MEASUREMENT & ANALYTICS | DATA SHEET | DS/ATS410-EN REV. C

4690 SERIES

Turbidity sensor

ENGINEERED
TO OUTRUN



MEASUREMENT MADE EASY

Accurate, reliable turbidity measurement

Flow-through turbidity design
- Fast response to process turbidity changes due to minimal sample residence time.

Automatic sensor cleaning
- Reduces maintenance requirements.
- Optimizes performance sensitivity.

Secondary standards for calibration
- Accurate, repeatable, simple, safe.
- Realize significant cost savings by reducing the use of primary standards.

Reliable and accurate measurement
- Ultralow backscatter for accurate measurement of low turbidity values.
- Automatic bubble rejection to compensate for erroneous readings due to degassing.

ABB's 4690 range of turbidity sensors

The measurement of turbidity is a critical measurement in drinking water as it is used to indicate water quality and filtration effectiveness (for example, whether disease-causing organisms are present).

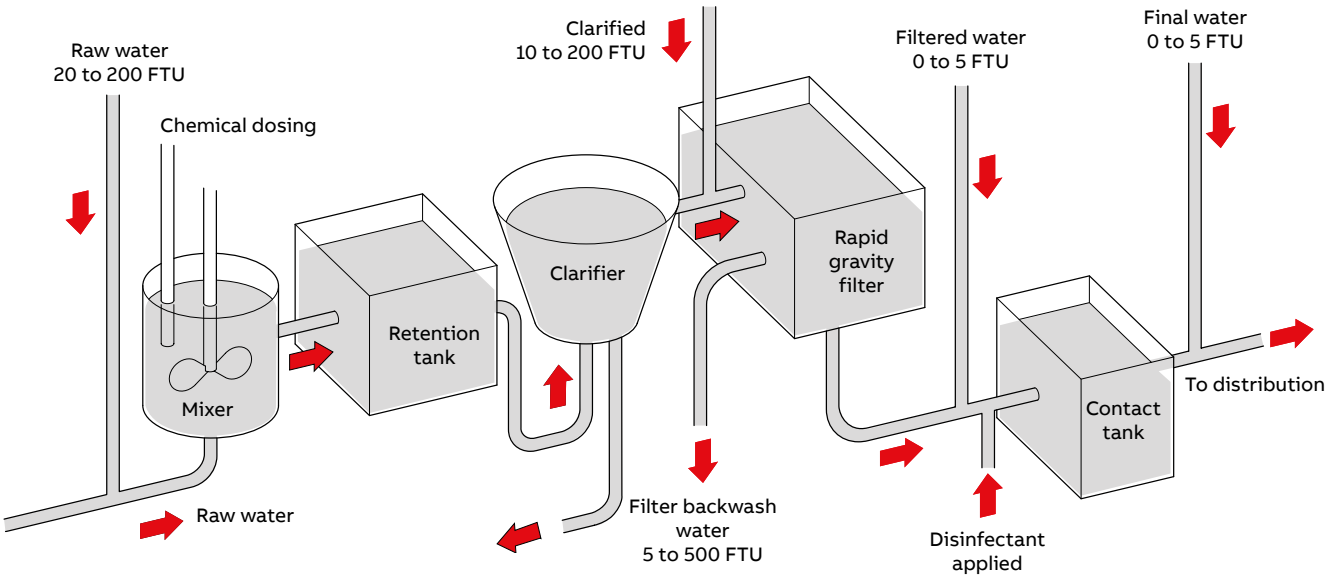
ABB's 4690 range of turbidity sensors has been designed specifically for the measurement of turbidity throughout the potable water treatment process.

Whichever of the two measurement ranges you choose, low range (0 to 40 NTU) or higher range (0 to 400 NTU), you can benefit from reliable, accurate turbidity measurement with automatic optical cleaning and dry standard calibration verification.

Applications

Typical applications for the 4690 range of flow-through turbidity sensors in potable water treatment include:

- Raw water/source monitoring
  - Provides an indication of the solids loading entering the treatment plant to enable adjustment of the coagulant dose.
- Monitoring clarified water
  - Clarifier supernatant turbidity measurement monitors clarifier efficiency to provide early warning of floc blanket break-up or incorrect coagulant dosing.
- Filter backwashing control
  - Monitors the filter backwash curve to minimize clean water usage.
- Monitoring of filtered water
  - Ensures correct operation of the filters and guards against turbidity breakthrough.
- Monitoring of final drinking water quality
  - Provides a final quality check after disinfection before distribution.



01 Typical turbidity monitoring application

4690 turbidity sensor overview



Auto-clean system
- Programmable automatic cleaning
- Reduces operator maintenance
- Ensures sensor accuracy and reliability

Dry secondary standards
- Simplifies routine instrument verification
- Eliminates chemical standard preparation errors
- Reduces cost-of-ownership

Sample flow cell
- Flow-through nephelometric design
- Minimal sample residence time provides fast response to turbidity changes for improved process control

Emitter and receiver assemblies
- ISO 7027 compliant

Integral sample feed and drain valves
- Simple installation
- Quick and easy calibration

Reliable measurement

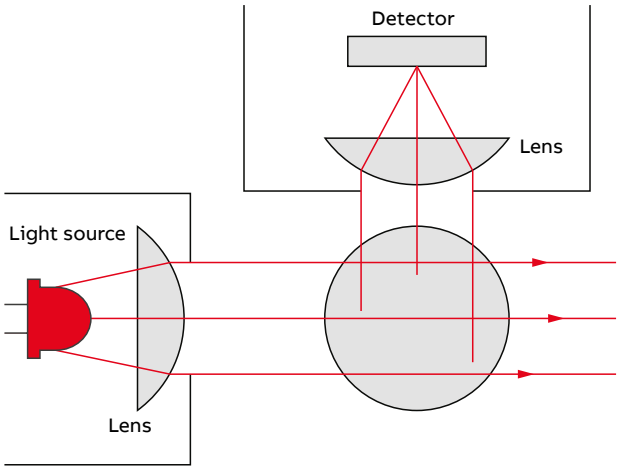
ABB's 4690 range of turbidity sensors has been designed for reliability, ease-of-use, and maintenance simplicity.

Measurement technique

The 4690 range of turbidity sensors utilizes a flow-through nephelometric design compliant to the ISO* 7027 standard.

Water flows continually through the sensor body. Light directed by the emitter assembly passes through the sample where it is scattered by any suspended particles present in the sample. This scattered light is detected by the sensor receiver assembly that is placed at a 90° angle to the incident beam.

The ultralow back scatter allows for very accurate readings as only light scattering due to turbidity is measured. This is especially important when measuring low turbidity values. Due to the short sample residence time in the flow cell the system is able to respond much faster than many competing systems.



02 Nephelometric turbidity monitor

Automatic cell cleaning

The 4690 range of turbidity sensors features an auto-clean system. This feature consists of a mechanical wiper assembly that physically wipes clean the optical cell at user-programmable intervals from every 15 minutes up to every 24 hours.

The highly efficient automatic cleaning process overcomes the problem of optical fouling and ensures that performance can be maintained for long periods (up to 6 months) without the need for manual intervention.



03 Auto-clean wiper unit

Automatic bubble rejection

Turbidity readings can be affected by short-term spikes, usually due to the effect of the sample degassing. The 4690 analyzer has an automatic bubble rejection feature that, when enabled, applies a digital filter to the measured results removing any spurious high reading.

Optional external de-bubbler

Any bubbles present in the sample give false turbidity readings. For applications where bubbles are likely, it is recommended that the optional external de-bubbler assembly is used to supply a constant head of de-bubbled sample to the sensor.

* International Organization for Standardization

Simple to calibrate

A key feature of the 4690 turbidity systems is the dry secondary calibration standard that simplifies routine instrument verification, and removes the need for the use of chemical standards.

Both low- and high-range secondary standards are available so that the analyzer calibration can be verified at a level that is suited to the application. Each secondary standard is supplied factory-certified against a primary formazine standard.



04 Dry secondary standard

The benefits of using ABB's secondary standards include:

- Minimum analyzer downtime
  - Simple and fast procedure to verify analyzer performance.
- Low cost-of-ownership
  - Reduce usage of consumable chemical standards and the time taken to prepare such standards.
- Minimize employee's exposure to Formazine
  - Formazine is highly toxic and a suspected carcinogen.
- Repeatable and reliable
  - Removes any chemical standard preparation errors.
- Simple to use
  - The secondary standard is simply inserted into the sensor assembly optical light path allowing the precalibrated optomechanical filter to divert a fixed quantity of light to the detector that corresponds to the calibrated turbidity value. Rotation of the dry standard blocks the light path enabling a zero turbidity calibration to be made.



05 Dry standard calibration

Simple to maintain

The 4690 turbidity sensing systems are designed to be as maintenance-free as possible. The inherent product design and auto-clean feature minimize the amount of maintenance required to external cleaning of sample lines and periodic replacement of the wiper blade and light source.

The sensor features ABB's patented light replacement system, a unique feature that enables bulb replacement in the field in seconds. Each bulb is supplied fully protected in a patented assembly with integral light guide so you never come into direct contact with the bulb. This not only protects the bulb, ensuring maximum lamp life, but also makes replacement very simple and fast as it just clicks into place.



06 Replacing the light source

Task	Recommended frequency
Visual checks – sample flow, leaks	Weekly
Calibration verification[1] with secondary standard[2] – as per regulatory guidelines	Monthly
Calibration[3] with primary standard[4] – as per regulatory guidelines	Quarterly
Replace wiper blade	Annually
Replace LED Light Source (ISO 7027)	Every 5 years

1. **Calibration verification**
A procedure used to check whether or not the calibration of the analyzer is within certain limits.

2. **Secondary standards**
Standards that the manufacturer (or an independent testing organization) has certified provide analyzer calibration results equivalent (within certain limits) to the results obtained when the instrument is calibrated with a primary standard.

3. **Calibration**
A procedure which checks or adjusts an analyzer's accuracy by comparison with a defined standard or reference.

4. **Primary standards**
Turbidity standards that are traceable and equivalent to the reference turbidity standard, within statistical errors. Formazine is the most commonly acceptable form of primary standard. Primary standards are used to calibrate a turbidity meter directly or to calibrate a secondary standard.

Versatile transmitters

The AWT420 four-wire, dual-channel transmitter offers true flexibility for measuring a wide variety of parameters in a single device.

The transmitter that gives you more choice

Offering swappable communications and sensor modules, options for panel-, pipe-, and wall-mountings and general purpose and safety enclosures, the AWT420 is the versatile single box solution for measuring a range of parameters including pH/ORP, conductivity and the 4690 turbidity sensor.



07 AWT420 transmitter

Available in both corrosion-resistant polycarbonate, or a durable metal version with optional non-incendive approvals for hazardous area installation, it offers a versatile solution for use in utility and industrial process applications.

Your data, when you need it



Secure access to your data
Easy and secure access to measurement, diagnostic and audit data.

Keep your analysis up-to-date
Access software updates and sensor information through your smartphone.

Reduce process downtime
Keep track of current and upcoming maintenance tasks.

The AWT420 incorporates several key features to help you find the data you need quickly and easily. An easily navigable full-color TFT display makes it easy to find and access sensor data, while Bluetooth® technology provides up-to-the-minute information and technical support using ABB's EZLink Connect app.

4690 sensor specifications

Range
Low range 0 to 40 NTU
High range 0 to 400 NTU

Measurement principle
90° scattered light measurement
Compliant to ISO 7027

Maximum linearity
Typically <1.0 %

Accuracy *, **
Low range version ±2 % of reading
High range version ±5 % of reading or 0.3 NTU

Repeatability ***
0 to 200 NTU: <1 %
200 to 400 NTU: 2 %

Limit of detection ****
Low range version: 0.003 NTU
High range version: 0.3 NTU

Response time
T90 < 1 min at 1 L/min (0.26 galUS/min)

Flow rate
0.5 to 1.5 L/min (0.13 to 0.39 galUS/min)

Integral wiper cleaning system
Programmable operational frequency every 0.25 h, 0.5 h, 0.75 h or multiples of 1 h up to 24 h

Sample operating temperature
0 to 50 °C (32 to 122 °F)

Sample pressure
Up to 3 bar (43.5 psi)

Ambient operating temperature
0 to 50 °C (32 to 122 °F)

Ambient operating humidity
Up to 95 % RH

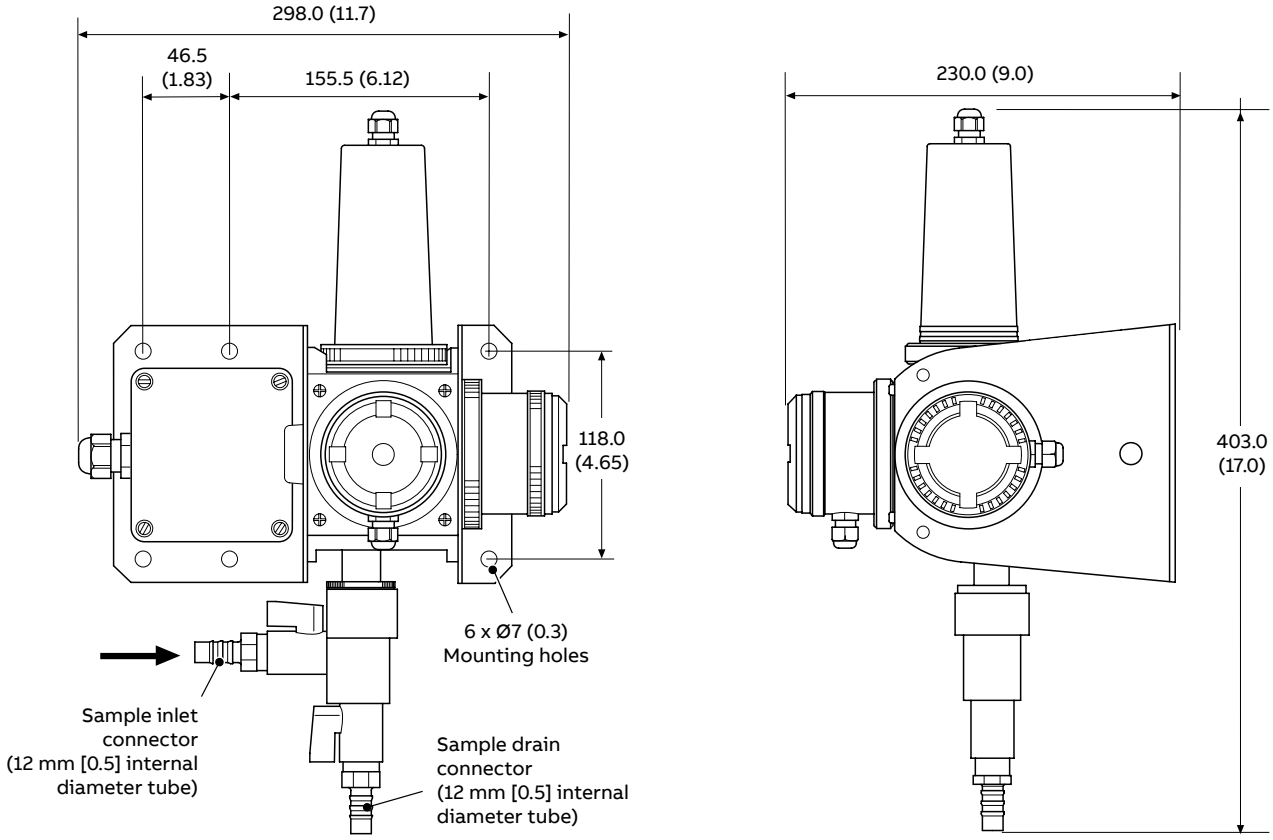
Wetted parts – materials used
Cell body unit
- Black POM (Polyoxymethylene) copolymer
- Spectrosil® 2000 fused silica
- Nitrile (O-ring)
- Epoxy preform (cured): Uni-forms 5034-00
- Polyamide 6
- Nickel plated brass
- Teflon™

Wiper unit
- Black polycarbonate, 10 % glass fiber filled – LEXAN® 500R
- Stainless steel (SS 316 S13/S11) w/ chemical black – MIL-C13924 class 4
- Silicone grease (WRC approved): Unisilkon® L 250 L
- 2-part epoxy adhesive (cured): DELO AD894
- EPDM (ethylene propylene diene monomer) black

* Maximum measured error across full measurement range(typical, limited by uncertainty in Formazine standards).
** Tested in accordance with IEC 61298 Parts 1-4: Edition 2.0 2008-10.
*** Tested in accordance with MCERTS: Performance Standards and Test Procedures for Continuous Water Monitoring Equipment. Version 3.1: Environment Agency 2010.
**** Tested in accordance with BS ISO 15839: 2003.

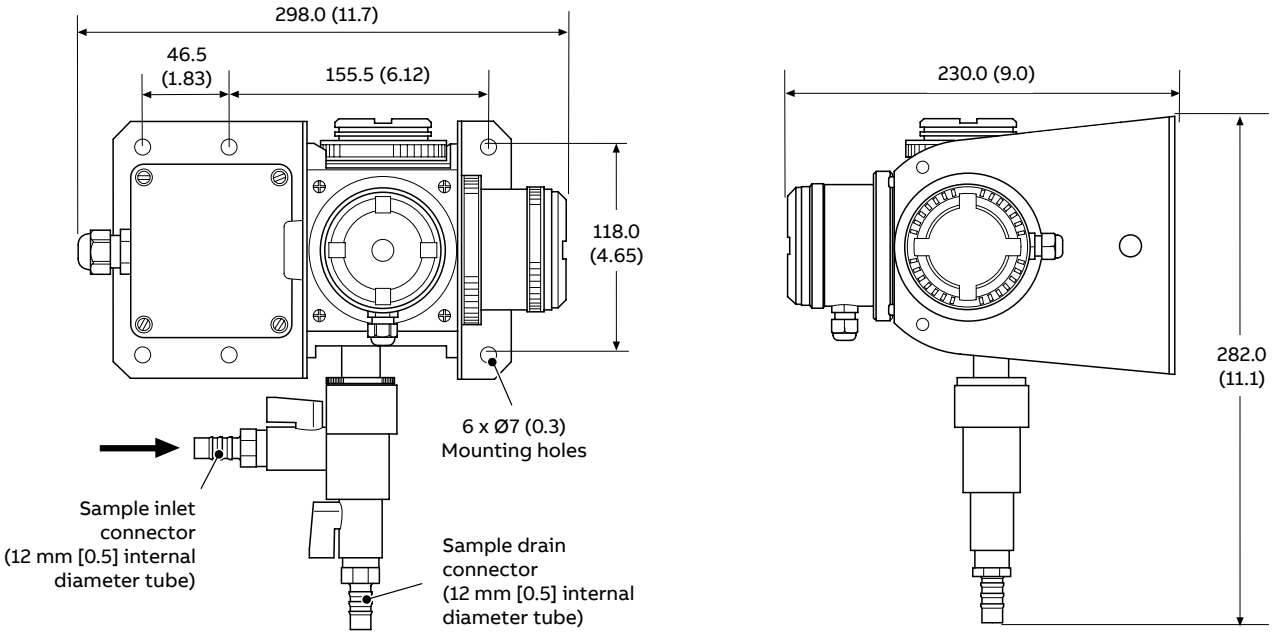
Overall dimensions

4690 turbidity sensor (with optional wiper unit)
Dimensions in mm (in)



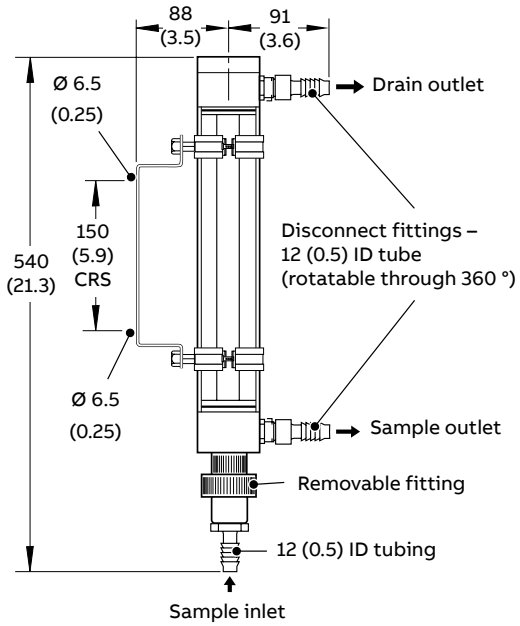
…Overall dimensions

4690 turbidity sensor (without optional wiper unit)
Dimensions in mm (in)



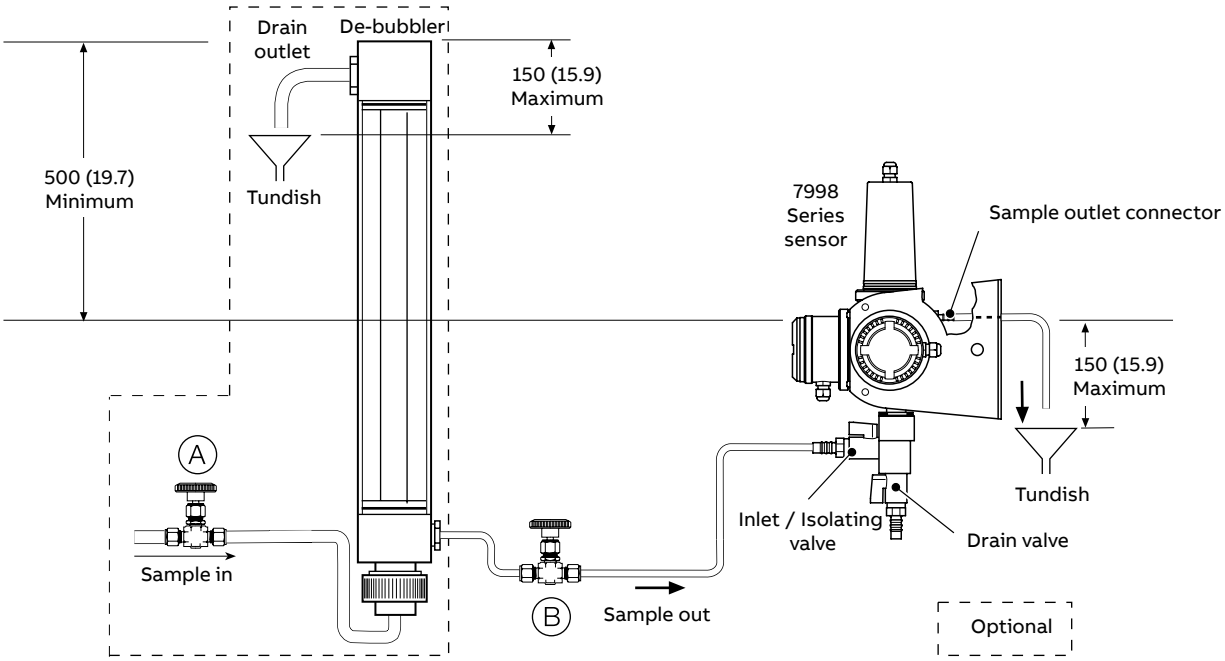
Optional de-bubbler assembly

Dimensions in mm (in)



Typical system installation schematic

With optional de-bubbler
Dimensions in mm (in)



Ordering information

4690 Turbidity Sensor	ATS410	X	X	XX	XX	Options
Build revision						
Reserved		A				
Reserved						
Reserved			1			
Sensor range						
0 - 40 NTU without auto-clean				P1		
0 - 40 NTU with auto-clean				P2		
0 - 400 NTU with auto-clean				P3		
Sensor cable length						
1 m (3.2 ft)					01	
5 m (16.4 ft)					05	
10 m (32.8 ft)					10	

Optional ordering codes Add one or more of the following codes after the standard ordering information to select any additional options if required	
Dry secondary standard	
Low-range (<5 NTU)*	A1
High-range**	A2
Certification	
Certification of calibration	CD
Accessories	
De-bubbler	B1
Language options (Commissioning Instruction not included as standard)	
English	M5
German	M1
Italian	M2
Spanish	M3
French	M4
Chinese	M6
Polish	M9
Portuguese	MA
Turkish	MT

* Available only with 0-40 NTU sensor range (P1 and P2).
** Available only with 0-400 NTU sensor range (P3).

Spares and consumables

Maintenance kits

Part number	Description
7998 023	Wiper blade pack (4 off)
7998 044	Replacement LED kit (ISO infrared LED version)

Accessories

Part number	Description
7998 047	Dry standard LOW for use with ISO infrared LED version
7998 048	Dry standard HIGH (ISO infrared LED version) and cal cert

Upgrade kits

Part number	Description
7998 022	Wiper unit upgrade kit
7997 500	De-bubbler assembly

Strategic spares

Part number	Description
7998 024	Feed/drain kit
7998 026	Emitter unit (ISO infrared LED version)
7998 029	Receiver unit (ISO infrared LED 0 to 40 NTU)
7998 030	Receiver unit (ISO infrared LED 0 to 400 NTU)
7998 037	Replacement ball valves (2 off)
7998 038	Replacement hose connectors (2 off)
7998 039	Replacement wiper O-ring (2 off)
7998 031	O-ring spares kit (1 off 20.3 mm ID × 2.62 mm, 2 off 29.83 ID × 2.62 mm, 2 off 63.17 ID × 2.62 mm, 1 off 37.77 ID ×2.62 mm, 1 off 47.3 ID × 2.62 mm)
7998 021	Replacement end caps (2 off)
7998 020	Wiper plug assembly (2 off)
7998 190	Cal record card kit (3 off)
7998 049	Wiper unit replacement (incl. wiper blade pack of 4 off)
3KXA867000L0001	Wiper collar replacement kit (incl. screws 4 off)

De-bubbler spares

Part number	Description
0211 322	O-ring large (3 off)
0211 138	O-ring small (2 off)
7997 511	Quick-fit connector (2 off)

Trademarks

- Spectrosil is a registered trademark of Heraeus Conamic UK Limited.
- Teflon is a trademark of The Chemours Company LLC.
- LEXAN is a registered trademark of SABIC Global Technologies B.V.
- Unisilkon is a registered trademark of Klüber Lubrication.

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