFE*, 0.5 µm pore size, unlaminated, without support pad, pack of 100 — required	225-17-21
After-filters, 37 mm PTFE* with PMP support ring‡, 2.0 µm pore size, pack of 50 — recommended	225-1709

* The back pressure of PTFE filters can vary within one lot. ‡ Maximum operating temperature 464 °F (240 °C), set by the PMP support ring.

Accessories and spare parts

Description	Order code
Tubing, Tygon, 3/8 in inside diameter, fits the impactor and the Leland Legacy pump, 10 ft	225-1351
Replacement collector plates, set of 4	P55016
Ring and spacer set: 4 filter retainer rings, 9 O-rings, 1 PTFE spacer ring	P51917
Filter retainers only, pack of 4	P20151
Forceps, precision stainless steel, serrated tips, for inserting filters	225-13-1

CHAPTER 7

Service, warranty and contacts

Analyt-MTC is your contact for everything concerning the Sioutas impactor: choosing filters and pump for your study, orders of impactors, filters and spare parts, technical questions and complaints. Warranty and returns follow Analyt-MTC's terms and conditions of sale.

Contact

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Before you contact Analyt-MTC

Have the following at hand so Analyt-MTC can help you quickly:

- the catalogue number of the impactor, 225-370;
- the filters you sample with and the number of stages you use;
- the pump and flowmeter you use, and the flow rate you verified.

Disposal

Dispose of the impactor under local regulations; separate metal, glass and plastic parts for recycling where possible.

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AMTC-MN-0034 · Rev. 2 · 2026-10

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