

CATALOG 2019

CS & CHS Analyzers | ONH Analyzers | Thermal Analyzers

NEW
ELEMENTRAC
series



Specialists for Elemental Analysis

The new ELEMENTRAC series from ELTRA are powerful elemental analyzers which measure the chemical elements carbon, sulfur as well as oxygen, nitrogen and hydrogen in mostly inorganic samples like metals or ceramics. The ELEMENTRAC ONH-p uses the inert carrier gas heat extraction technique whereas the ELEMENTRAC CS-i utilizes inductive combustion for element measurements from the ppm range up to 100 %

Due to many innovative technical solutions the ELEMENTRAC series with its convincing ELEMENTS software guarantees:

- ▶ **Reliable results from the ppm range up to 100 %**
- ▶ **Outstanding precision and recovery**
- ▶ **Maximum traceability of the measured results**
- ▶ **Compliance to all relevant international standards**
- ▶ **High functionality**
- ▶ **Elegant design**



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REMARKS

- We reserve the right to effect technical changes as well as price adjustments due to technical progress or increases in raw material prices. All listings in our price list are based on our General Terms for Delivery and Payment.
- This price list covers only the current versions of instruments and accessories. Please indicate the type of instrument and serial number when ordering spare parts.
- Further measuring range combinations are available upon request.
- Measuring ranges may vary depending on sample weight and sample material
- Detailed information about composition of calibration standards at www.eltra.com/consumables
- The images may show accessories which are not part of the standard delivery scope.
- Our warranty period is two years from the date of purchase.
- All prices are ex works, excluding packaging and insurance.
- ELTRA price list 99000-2019/E, valid as of 1st January 2019.

How to find the correct Analyzer

The following tables and information can give you a recommendation to find out the correct type of analyzer for you needs. Before using these tables it is important to answer the following questions:

Which element do I want to analyze?

Carbon, sulfur, hydrogen, nitrogen or oxygen or a combination of them? Sometimes not the total amount of a chemical element is of interest, but a special form of it. Esp. the element carbon is analysed in a lot of different forms like Total Carbon (TC), Total Organic Carbon (TOC), Total Inorganic Carbon (TIC) or Surface Carbon.

Which kind of sample do I have to analyze?

Suitable samples for Eltra analyzers are on the one hand metallic (inorganic) samples like metals (iron, copper), alloys (steel, brass) and on the other hand combustible (organic) samples likes coal, coke, oil. Other typical samples encompass not combustible samples which are not metals like soil, cement, ores.

Do I have to fulfill the requirements of some national or international standards?

E.g. the ASTM E1019 Standard describes a test method for determination of carbon, sulfur, nitrogen and oxygen in samples like steel, iron, nickel and cobalt alloys by the use of various combustion and fusion techniques.

The following table summarizes all available ELTRA analyzers:

More information about the possible configuration are available on the corresponding analyzer pages in the internet or this catalogue.

Typical samples for ELTRA analyzers

Inorganik



Steel



Copper



Titanium

Organik



Coal/Coke



Soil



Wood

Overview

ELTRA Analyzer	Analyzed elements	Typical samples	Applicable temperature	Used furnace	Available configurations (element combination)	Common carrier gas
ELEMENTRAC ONH-p series	O, N, H (ON or OH can be analyzed simultaneously)	"Metals", like steel, copper, titanium or alloys	Up to 3000 °C	Electrode furnace, also called impulse furnace	ONH / ON / OH H N / NH O ¹ O ²	Helium, Nitrogen, Argon on request ³
H-500	H (diffusible and residual)	Steel samples	1000 °C (steps of 1 °C); no ramping during measurement	Resistance furnace, quartz tube, horizontal alignment	H	Nitrogen
ELEMENTRAC CS-i series	C, S (simultaneously)	"Metals" like steel, iron, cast iron, copper "Other" like ores, cement, soil, catalyst	2200 °C (nominal) ⁴	Induction furnace	CCSS ⁵ / CSS / CS CCS / CC / C SS / S	Oxygen
CS-2000 series	C, S ⁶ (simultaneously)	See CS-i series (induction furnace) and combustible samples like coal, coke, oil, wood in resistance furnace	Induction furnace: 2200 °C ⁴ Resistance furnace: 1550 °C	Induction furnace and resistance furnace (ceramic tube)	CCSS ⁷ / CSS / CS CCS / CC / C SS / S	Oxygen
C(H)S-580	C, H, S ⁸ (simultaneously)	Coal, coke, oil, soil, plastics	1550 °C (steps of 1 °C)	Resistance furnace, ceramic tube, horizontal alignment	CHS configurations: CHS / CCH / SSH / CH / HS / H ---- CS configurations: CCSS / CSS SS / S / CCS CC / C	Oxygen
C(H)S-580A	C, H, S ⁹ (simultaneously)	Coal, coke, oil, soil, plastics	1550 °C (steps of 1 °C)	Resistance furnace, ceramic tube, vertical alignment	CHS configurations: CHS / CCH / SSH / CH / HS / H ---- CS configurations: CCSS / CSS SS / S / CCS CC / C	Oxygen
CW-800	C as CO ₂ water	Limestone, cement	1000 °C (steps of 1 °C); no ramping during measurement	Resistance furnace, quartz tube, horizontal alignment	CO ₂ / H ₂ O CO ₂ H ₂ O	Nitrogen
CW-800 M	C as CO ₂ moisture, H as water	Limestone, cement, soil	1000 °C (steps of 1 °C); ramping during measurement possible	Resistance furnace, quartz tube, horizontal alignment	CO ₂ / H ₂ O CO ₂ / CO ₂ CO ₂ H ₂ O	Nitrogen and Oxygen
SurfaceC-800	C (only on surface)	Tubes, sheets made of steel, copper	1000 °C (steps of 1 °C); no ramping during measurement	Resistance furnace, quartz tube, horizontal alignment	C C robust C sensitive	Oxygen
TGA Thermostep	Weight loss during heating	Coal, coke, plastics, food	1000 °C (steps of 1 °C); ramping during measurement possible	Resistance furnace made of ceramic with 19 sample places	TGA	Oxygen, Nitrogen and Air

i Please note:

- ¹ Based on OH platform with Schuetze reagent as catalyst. Only recommended for low oxygen concentration
- ² Based on ON platform with copper oxide catalyst. Recommend for low and high oxygen concentration.
- ³ Contact ELTRA for fixing the application and requested working range
- ⁴ Due to the combustion process the resulting temperature is higher (above 3400 °C)
- ⁵ Cuvettes made of gold available as an option
- ⁶ Analyzer uses two different furnaces with one detection unit. Furnaces can be used alternating but not at the same time.
- ⁷ Cuvettes made of gold are included (beginning with 10 mm path length)
- ⁸ Analyzer in CS configuration cannot be upgraded to CHS configuration; no autosampler available
- ⁹ Analyzer in CS configuration cannot be upgraded to CHS configuration; can be used with and without autosampler

ELTRA analyzers fulfill or exceed the specifications of the following standards. For some type of samples (e.g. cement) no standard is mentioned. This is due to the fact that no international standard (ASTM; ISO; DIN) is published for elemental analysis.

Carbon analyzer and typical samples

Requested Form	Typical samples and matrices	Fulfilled standards	Recommended Analyzer
Total Carbon	Metallic samples like steel, iron, cast iron, copper, manganese; nickel; ferro nickel; nickel alloys; refractories	ASTM: E-1019; E-1587; E-1941; E1915 ISO 9556;15349-2; 7524; 15350	CS-i
	Ores	ASTM E1915	C(H)S-580 (A) series
	Catalyst	UOP703-09	CS-i
	Cement; building materials		CS-i; C(H)S 580 (A) series; CW-800; CW-800 M
	Geological samples (rocks)		CS-i
Total Carbon and TOC	Soil	ISO 10694	CS-580 (A) series; CS-i
Free Carbon	Iron	ISO 10719	CS-i
TOC	Waste, sludge and sediment	DIN EN 13137	CS-580 (A) series; TIC Module (for indirect method)
TOC	Sludge, treated biowaste, soil and waste	DIN EN 15936	TIC Module (Method (A)); CS-580A series
Surface C	Copper and copper alloys	DIN EN 723	Surface C-800
TOC 400; ROC; TIC 900	Solid samples like soil, waste	DIN 19539	CW-800 M

Additional comment:

The standard ISO 10694 allows the CS 580 (A) series as well as CS-i for the determination of the TOC content. Due to working with acidified samples the CS-580 (A) series is recommended due to lower combustion temperature and the possibilities to absorb halogens via copper flakes.

Sulfur analyzer and typical samples

Requested Form	Typical samples and matrices	Fulfilled standards	Recommended Analyzer
Total Sulfur	Metallic samples like steel, iron, cast iron, copper, manganese; nickel; ferronickel; nickel alloys	ASTM: E-1019;E-1587; ISO 4935;13902; 7526;15350	CS-i
	Cement and building materials		CS-i
	Ores	ASTM E1915	C(H)S-580 (A) series
	Geological samples (rocks)	DIN EN 1744-1	CS-i and C(H)S-580 (A) series
	Petroleum and products	ASTM D1552	C(H)S-580 (A) series
	Coal and coke	ASTM D4239	C(H)S-580 (A) series
	Ash from coal and coke	ASTM D5016	C(H)S-580 (A) series
	Carbon Black	ASTM D1619	C(H)S-580 (A) series
	Iron ores	ISO 4689-3	CS-i
	Soil	ISO 15178	C(H)S-580 (A) series

Additional comment:

ASTM D 1552 in general also allows the use of induction furnace like CS-i. For less maintenance, more comfort ELTRA recommends an C(H)S-580 (A) series analyzer.

Oxygen analyzer and typical samples

Requested Form	Typical samples and matrices	Fulfilled standards	Recommended analyzer
Oxygen	Steel, iron, nickel, cobalt alloys	ASTM E1019	ONH-p series
	Nickel	ASTM E1587	ONH-p series
	Titanium	ASTM E1409 ISO 22963	ONH-p series
	Tantalum	ASTM E1569	ONH-p series
	Steel	ISO 17053	ONH-p series
	Other metals and their alloys		ONH-p series

Nitrogen analyzer and typical samples

Requested Form	Typical samples and matrices	Fulfilled standards	Recommended analyzer
Nitrogen	Steel, iron, nickel, cobalt alloys	ASTM E1019	ONH-p series
	Nickel	ASTM E1587	ONH-p series
	Titanium	ASTM E1409	ONH-p series
	Steel and iron	ISO 10720; 15351	ONH-p series
	Copper and copper alloy	ASTM E 2575	ONH-p series
	Other metals and their alloys		ONH-p series

Hydrogen and water analyzer and typical samples

Requested Form	Typical samples and matrices	Fulfilled standards	Recommended analyzer
Hydrogen	Titanium	ASTM E1447	OH-p /ONH-p
	Steel / iron		OH-p /ONH-p
	Other metals and its alloys		OH-p /ONH-p
	Arc weld metal	ISO 3690	H-500
Diffusible / Residual Hydrogen	Steel		H-500
Water	Welding fluxes	AWS A4.4M:2001	CW-800; CW-800 M
	Cement, limestone, building materials		CW-800; CW-800 M

In the tables shown above some abbreviations are used:

- * C(H)S-580 (A) series means that one of the following analyzer is suitable:
CS-580; CHS-580; CS-580A; CHS-580A
- * CS-580 (A) series means that one of the following analyzer is suitable: CS-580; CS-580A;
- * ONH-p series means that one of the following analyzer is suitable: ON-p; OH-p; ONH-p

ELTRA





ELEMENTRAC ONH-p

Gas analysis via inert gas fusion

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H-500

Hydrogen measurement via carrier gas heat extraction

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ELEMENTRAC® ON-p, OH-p, ONH-p

The ELEMENTRAC ONH series is used to analyze oxygen, nitrogen and hydrogen in inorganic sample materials like steel, iron, copper, brass, titanium, alloys by inert gas fusion.

- ▶ Powerful 8.5 kW electrode furnace (6 kW useable in application)
- ▶ Optimized sensitivity due to closed gas system
- ▶ Use of cost-efficient argon as carrier gas possible (ask ELTRA for more details)
- ▶ Water cooled sample port system
- ▶ Reliable oxygen determination thanks to enlarged catalyst furnace
- ▶ ELEMENTS software with integrated leakage tests and comprehensive diagnosis tools

More information available at www.eltra.com



General information / Analysis principle

After weighing the sample and applying it to the loading head it is purged with inert gas and falls into the preheated crucible. The oxygen of the sample forms carbonmonoxide whereas the other impurities like hydrogen and nitrogen are released in its elemental form. The ELEMENTRAC ONH-p measures either oxygen and nitrogen or oxygen and hydrogen simultaneously.

Depending on the configuration different carrier gases and catalysts are used to obtain the correct results. The ON-p configuration uses a heated copper oxide catalyst, helium as carrier gas and measures the oxygen and nitrogen concentration.

The OH-p configuration uses not heated Schuetze reagent as catalyst and nitrogen as carrier gas and measures the oxygen and hydrogen concentration accordingly. The ONH-p combines both measuring methods and can switch between OH or ON operation mode.

ELTRA provides different configurations and different working ranges for the ELEMENTRAC ONH-p series. Due to different ELEMENTRAC ONH-p configurations it is possible to purchase the best suitable analyzer for an economic price. E.g. it is not necessary to purchase an ONH-p configuration when only determination of hydrogen in titanium is required. A single hydrogen analyzer is much more economic in this case. This ELTRA concept provides a powerful analyzer for a reasonable price.

ELEMENTRAC Configuration	Measures Elements	Used catalyst / carrier gas
ON-p	Oxygen (O), Nitrogen (N)	Heated copper oxide / Helium optional: Argon
OH-p	Oxygen (O), Hydrogen (H)	Schuetze reagent / Nitrogen
ONH-p	Oxygen (O), Nitrogen (N), Hydrogen (H)	Heated copper oxide / Helium (optional: Argon) and Schuetze reagent / Nitrogen

How to read the given measuring ranges?

The ELEMENTRAC ON-p (88200-2005) supports the following measuring range for 1 g sample:

Oxygen: 0.1–200 ppm / 10 ppm–0.7%
 Nitrogen: 0.1–200 ppm / 10 ppm–2%

Taken the nominal weight of 1 g into account the maximum valid oxygen concentration for oxygen is 7 mg (0.7% of 1000 mg) and 20 mg for nitrogen (2% of 1000 mg). Samples which have a higher concentration of oxygen and nitrogen can be analyzed with this configuration by applying a reduced sample weight:

Sample	Expected concentrations	Weight	Resulting amount of gas	Can be analysed with 88200-2005?
Steel	O: 200 ppm, N: 1000 ppm	1000 mg	0.2 mg Oxygen, 1 mg Nitrogen	Yes
Furnace Slag	O: 10%	500 mg	50 mg Oxygen	No
Furnace Slag	O: 10%	50 mg	5 mg Oxygen	Yes

Why is the measuring range of 88200-2005 separated into two parts?

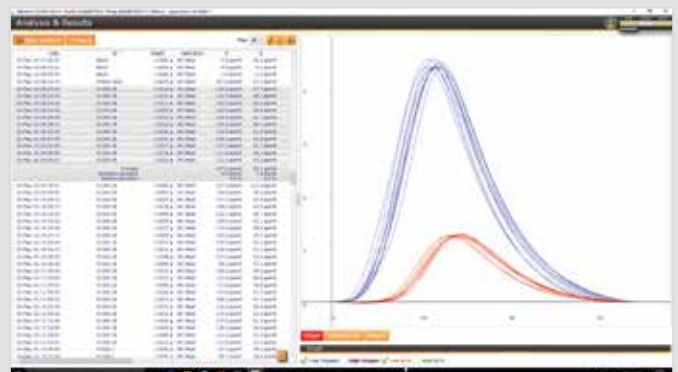
The oxygen content is measured in two independent infrared cells which have a different sensitivity. The lower working range (0.1–200 ppm) is covered by the first sensitive cell which is also used as a single cell in the 88200-2001 configuration. The higher working range (10 ppm–0.7%) is covered by a second less sensitive cell. The thermal conductivity cell which is responsible for nitrogen and hydrogen determination provides also two measuring ranges (sensitive and high).

Typical Results: Steel

Sample weight approx. 1,000 mg (ELTRA samples),
 500 mg (CRM 281-1), 10 measurements

Reference material	Oxygen [ppm]	Nitrogen [ppm]	Hydrogen [ppm]
ELTRA 91100-1001	6.0 ± 0.6	18.5 ± 0.6	*
EURO CRM 281-1	108.7 ± 5.2	232 ± 8.1	*
ELTRA 91400-1003	*	*	6.0 ± 0.3

* not certified



O - N - H

Descriptions and recommendation for major accessories

For ELTRA ONH-p analyzers some major accessories are available which are suitable for some applications. The described accessories can increase comfort or improve repeatability of measurements.

Part number	Name and description	Useful for
27000-2021	Gas calibration unit Can be used to calibrate the hydrogen channel without solid samples	Laboratories which require additional hydrogen calibration
88600-0016	Gas calibration unit upgrade pack Beside the pure gas calibration unit also connections and tubes are included in the delivery content	Laboratories which would like to upgrade an existing ONH-p
21000-1001	Gas purification furnace ELTRA ELEMENTRAC ONH-p series analyzer requires carrier gas in 99,995% pure quality. Smallest contaminations of hydrocarbons, oils can influence the repeatability of results. The carrier gas purification furnace removes contaminations for reliable determination of traces of O ₂ /N ₂ /H ₂ .	Laboratories which measure O ₂ /N ₂ /H ₂ in the lower ppm range
90426-1001	Filling for gas purification furnace The gas purification furnace needs a special chemical filling for effective removal of contaminations.	Laboratories which use a gas calibration furnace
88400-0467	Chiller (SMC; 5900W) This chiller can replace the heat exchanger unit which is in the ELEMENTRAC ONH-p delivery content. It is recommended for titanium analysis and high throughput steel analysis	Laboratories which have a high throughput in titanium analysis

Delivery content, required accessories and consumables which have to be ordered separately

All ELEMENTRAC analyzers are equipped with the necessary tools for operation like tweezers for applying a sample or brushes to clean the analyzer.

To run an ELEMENTRAC ONH-p it is necessary to also purchase a PC, TFT and a balance to weigh the sample. These accessories have to be ordered separately.

Additionally some consumables and chemicals have to be ordered to assure the correct working of the analyzer:

ELEMENTRAC Analyzer	Required chemicals and consumables
ON-p	88500-0007 (Starter pack with crucibles and glass resp. quartz wool) 90200 Anhydrone 90210 Sodium hydroxide 90289 Copper II Oxide
OH-p	88500-0008 (Starter pack with crucibles and glass wool) 90200 Anhydrone 90210 Sodium hydroxide 90270 Schuetze reagent
ONH-p	88500-0009 (Starter pack with crucibles and glass resp. quartz wool) 90200 Anhydrone 90210 Sodium hydroxide 90270 Schuetze reagent 90289 Copper II Oxide



New carrier gas purification furnace (21000-1001)

Recommended consumables for selected applications

The following tables summarize the typically used consumables for some applications:

Application	Recommended consumables
Titanium (Solid samples; ON determination)	Calibration material like 91205-1001 → 91205-1005 88600-0012 Nickel baskets 90180 and 90185 Graphite crucibles
Titanium (powder samples; ON determination)	Calibration material like 91205-1001 → 91205-1005 88600-0012 Nickel baskets 90257 Nickel capsules 88400-0066 Nickel capsules pressed 90180 and 90185 Graphite crucibles
Titanium (solid samples; H determination)	Calibration material like 91205-1001 → 91205-1005 90251 Tin pellets 90180 and 90185 Graphite crucibles
Titanium (powder samples; H determination)	Calibration material like 91205-1001 → 91205-1005 90257 Nickel capsules 88400-0066 Nickel capsules pressed 90251 Tin pellets 90180 and 90185 Graphite crucibles
Iron powder; slags	Calibration material like 91500-1001 Iron powder 90257 Nickel capsules 88400-0066 Nickel capsules pressed 90800 Graphite
Copper (solid samples)	Calibration material 91000-1001/1002/1004 90190 Graphite crucibles
Iron and steel (solid samples)	Calibration material 91100-1001 → 91100-1007 (ON) 91400-1001 → 91400-1003 (H) 90180 and 90185 Graphite crucibles

Exemplary analyzer recommendations

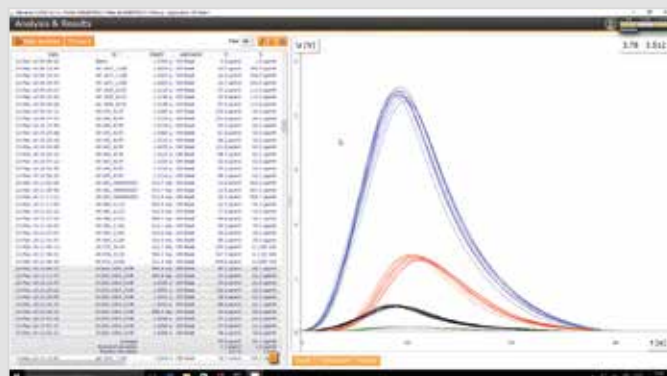
Additionally to the configurations in this price list also other working ranges (e.g. working range for oxygen up to 2%) are available on request. Please contact ELTRA.

Application	Analyzer and part number	Working range (1 g sample)
ON in steel	ON-p (88200-2005)	O: 0.1 ppm-0.7%, N: 0.1 ppm-2%
ONH in stainless steel	ONH-p (8820-2015)	O: 0.1 ppm-0.7%, N: 0.1 ppm-2%, H: 0.01 ppm-2%
O in copper	ON-p (88200-2003)	O: 0.1 ppm-0.7%
H in titanium	OH-p (88200-2007)	H: 0.01 ppm-2%

Typical Results: Titanium

Sample weights approx. 100 mg, 10 measurements

Reference material	Oxygen [%]	Nitrogen [%]	Hydrogen [ppm]
ELTRA 912505-1004 (Lot 613B)	0.215 ± 0.008	0.0065 ± 0.0012	77 ± 8
ELTRA 912505-1001 (Lot 114C)	0.0522 ± 0.0013	0.0101 ± 0.0009	11 ± 0.9



ELEMENTRAC® ON-p / OH-p / ONH-p



Order data

Item Number	Price (€)	Description
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Please note: Every analyzer requires PC, monitor, balance and some consumables (crucibles, chemicals) which have to be ordered separately

ELEMENTRAC® ON-p

10)

Measuring ranges at 1,000 mg sample weight (further measuring range combinations on request)

88200-2001	DE	ON-p 1xO 0.1–200 ppm O
88200-2002	DE	ON-p 2xN 0.1–200 ppm N 10 ppm–2% N
88200-2003	DE	ON-p 2xO 0.1–200 ppm O 10 ppm–0.7% O
88200-2004	DE	ON-p 1xO 0.1–200 ppm O + 2xN 0.1–200 ppm N 10 ppm–2% N
88200-2005	DE	ON-p 2xO 0.1–200 ppm O 10 ppm–0.7% O + 2xN 0.1–200 ppm N 10 ppm–2% N

ELEMENTRAC® OH-p

88200-2006	DE	OH-p 1xO 0.1–200 ppm O
88200-2007	DE	OH-p 2xH 0.01–50 ppm H 20–1,000 ppm H
88200-2008	DE	OH-p 2xO 0.1–200 ppm O 10 ppm–0.7% O
88200-2009	DE	OH-p 1xO 0.1–200 ppm O + 2xH 0.01–50 ppm H 20–1,000 ppm H
88200-2010	DE	OH-p 2xO 0.1–200 ppm O 10 ppm–0.7% O + 2xH 0.01–50 ppm H 20–1,000 ppm H

ELEMENTRAC® ONH-p

88200-2011	DE	ONH-p 1xO 0.1–200 ppm O
88200-2012	DE	ONH-p 2xN 0.1–200 ppm N 10 ppm–2% N + 2xH 0.01–50 ppm H 20–1,000 ppm H
88200-2013	DE	ONH-p 2xO 0.1–200 ppm O 10 ppm–0.7% O
88200-2014	DE	ONH-p 1xO 0.1–200 ppm O + 2xH 0.01–50 ppm H 20–1,000 ppm H
88200-2015	DE	ONH-p 2xO 0.1–200 ppm O 10 ppm–0.7% O + 2xN 0.1–200 ppm N 10 ppm–2% N
		+ 2xH 0.01–50 ppm H 20–1,000 ppm H

Required accessories

PC, monitor, balance

71015	DE	Computer with Intel Core i5-8400 Processor, 500 GB HDD; 8 GB RAM; Windows 10 operating system; keyboard; mouse
71016	DE	Monitor, TFT (21.5 inch)
88600-0002	DE	Balance (resolution 0.0001 g)
71002	DE	Printer (Inkjet, colour)

i Please note:

- 10 Measuring ranges may vary depending on sample weight and sample material
 11 Hazardous material
 12 Further calibration standards and compositions on chapter consumables. Detailed information about compositions at www.eltra.com/consumables
 13 As long as not stated differently, the listed part number means one piece

All prices ex works, excluding packaging and insurance · ELTRA price list 99000-2019/E · valid as of January 1, 2019

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Order data

Item Number	Price (€)	Description
Required consumables / chemicals for first operations		
88500-0007	DC	ON-Starter-kit for 500 analyses (400 graphite crucibles, 50 outer graphite crucibles, 200 inner graphite crucibles, 50 g glass wool, 50 g quartz wool)
88500-0008	DC	OH-Starter-kit for 500 analyses (400 graphite crucibles, 50 outer graphite crucibles, 200 inner graphite crucibles, 50 g glass wool)
88500-0009	DC	ONH-Starter-kit for 500 analyses (400 graphite crucibles, 50 outer graphite crucibles, 200 inner graphite crucibles, 50 g glass wool, 50 g quartz wool)
11) 90200	DC	Anhydron (magnesium perchlorate), 454 g
11) 90210	DC	Sodium hydroxide, 500 g
11) 90270	DC	Schuetze reagent, 100 g, (only for OH-p and ONH-p)
11) 90289	DC	Copper II oxide, 100 g, (only for ON-p and ONH-p)

Further options and consumables

Accessories (Hardware)

27000-2021	DE	Gas calibration unit ELEMENTRAC series (for calibrating hydrogen)
88600-0016	DE	Gas calibration unit ELEMENTRAC (for upgrading installed units; contains tubes and connection devices)
21000-1001	DE	Carrier gas purification furnace, without filling (please order filling and quartz wool separately)
88400-0467	DE	Chiller (SMC, 5900 W)
72080	DE	Nitrogen regulator, 1 piece
72081	DE	Pressure regulator, 1 piece

Crucibles

90190	DC	Graphite crucibles, 400 pieces (for copper, brass and steel analysis)
90180	DC	Inner graphite crucibles, 100 pieces (requires outer graphite crucible 90185)
90185	DC	Outer graphite crucibles, 50 pieces
88400-0491	DC	HT crucibles, 1000 pieces, recommended for refractories (special application settings and 31360-3002 graphite tip required)

Tips

31360	DW	Graphite tip, 1 piece (for crucibles 90190 and 90185)
31360-3002	DW	Graphite tip, 1 piece (for HT crucibles 88400-0491)

Capsules (required for any kind of powder analysis)

90257	DC	Nickel capsules, 3.2x7 mm, 100 pieces
90256	DC	Nickel capsules, 4.5x10 mm, 250 pieces
88400-0066	DC	Nickel capsules, pressed, 12.5x5 mm, 100 pieces
90252	DC	Tin capsules, 5x18 mm, 100 pieces



Nickel capsules (90256)



Graphite crucibles (90190)

ELEMENTRAC® ON-p / OH-p / ONH-p

Order data

Item Number	Price (€)	Description
Baskets (required for oxygen and nitrogen determination in refractories)		
90250	DC	Nickel baskets, 100 pieces, 1 g each
88600-0012	DC	Nickel baskets, high purity (low oxygen), 100 pieces, 1 g each
Fluxes (required for some applications)		
90251	DC	Tin pellets, 454 g (for determination of hydrogen in titanium)
90800	DC	Graphite, 50 g (improves oxygen determination)
90258	DC	Nickel accelerator, 100 g (for analysis of high amount of refractories)
Chemicals (fillings for glass and quartz tubes)		
11) 90200	DC	Anhydron (magnesium perchlorate), 454 g
11) 90210	DC	Sodium hydroxide, 500 g
11) 90270	DC	Schuetze reagent, 100 g for OH-p and ONH-p
11) 90289	DC	Copper II oxide, 100 g for ON-p and ONH-p
11) 90426-1001	DC	Filling for carrier gas purification furnace (suitable for one filling, ONH series)
90330	DC	Quartz wool, 50 g
90331	DC	Glass wool, 454 g
90332	DC	Glass wool, 50 g
92610	DC	Tube of high vacuum grease, 35 g
11) 90870	DC	Cooling agent, 0.5 l
All ELEMENTRAC analyzers are equipped with a set of necessary tools The following list provide part numbers for replacement of worn tools and some new tools to improve handling.		
Spatulas and tweezers		
88400-0476	DC	Micro spatula, 1 piece XS size for filling small capsules
23110	DC	Spatula, 1 piece M size
23111	DC	Spatula, 1 piece L size
88400-0475	DC	Set with 6 spatula and 1 tweezers for multiple weighing procedures
88400-0229	DC	Tweezers (160 mm), curved, 1 piece for transporting pins and baskets
88400-0472	DC	Tweezers (145 mm), straight, 1 piece for removing samples out of the ONH-p furnace
88400-0213	DC	Tongs for crucibles, 1 piece for putting crucibles on the electrode tip
Tools for storage, transporting and weighing		
88400-0477	DC	Weighing boat, 1 piece for weighing and usage of granulates
36121	DC	Quartz boat, 1 piece, 74x22x10 mm, 1 piece for weighing pins
88400-0509	DC	Metal pan, 1 piece for storage of used crucibles, boats
Tools for cleaning and maintenance		
71010	DC	Brush, 16 mm, 1 piece for cleaning balance from dust
88400-0500	DC	Telescope mirror, 1 piece for inspection of upper electrode of ONH-p/ONH-2000
88400-0473	DC	Powder funnel (plastics), 1 piece for easy filling of chemical tubes
88400-0489	DC	Rubber plug 14x20x24 mm, 1 piece for sealing small glass tubes like 70230
71032	DC	Composite brush, 1 piece for cleaning upper electrode of ONH-p furnace
71035	DC	Cleaning brush / furnace brush, 1 piece for cleaning sample inlet of ONH furnaces
71031	DC	Metal brush, 1 piece for cleaning graphite tip and its holder
88400-0504	DC	Cylinder brush, brass for intensive cleaning of lower furnace
88400-0501	DC	Micro brush, 1 piece for cleaning of ONH series furnace outlet tube
61030	DC	Allen key, 3 mm, 1 piece
61040	DC	Allen key, 4 mm, 1 piece
61050	DC	Allen key, 5 mm, 1 piece

Order data

Item Number	Price (€)	Description
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Calibration materials

Calibration materials may show slight variations depending on the current lot.
To see the current certification please visit www.ELTRA.com.

12)

Oxygen and nitrogen in steel, pins

91100-1001	DC	Steel, 100 pins, 1 g each	25–40 ppm N
91100-1002	DC	Steel, 100 pins, 1 g each	30–70 ppm N
91100-1003	DC	Steel, 100 pins, 1 g each	150–250 ppm N
91100-1004	DC	Steel, 100 pins, 1 g each	50–80 ppm N
91100-1005	DC	Steel, 100 pins, 1 g each	300–600 ppm N
91100-1006	DC	Steel, 100 pins, 1 g each	80–150 ppm N
91100-1007	DC	Steel, 100 pins, 1 g each	70–130 ppm N
91100-1010	DC	Steel, 100 pins, 1 g each	> 1000 ppm N

Hydrogen in steel, pins

91400-1001	DC	Steel, 100 pins, 1 g each	0.5–1 ppm H
91400-1002	DC	Steel, 100 pins, 1 g each	1.5–4 ppm H
91400-1003	DC	Steel, 100 pins, 1 g each	>5 ppm H

Steel, balls (H), for H-500

91110	DC	Steel, 100 balls, gold plated, 1 g each	1.9 ppm H
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Oxygen in copper, pins

91000-1001	DC	Copper, 100 pins, 1 g each	~500 ppm O
91000-1002	DC	Copper, 100 pins, 1 g each	~300 ppm O

Oxygen, nitrogen and hydrogen in titanium, pins

91205-1001	DC	Titanium, 100 pins, 0.1 g each	10–35 ppm H
91205-1002	DC	Titanium, 100 pins, 0.1 g each	20–70 ppm H
91205-1003	DC	Titanium, 100 pins, 0.1 g each	30–90 ppm H
91205-1004	DC	Titanium, 100 pins, 0.1 g each	60–120 ppm H
91205-1005	DC	Titanium, 100 pins, 0.1 g each	150–250 ppm H



Hydrogen in steel, pins (91400-1001)



Hydrogen, oxygen, nitrogen in titanium, pins (91205-1001)

Order data

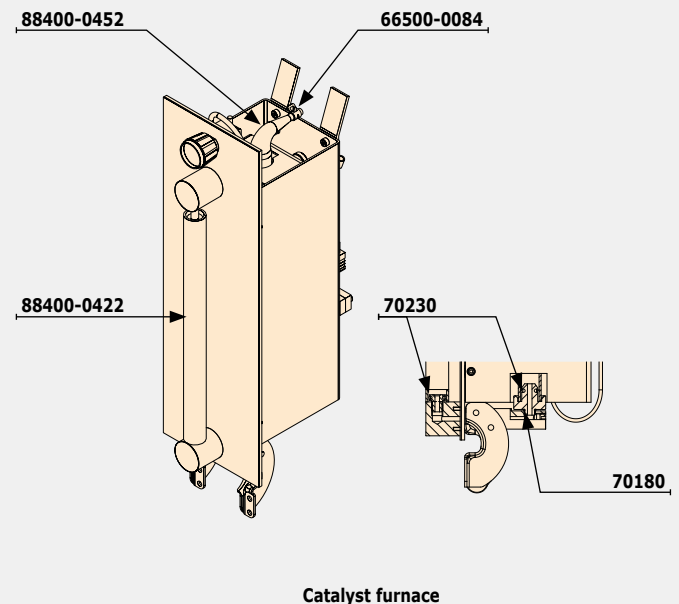
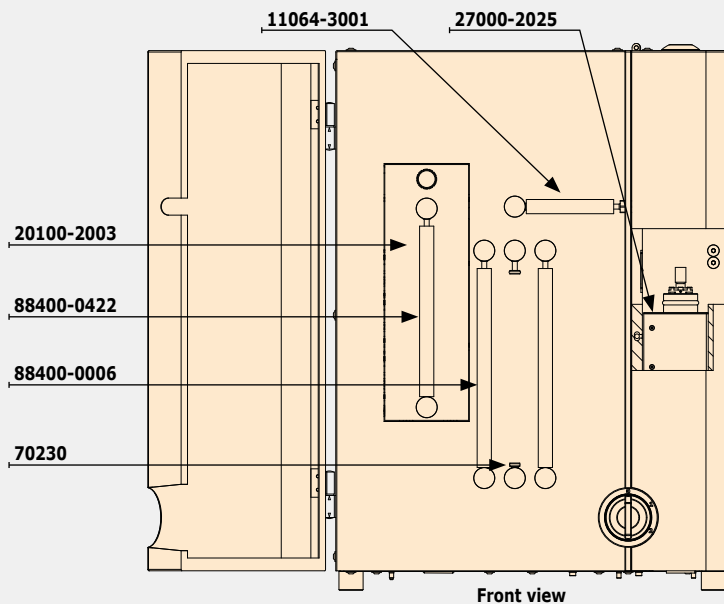
Item Number	Price (€)	Description
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Spare and wear parts ELEMENTRAC ONH-p series

13)

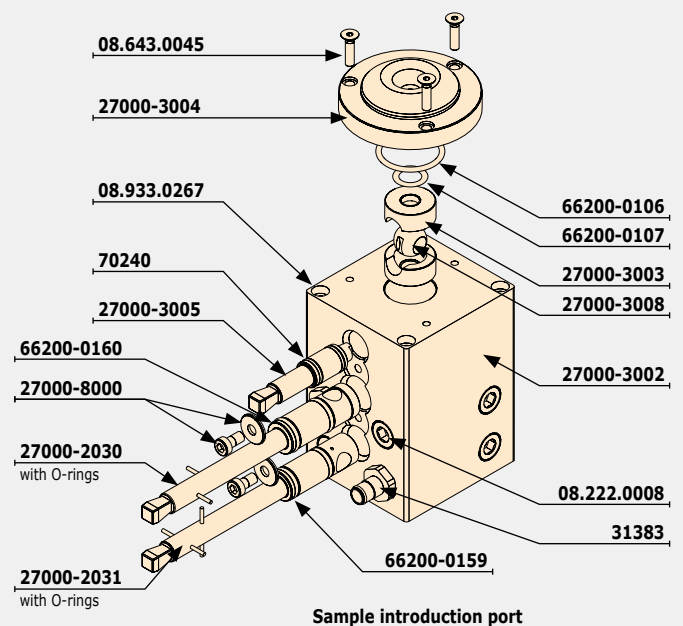
Front side and catalyst furnace

70230	DC	O-ring 9 x 3 (required O-ring for quartz and glass tubes)
70180	DC	O-ring 8 x 1.5 (required O-ring for quartz and glass tubes)
11064-3001	DC	Reagent glass tube 20 x 123 mm
66500-0084	DC	Hose clip for quartz tube
88400-0006	DC	Reagent glass tube 20 x 280 mm
88400-0422	DC	Reagent glass tube 20 x 240 mm
88400-0452	DC	Reagent quartz tube catalyst furnace



Sample introduction port

31383	DC	Hose nozzle R3/8"
70240	DC	O-ring 12 x 2
08.643.0045	DC	Cylindric screw M5 x 20 A2
08.933.0267	DC	Cylindric screw DIN 912 M5 x 120-A2
27000-2030	DC	Lock (V hole), complete
27000-2031	DC	Lock (heat shield), complete
27000-3003	DC	Spherical shell
27000-3004	DC	Hopper
27000-3005	DC	Ball valve shaft
27000-3008	DC	Ball valve
66200-0106	DC	O-ring 30 x 3 mm
66200-0107	DC	O-ring 13 x 3 mm
66200-0159	DC	O-ring 12.5 x 3 mm
66200-0160	DC	O-ring 14.5 x 3 mm



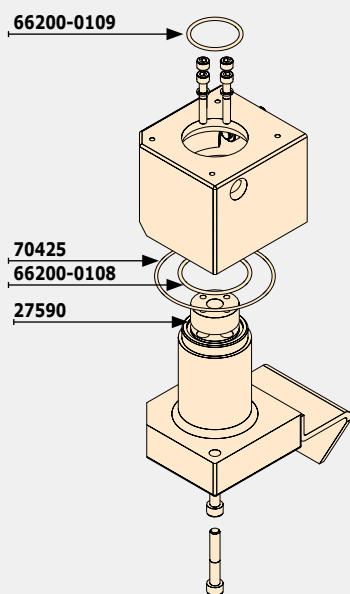
Order data

Item Number	Price (€)	Description
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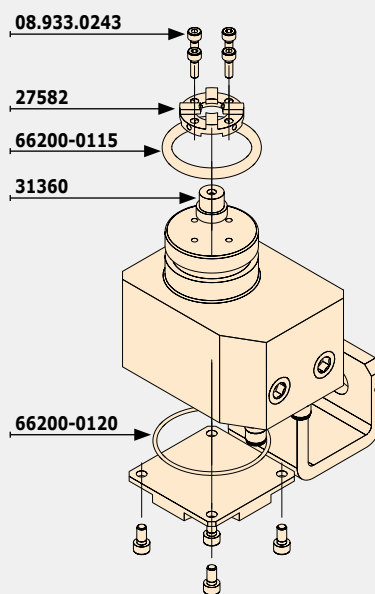
13)

Upper and lower electrode

27582	DC	Holder for crucible support
27590	DC	Electrode insert (above)
31360	DC	Graphite support
70425	DC	O-ring 90 x 2.5 mm
08.933.0243	DC	Cylindric screw 912 M4 x 12 A2
66200-0108	DC	O-ring 51 x 3 mm
66200-0109	DC	O-ring 37 x 3 mm
66200-0115	DC	O-ring 40 x 6 mm
66200-0120	DC	O-ring 56 x 2 mm



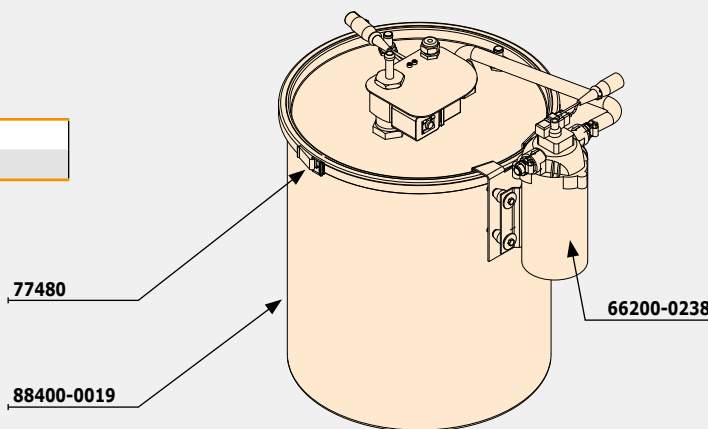
Upper electrode



Lower electrode

Heat exchanger unit

77480	DC	Water hose clamp
66200-0238	DC	Water pump



Heat exchanger unit

O - N - H

H-500

H-500

The H-500 measures the residual, diffusible and in some cases total hydrogen content in ferro alloys by carrier gas heat extraction.

- ▶ High capacity thermal conductivity cell
- ▶ Integrated gas calibration unit
- ▶ Precise measurements of low and high hydrogen concentrations

More information available at www.eltra.com



General information / Analysis principle

In contrast to the ELMENTRAC ONH-p series the H-500 uses a resistance furnace with quartz tube which can be set up to a constant temperature of up to 1000°C in steps of 1°C. After weighing the sample and applying it to the heated quartz tube it

will release elemental hydrogen which is measured in a sensitive thermal conductivity cell. During the analysis process the sample will not melt inside the furnace and it can be removed from the furnace by tilting it out.

How to read the given measuring ranges?

The H-500 (88100-1016) supports the following measuring range for 1 g sample:

Hydrogen: 0.01 – 50 ppm / 20 ppm – 1000 ppm

Taken the nominal weight of 1 g into account the maximum valid hydrogen amount is 1 mg (1000 ppm = 0,1% of 1000 mg) Samples which have a higher concentration of hydrogen can be analysed with this configuration by applying a reduced sample weight.

Why is the measuring range of 88100-1016 separated into two parts?

The thermal conductivity cell, which is employed for hydrogen determination, uses two different sensitivity stages to provide a large working range. The sensitive stage can measure concentrations up to 50 ppm, whereas the robust stage can determine concentrations of up to 1000 ppm.

Exemplary analyzer recommendations

The determination of diffusible, residual and total hydrogen for ferro alloys requires only one H-500 configuration: 88100-1016

Descriptions and recommendations for major accessories

For the ELTRA H-500 analyzer some major accessories are available which are suitable for some applications. The described accessories can increase comfort or improve repeatability of measurements

Part number	Name and description	Useful for
21000-1001	Gas purification furnace ELTRA H-500 analyzer requires carrier gas in 99.995% pure quality. Smallest contaminations of hydrocarbons, oils can influence the repeatability of results. The carrier gas purification furnace removes contaminations for reliable determination of traces of hydrogen.	Customers who want to measure hydrogen in the lower ppm range. Customers with long connections to the gas supply
90426-1001	Filling for gas purification furnace (ONH) The gas purification furnace needs a special chemical filling for effective removing of contaminations	All customers who ordered the gas purification furnace

Delivery content, required accessories and consumables which have to be ordered separately

All H-500 analyzers are equipped with the necessary tools for operation like tweezers for applying a sample or a vessel to store the waste.

To run an ELTRA H-500 it is necessary to purchase also a PC, TFT and a balance to weigh the sample. These accessories have to be ordered separately. Additionally some consumables and chemicals have to be ordered to assure the correct working of the analyzer.

ELTRA Analyzer	Required chemicals and consumables
H-500	88500-0012 Starter Kit (Quartz wool; quartz boat) 90200 Anhydron 90210 Sodium hydroxide 90270 Schuetze reagent

Recommended consumables for selected applications

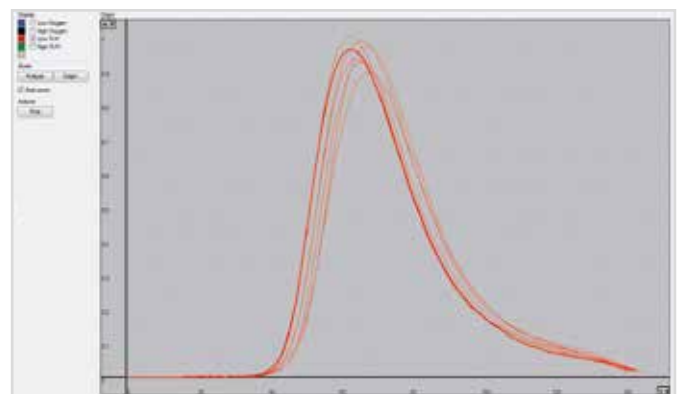
The following tables summarize the typically used consumables for some applications:

Application	Recommended Consumables
Steel	Calibration material like 91110 Steel balls

Example: Hydrogen standard AR 556 from Alpha Resources

Only a resistance furnace with quartz tube is suitable to determine the content of diffusible and residual hydrogen in a steel sample, due to the required temperature of up to 1,000 °C and the sample length of several centimeters (for H-500: 6 cm). ELTRA's H-500 provides precise analysis results even in the low ppm range.

Sample weight	Hydrogen content
1,001.4 mg	6.55 ppm H
999.5 mg	6.55 ppm H
1,000.9 mg	6.41 ppm H



H-500



Order data

Item Number	Price (€)	Description
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Please note: Every analyzer requires PC, monitor, balance and some consumables (crucibles, chemicals) which have to be ordered separately

ELTRA H-500

¹⁰⁾

Measuring ranges at 1,000 mg sample weight (further measuring range combinations on request)

Item Number	Price (€)	Description
88100-2016	DE	H-500 0.01 – 50 ppm H 20 – 1,000 ppm H

Required accessories

PC, monitor, balance

71015	DE	Computer with Intel Core i5-8400 Processor, 500 GB HDD; 8 GB RAM; Windows 10 operating system; keyboard; mouse
71016	DE	Monitor, TFT (21.5 inch)
88600-0002	DE	Balance (resolution 0.0001 g)
71002	DE	Printer (Inkjet, colour)

Required consumables / chemicals for first operations

88500-0012	DC	Starter-kit (2 quartz boats, 50 g glass wool)
¹¹⁾ 90200	DC	Anhydron (magnesium perchlorate), 454 g
¹¹⁾ 90210	DC	Sodium hydroxide, 500 g
¹¹⁾ 90270	DC	Schuetze reagent, 100 g

Further options and consumables

Accessories (Hardware)

21000	DE	Carrier gas purification furnace, without filling (please order filling and quartz wool separately)
72080	DE	Nitrogen regulator, 1 piece

Chemicals (fillings for glass and quartz tubes)

¹¹⁾ 90200	DC	Anhydron (magnesium perchlorate), 454 g
¹¹⁾ 90210	DC	Sodium hydroxide, 500 g
¹¹⁾ 90270	DC	Schuetze reagent, 100 g
¹¹⁾ 90426-1001	DC	Filling for carrier gas purification furnace (suitable for one filling)
90332	DC	Glass wool, 50 g
92610	DC	Tube of high vacuum grease, 35 g

Order data

Item Number	Price (€)	Description
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Spatulas, tweezers, spoons and tongs

88400-0229	DC	Tweezers (160 mm), curved, 1 piece
88400-0472	DC	Tweezers (145 mm), straight, 1 piece
88400-0475	DC	Set with 6 spatula and 1 tweezers for multiple weighing procedures

Tools for storage, transporting and weighing

36121	DC	Quartz boat, 74 x 22 x 10 mm, 1 piece for weighing pins
88400-0477	DC	Weighing boat, 1 piece for weighing and usage of granulates
88400-0509	DC	Metal pan, 1 piece for storage of used crucibles, boats

Tools for maintenance

88400-0473	DC	Powder funnel (plastics), 1 piece for easy filling of chemical tubes
88400-0489	DC	Rubber plug 14 x 20 x 24 mm, 1 piece for sealing small glass tubes like 70230
88400-0490	DC	Rubber plug 29 x 35 x 30 mm, 1 piece for sealing small glass tubes like 09090
71010	DC	Brush, 16 mm, 1 piece for cleaning balance from dust

Calibration materials

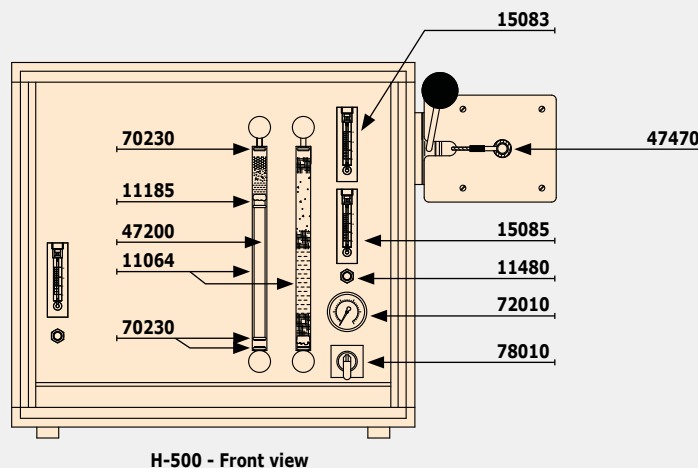
Calibration materials may show slight variations depending on the current lot. To see the current certification please visit www.ELTRA.com.

91110	DC	Calibration standard - Steel, 100 balls gold plated, 1 g each 1.9 ppm H
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Spare and wear parts ELTRA H-500

13) Front side

11064	DC	Reagent tube (set of 2)
11185	DC	Paper filter (set of 10)
11480	DC	Adjustable restrictor
15083	DC	Flow display 15l/h
15085	DC	Flow display 130l/h
47200	DC	Holder
47470	DC	Combustion tube
70230	DC	O-ring
72010	DC	Pressure gauge
78010	DC	Main power switch



Please note:

- 10 Measuring ranges may vary depending on sample weight and sample material
- 11 Hazardous material
- 12 For further calibration standards and compositions see chapter 'consumables' (page 90 ff.). Detailed information about compositions at www.eltra.com/consumables
- 13 As long as not stated differently, the listed part number means one piece



Analysis of C, H, S

ELEMENTRAC CS-i

Carbon & sulfur analysis via inductive combustion

Introduction	26
Available analyzers & options and accessories	30
Suitable calibration materials	32
Spare and wear parts	33

CS-2000

Carbon & sulfur analysis with induction and resistance furnace

Introduction	34
Available analyzers & options and accessories	38
Suitable calibration materials	41
Spare and wear parts	42

C(H)S-580

Manual carbon, (hydrogen), sulfur analysis in organic samples

Introduction	44
Available analyzers & options and accessories	48
Suitable calibration materials	50
Spare and wear parts	51

C(H)S-580A

Automated carbon, (hydrogen), sulfur analysis in organic samples

Introduction	54
Available analyzers & options and accessories	58
Suitable calibration materials	60
Spare and wear parts	61



ELEMENTRAC® CS-i

ELEMENTRAC® CS-i

The ELEMENTRAC CS-i series is used to analyze carbon and sulfur in mostly inorganic samples like steel, iron, copper, alloys and cement or catalyst via inductive combustion

- ▶ Freely selectable configuration of each IR cell
- ▶ New vacuum cleaning system ensures higher measurement precision and stability
- ▶ Heated dust trap allows for improved sulfur detection
- ▶ Optimized catalyst furnace permits more accurate carbon detection
- ▶ Control of induction performance provides more precise analysis of samples with low melting temperature
- ▶ New ELEMENTS software with comprehensive analysis and diagnosis tools

More information available at www.eltra.com



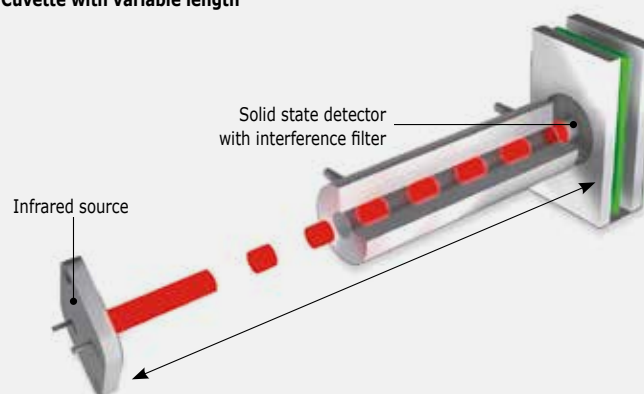
General information / Analysis principle

After weighing the sample and applying the accelerators to the crucibles the sample is placed on the crucible support. At the start of the analysis the sample is combusted in the induction furnace in a stream of oxygen. The sample releases SO_2 , CO_2 and traces of CO . The carrier gas oxygen first leads the combustion gases through up to two sulfur infrared cells followed by a heated catalyst and up to two carbon measuring cells. The heated catalyst oxidizes traces of CO to CO_2 to improve the repeatability of the carbon measurement.

ELTRA provides different configurations and working ranges for the ELEMENTRAC CS-i series. Hence, it is possible to select the best suited analyzer for a reasonable price. It is not necessary to purchase, for example, a carbon and sulfur analyzer with two measuring cells per element when only carbon concentrations are measured, e.g. in cast iron.

The ELEMENTRAC CS-i configurations can vary regarding cell sensitivity (length) and material of the IR cuvette. For standard configurations IR cuvettes made of aluminium are used whereas gold IR cuvettes are available as an option.

Cuvette with variable length



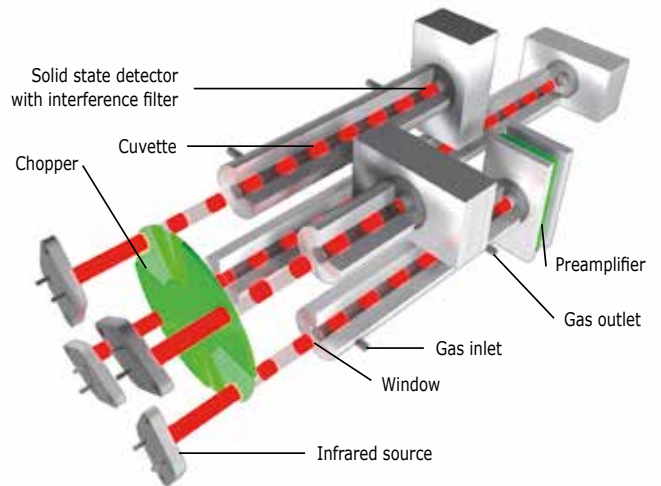
ELEMENTRAC Configuration	Measures Elements	Number of measuring cells
CS-i (2C, 2S)	C, S	2 cells for carbon 2 cells for sulfur
CS-i (1C)	C	1 cell for carbon
CS-i (2C, 1S)	C, S	2 cells for carbon 1 cells for sulfur

Configuration of the measuring range (infrared cells)

The ELEMENTRAC CS-i controls up to 4 IR cells which differ in their cuvette lengths and the element to be determined. The longer the cuvette, the more sensitive it is for low concentrations, e.g. 10 ppm. Shorter cuvettes, like the 3 mm one in the 88200-1010 configuration, also allow for measurements in the low ppm range, however, with increasing standard deviation of the measured values.

For optimum analysis of low and high concentrations, a configuration of two IR cells for one element should be selected. The use of latest detector technology permits an advanced configuration, e.g. 88200-1013, which reliably covers the measuring range from 0.6 ppm to more than 6% for a sample weight of 1000 mg. Optional gold cuvettes provide higher reliability for the analysis of halogenated samples.

Infrared cells with flexible measuring range

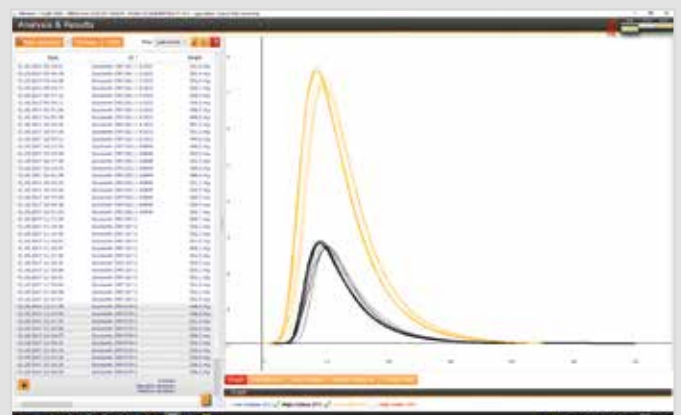


Part number / configuration	Working range 500 mg sample	Working range 1000 mg sample	Comments	Recommended for
88200-1008 (2C;2S)	0.0001–7% C 0.0001–4.5% S	0.00006–3.5% C 0.00006–2.2% S	Standard 4 cell configuration	Steel, stainless steel, cast iron
88200-1010 (1C;1S)	0.0004–14% C 0.0004–0.84% S	0.0002–7% C 0.0002–0.42% S	Economic 2 cell configuration	Carbon steel, cast iron, building materials
88200-1013 (2C;2S)	0.0001–14% C 0.0001–12.8% S	0.00006–7% C 0.00006–6.4% S	Advanced 4 cell configuration	Steel, carbides, ores
88200-1012 (2C;2S)	0.0001–7% C 0.0001–4.5% S	0.00006–3.5% C 0.00006–2.2% S	Configuration with gold cuvettes	Halogenated samples

Typical Results: Steel

Sample volume: approx. 500 mg, accelerator: 1.5 g tungsten;
10 times measurement

Sample	Sample type	% C	% S
ZRM 079-2	Machine steel	0.596 ± 0.0035 (0.6%)	0.192 ± 0.003 (1.6%)
ZRM 187-2	Case-hardened steel	0.204 ± 0.001 (0.5%)	0.03 ± 0.0003 (0.9%)
CRM 281-1	High-alloy steel	0.048 ± 0.0002 (0.4%)	0.016 ± 0.0002 (1.1%)
CRM 292-1	Nb-stabilized stainless steel	0.036 ± 0.002 (0.5%)	0.005 ± 0.0001 (2.6%)



C - H - S

ELEMENTRAC® CS-i

Descriptions and recommendations for major accessories

For ELTRA CS-i analyzers some major accessories are available which are suitable for some applications. The described accessories can increase comfort or improve repeatability of measurements:

Part number	Name and description	Useful for
36999	HTF-540 crucible pre-heating furnace The ceramic crucibles can contain traces of carbon which may cause a higher deviation in carbon measurements. The HTF-540 furnace removes these contaminations by preheating them up to 1000°C	Applications which require a precise carbon measurement (e.g. carbon in high alloyed steel)
21000-1001	Gas purification furnace ELTRA ELEMENTRAC CS-i series analyzers require carrier gas in 99.5% pure quality. Smallest contaminations of hydrocarbons (oils) can influence the repeatability of carbon measurements. The carrier gas purification furnace removes contaminations by leading the carrier gas over heated chemicals	Customers who want to measure C,S in the lower ppm range Customers with long connections to the gas supply
88400-0122	Filling for gas purification furnace (CS) The gas purification furnace needs a special chemical filling for effective removal of contaminations	All customers who ordered the gas purification furnace
88200-1400	36 Position Autoloader up to 36 samples can be placed on the autoloader and will be analyzed automatically	Customers with a high sample throughput
88600-0019	CS-i vacuum cleaner (standard filter)	Customers which analyze dusty samples (cast iron, soil, building materials)
88600-0018	CS-i vacuum cleaner (hepa filter)	Customers which analyze hazardous samples
88400-0559	Additional power socket	Customers who need additional power supply at the back side of the analyzer
88400-0492	Jun air compressor	Laboratories with restricted access to compressed air.

Delivery content, required accessories and consumables which has to be ordered separately

All Elementrac analyzers are equipped with the necessary tools for operation like tweezers for applying a sample or brushes to clean the analyzer.

To run an ELEMENTRAC CS-i it is necessary to purchase also a PC, TFT and a balance to weigh the sample. These accessories have to be ordered separately.

Additionally some consumables and chemicals have to be ordered to assure the correct working of the analyzer:

ELEMENTRAC Analyzer	Required chemicals and consumables
Every Elementrac which provides a C channel E.g. (CCS) or (C)	88400-0535 Pt/Si catalyst
Every Elementrac CS-i needs	88500-0001 Starter Kit with crucibles, tungsten and iron accelerator, glass wool, cellulose 90200 Anhydron 90210 Sodium hydroxide

Recommended consumables for selected applications

The following tables summarizes the typically used consumables for some applications:

Application	Recommended consumables
Steel	Calibration material like 92400-3020 → 92400-3100 90149 Crucibles 90220 Tungsten
Refractory metals	Calibration material like 92400-3020 → 92400-3100 90149 Crucibles 90220 Tungsten 88600-0013 high purity iron accelerator 88600-0010 Tungsten/tin accelerator
Soil, rocks	Calibration material like 92400-3020 → 92400-3100 91900-1001 → 91900-1002 90149 Crucibles 90220 Tungsten 88600-0013 high purity iron accelerator 88600-0014 Crucible lids
Copper	Calibration material like 91000-1001 → 91000-1004 90149 Crucibles 90240 Copper accelerator



Steel

C - H - S

Typical Results: Tungsten carbide, silicon carbide

The following measurement results were obtained with the ELEMENTRAC CS-i (10 measurements per sample).

Sample volume: approx. 250 mg (WC); 80 mg (SiC)
accelerator: 1 g copper / 1 g pure iron

Sample	Sample type	% C
ELTRA 90816-3001 Lot: 914 C	Tungsten carbide	6.13 ± 0.0051 (0.1%)
ECRM 783-1	Tungsten carbide	6.18 ± 0.0053 (0.09%)
BAM-S003	Silicon carbide ^(*)	29.9 ± 0.03 (0.09%)

^(*) Sample weight approx. 80 mg



ELEMENTRAC® CS-i



Order data

Item Number	Price (€)	Description
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Please note: Every analyzer requires PC, monitor, balance and some consumables (crucibles, chemicals) which have to be ordered separately

ELEMENTRAC® CS-i

10)

Measuring ranges at 500 mg sample weight (further measuring range combinations on request)

88200-1001	DE	CS-i 1xC 0,1-7% C	
88200-1002	DE	CS-i 2xC 0.0001-0.1% C 0.1%-7% C	
88200-1003	DE	CS-i 1xS 0.015-0.9% S	
88200-1004	DE	CS-i 2xS 0.0001-0.3% S 0.3%-4.5% S	
88200-1005	DE	CS-i 1xC 0.1-7% C	+ 1xS 0.0001-0.3% S
88200-1006	DE	CS-i 2xC 0.0001-0.1% C 0.1%-7% C	+ 1xS 0.0001-0.3% S
88200-1007	DE	CS-i 1xC 0.1-7% C	+ 2xS 0.0001-0.3% S 0.3%-4.5% S
88200-1008	DE	CS-i 2xC 0.0001-0.1% C 0.1-7% C	+ 2xS 0.0001-0.3% S 0.3%-4.5% S

Required accessories

PC, monitor, balance

71015	DE	Computer with Intel Core i5-8400 Processor, 500 GB HDD; 8 GB RAM; Windows 10 operating system; keyboard; mouse
71016	DE	Monitor, TFT (21.5 inch)
88600-0002	DE	Balance (resolution 0.0001 g)
71002	DE	Printer (Inkjet, colour)

Crucibles and chemicals for ELEMENTRAC CS-i

88500-0001	DC	Starter-kit for 1,000 analyses (1,000 crucibles, 2,500 g tungsten, 908 g pure iron accelerator, 50 g glass wool, 50 g cellulose, 50 g quartz wool)
11) 90200	DC	Anhydrone (magnesium perchlorate), 454 g
11) 90210	DC	Sodium hydroxide, 500 g
88400-0535	DC	Pt/Si catalyst, 15 g

Further options and consumables

Accessories (Hardware)

36999	DE	HTF-540 crucible pre-heating furnace
72070	DE	Oxygen regulator
21000	DE	Carrier gas purification furnace, without filling (integrated in analyzer, please order filling and quartz wool separately)
88200-1400	DE	Autoloader for 36 crucibles
88600-0018	DE	Vacuum cleaner for CS-i with HEPA filter
88600-0019	DE	Vacuum cleaner for CS-i with standard filter

All prices ex works, excluding packaging and insurance · ELTRA price list 99000-2019/E · valid as of January 1, 2019

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Order data

Item Number	Price (€)	Description
Crucibles and lids		
90149	DC	Ceramic crucibles, premium, Ø 1", foil-wrapped, 1,000 pieces
90148	DC	Ceramic crucibles, premium, Ø 1", bagged, 1,000 pieces
88400-0176	DC	Ceramic filtering crucibles, 100 pieces
88600-0014	DC	Ceramic lid, 10 mm hole, 250 pieces
88600-0017	DC	Ceramic lid, 4 mm hole, 1000 pieces
Accelerators		
90220	DC	Tungsten, premium, 2,500 g
90260	DC	Iron accelerator, premium, 908 g
88600-0013	DC	Iron accelerator, high purity, 454 g
88600-0010	DC	Tungsten-tin accelerator, 750 g
90280	DC	Tin accelerator, 908 g
90240	DC	Copper accelerator, 1392 g
Chemicals		
11) 90200	DC	Anhydrone (magnesium perchlorate), 454 g
11) 90210	DC	Sodium hydroxide, 500 g
88400-0535	DC	Pt/Si catalyst, 15 g
90331	DC	Glass wool, 454 g
90340	DC	Cellulose, 100 g
90341	DC	Cellulose, 50 g
90330	DC	Quartz wool, 50 g
92610	DC	Tube of high vacuum grease
88400-0122	DC	Filling for carrier gas purification furnace
General tools and accessories		
23110	DC	Spatula, 1 piece M size
23111	DC	Spatula, 1 piece L size
23113	DC	Spoon, 1 piece for dosing sample and accelerator in CS series
90145	DC	Tongs for ceramic crucibles and boats, 220 mm 1 piece for CS series
88400-0229	DC	Tweezers (160 mm), curved, 1 piece
88400-0472	DC	Tweezers (145 mm), straight, 1 piece
88400-0475	DC	Set with 6 spatula and 1 tweezers for multiple weighing procedures
Tools for storage, transporting and weighing		
36121	DC	Quartz boat, 74x22x10 mm, 1 piece for weighing pins
71010	DC	Brush, 16 mm, 1 piece for cleaning balance from dust
88400-0477	DC	Weighing boat, 1 piece for weighing and usage of granulates
88400-0509	DC	Metal pan, 1 piece for storage of used crucibles, boats
88600-0015	DC	Crucible holder for storage of crucibles
Tools for maintenance		
88400-0473	DC	Powder funnel (plastics), 1 piece for easy filling of chemical tubes
88400-0489	DC	Rubber plug 14x20x24 mm, 1 piece for sealing small glass tubes like 70230
88400-0332	DC	Threaded rod M4x150, 1 piece for removing paper filter holder

Please note:

- 10 Measuring ranges may vary depending on sample weight and sample material
- 11 Hazardous material
- 12 For further calibration standards and compositions see chapter 'consumables' (page 90 ff.). Detailed information about compositions at www.eltra.com/consumables
- 13 As long as not stated differently, the listed part number means one piece

ELEMENTRAC® CS-i

Order data

Item Number	Price (€)	Description
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Calibration materials

Calibration materials may show slight variations depending on the current lot.
To see the current certification please visit www.ELTRA.com.

12)

Steel and cast iron

92400-3020	DC	Steel, 100 g, 0.001–0.01% C
92400-3030	DC	Steel, 100 g, 0.01–0.05% C
92400-3040	DC	Steel, 100 g, 0.05–0.1% C
92400-3050	DC	Steel, 100 g, 0.1–0.2% C
92400-3060	DC	Steel, 100 g, 0.2–0.5% C
92400-3070	DC	Steel, 100 g, 0.5–1.0% C
92400-3090	DC	Cast iron, 100 g, 2.0–3.0% C
92400-3100	DC	Cast iron, 100 g, 3.0–5.0% C
92400-4010	DC	Steel, 150 g, approx. 0,1% S
92400-4020	DC	Steel, 150 g, approx. 0,3% S

Steel pins

92500-1001	DC	C/S pins; 454 g; C approx. 0.2%
92500-1002	DC	C/S pins; 454 g; C approx. 0.4%
92500-2001	DC	C/S pins; 454 g; S approx. 0.2%

Copper pins

91000-1001	DC	Copper pins, approx. 10 ppm S
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Tungsten carbide

90816-3001	DC	Tungsten carbide; approx. 6.1% C
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Other calibration material suitable for resistance and induction furnace

92811-3020	DC	Cement, 100 g; 2.0–4.0% SO ₃
90812-3001	DC	Limestone, 25 g; 0.04% S
90812-3002	DC	Limestone, 25 g; 0.4% S
90812-3003	DC	Limestone, 25 g; C < 5%
90812-3004	DC	Limestone, 25 g; C = 5–10%
90817-3001	DC	Soil, 25 g, C, S > 2%
90817-3002	DC	Soil, 25 g, C, S < 1%
90817-3003	DC	Soil, 25 g, C, S < 2%
91900-1001	DC	Ore, 30 g; ~1.4% S
91900-1002	DC	Ore, 30 g; ~4.2% S
90810	DC	Calcium carbonate, 100 g
90821	DC	Barium sulphate, 50 g

Spare and wear parts ELEMENTRAC® CS-i

13)

Front side

11105	DC	Metal dust filter
11170	DC	Balston filter
70230	DC	O-ring 9 x 3 mm
27000-3070	DC	Cover furnace illumination
51100-2035	DC	Heated dust filter cartridge
88400-0005	DC	Reagent tube
88400-0006	DC	Reagent tube

Order data

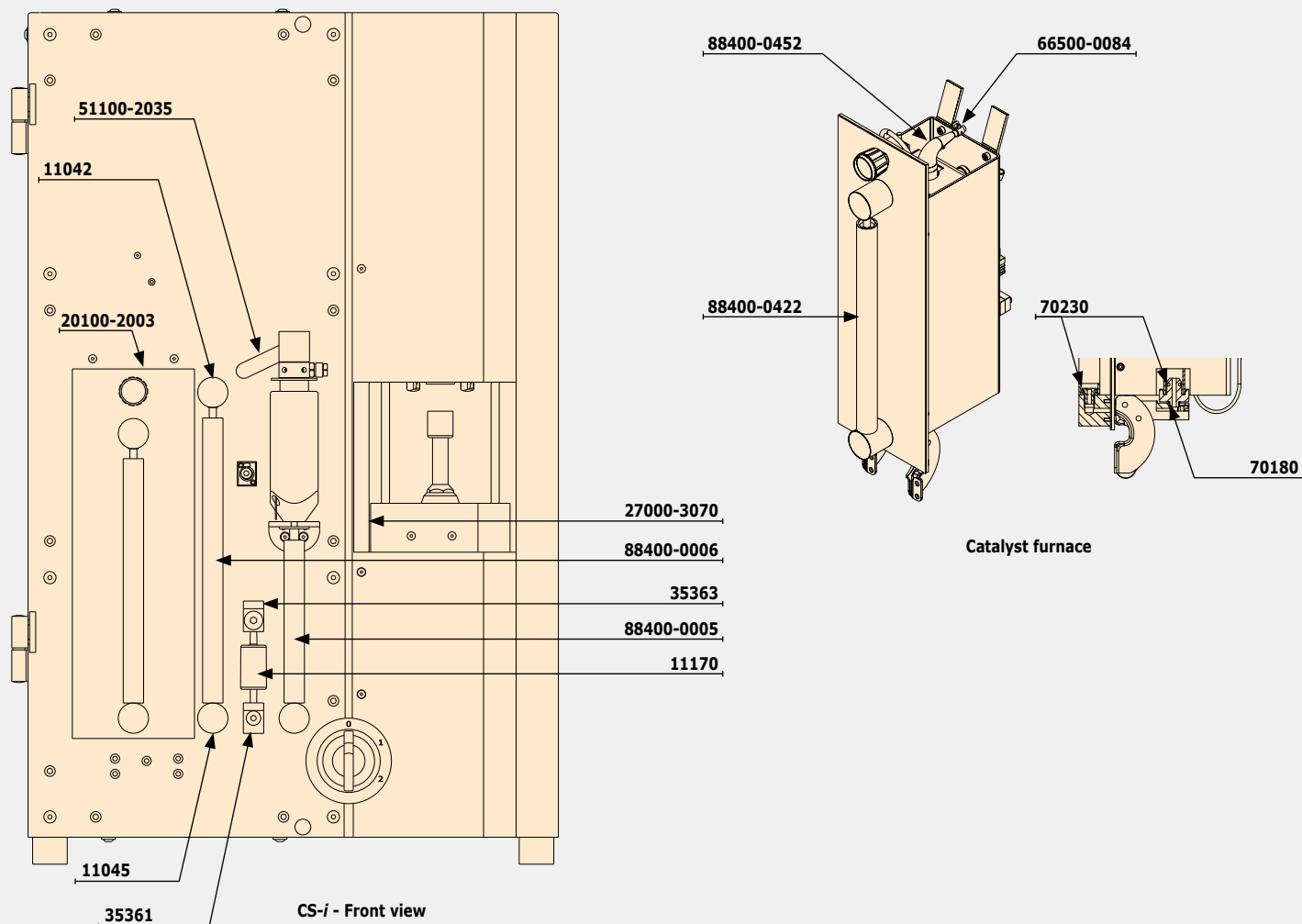
Item Number	Price (€)	Description
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Furnace of CS-i

14014	DW	Cleaning mechanism complete
14021	DW	Upper furnace closing
14045	DW	Cleaning brush for combustion tube
14072	DW	Ceramic heat shield for brush
14130	DW	Combustion tube
14168	DW	Pedestal
70380	DW	O-ring 35 x 5 mm
70390	DW	O-ring 38 x 5 mm

Catalyst furnace

66500-0084	DC	Hose clip
70180	DC	O-ring 8 x 1.5 mm for catalyst furnace
70230	DC	O-ring 9 x 3 mm
88400-0452	DC	Quartz tube
88400-0422	DC	Reagent tube 240 x 20 mm



C-H-S

CS-2000

CS-2000

The CS-2000 uses an induction and a resistance furnace for measuring carbon and sulfur. With these two furnaces multiple inorganic samples like steel, iron, copper, alloys and organic samples like coal, coke and wood can be analyzed.

- ▶ Induction furnace with integrated cleaning mechanism
- ▶ High temperature resistance furnace up to 1550° C and a resolution of 1°C
- ▶ Infrared cells with gold cuvette (10 mm length or longer) for higher persistence vs. halogens and acids
- ▶ Robust design and easy maintenance

More information available at www.eltra.com



General information / Analysis principle

The CS-2000 analyzer is a unique combination of two furnaces and a shared detection unit. The induction furnace requires the addition of accelerators to the sample and is well suited for the C/S analysis in metals like iron, brass or steel. Organic (combustible) samples like coal and coke are typically measured without any accelerator in the resistance furnace. At the start of the analysis, the sample is combusted either in the induction or in the resistance furnace; the released combustion gases are led through up to two sulfur infrared cells and up to two carbon measuring cells.

ELTRA provides different configurations and working ranges for the CS-2000 series. Hence, it is possible to select the best suited analyzer for a reasonable price. It is not necessary to purchase, for example, a carbon and sulfur analyzer with two measuring cells per element when only sulfur concentrations are measured, e.g. in coal or steel samples. In such a case, the most economic choice would be an ELTRA analyzer equipped only with sulfur measuring cells. The following table illustrates the CS-2000 configuration range:

ELEMENTRAC configuration	Measures elements	Number of measuring cells
CS-2000 (2C, 2S)	C, S	2 cells for carbon 2 cells for sulfur
CS-2000 (1C)	C	1 cell for carbon
CS-2000 (2C, 1S)	C, S	2 cells for carbon 1 cells for sulfur

The CS-2000 configurations may vary regarding cell sensitivity (length) and material of the IR cuvette. The CS-2000 uses IR cuvettes with gold IR path (10 mm length and longer) for higher resistance against halogens and acids.

How to read the given measuring ranges?

The CS-2000 (88100-1011) supports the following measuring range for a 500 mg sample:

Carbon: 0.0002–0.1% C / 0.1%–12% C for the induction furnace
0.005–0.3% / 0.3–40% C for the resistance furnace

For the CS-2000 always working ranges for the resistance furnace and the induction furnace are given. This is due to the different combustion behaviour of organic samples which are combusted within 1–2 minutes in the resistance furnace and metal samples which are combusted with 20–30 seconds in the induction furnace.

The speed of combustion influences the working range of the infrared cells.

Taken the nominal weight of 500 mg into account the maximum valid concentration for carbon is 60 mg (12% of 500 mg) for the induction furnace and 200 mg carbon (40% of 500 mg) for the resistance furnace.

Samples which have a higher concentration of carbon can be analyzed with this configuration by applying a reduced sample weight:

Sample	Expected concentrations	Weight	Resulting amount of C/S	Can be analysed with 88100-1011?
Steel: Induction furnace	C: 0.2%	500 mg	1 mg Carbon	Yes
Graphite powder: Resistance furnace	C: 100%	250 mg	250 mg Carbon	No
Graphite powder: Resistance furnace	C: 100%	180 mg	180 mg Carbon	Yes

The measuring range of 88100-1011 is separated into two parts, e. g. 0.0002–0.1% C / 0.1–12% C for induction furnace.

The carbon measurement is processed in two independent infrared cells with different sensitivity. The lower working range (0.0002–0.1%) is covered by the first cell with high sensitivity and the higher working range (0.1%–12%) is covered by a second, less sensitive cell. For some applications, like carbon in stainless steel, the sensitive cell is needed, whereas other applications (carbon in cast iron) requires the less sensitive cell.

Exemplary analyzer recommendations

Additionally to the configurations in this price list other configurations are available on request. Please contact ELTRA.

Application	Analyzer and part number	Working range (500mg sample)
C,S analyzer for Contract labs Cement industries	CS-2000 (2C, 2S) (88100-1016)	C: 0.0002–12%, S: 0.0001–6% (induction furnace) C: 0.005–40%, S: 0.005–13% (resistance furnace)
C,S analyzer for steel plant	CS-2000 (2C, 1S) (88100-1015)	C: 0.0002–12%, S: 0.0001–0.3% (induction furnace) C: 0.005–40%, S: 0.005–2% (resistance furnace)
C,S analyzer for ores	CS-2000 (2S) (88100-1012)	S: 0.0001–6% (induction furnace) S: 0.005–13% (resistance furnace)

CS-2000

Descriptions and recommendation for major accessories

For the ELTRA CS-2000 some major accessories are available which are suitable for some applications. The described accessories can increase comfort or improve repeatability of measurements

Part number	Name and description	Useful for
36999	HTF-540 crucible pre-heating furnace The ceramic crucibles and boats can contain traces of carbon which may cause a higher deviation in carbon measurements. This furnace removes these contaminations by preheating them up to 1000 °C	Applications which require a precise carbon measurement in resistance and induction furnace
21000-1001	Gas purification furnace ELTRA CS-2000 analyzer requires carrier gas in 99.5% pure quality. Smallest contaminations of hydrocarbons, oils can influence the repeatability of results. The carrier gas purification furnaces removes contaminations for reliable determination of traces of C and S	Customers who want to measure C,S in the lower ppm range in the induction furnace. Customers with long connections to the gas supply
88400-0122	Filling for gas purification furnace (CS) The gas purification furnace needs a special chemical filling for effective removing of contaminations	All customers who ordered the gas purification furnace
38001	TIC Module The TIC module allows the determination of the Total Inorganic Carbon (TIC) content. The sample is treated with acid and the released carbon dioxide is measured	Customers who want to determine TOC and TIC content of soils, waste, rocks, ores
36400	Support for low carbon measurement Small attachment for the resistance furnace. It reduces the outer diameter of the furnace and leads to higher precision of carbon measurements in the lower percentage range.	Customers which analyse samples with low carbon content in the resistance furnace
14532 or 14530	Autoloader This Autoloader is suitable for the induction furnace and can be purchased in a 36 position (14532) or 130 position (14530) configuration	For all customers who run large amounts of samples in the induction furnace

Delivery content, required accessories and consumables which have to be ordered separately

All CS-2000 analyzers are equipped with the necessary tools for operation like tweezers for applying a sample or brushes to clean the analyzer.

To run a CS-2000 it is necessary to purchase also a PC, a monitor and a balance to weigh the sample. These accessories have to be ordered separately.

Additionally some consumables and chemicals have to be ordered to assure the correct working of the analyzer:

CS-2000 Analyzer	Required chemicals and consumables
CS-2000 which provides a C channel E.g. (CCS) or (C)	88400-0535 Pt/Si catalyst
Every CS-2000 requires	88500-0002 Starter Kit with crucibles, tungsten and iron accelerator, glas and quartz wool, cellulose, re-usable combustion boat, disposable boats, combsolid 90200 Anhydron 90210 Sodium hydroxide

Recommended consumables for selected applications

The following table summarizes the typically used consumables for some applications:

Application	Calibration material	Recommended consumables
Steel plants	92400-3020 → 92400-3100	90149 Crucibles 90220 Tungsten 90160 Disposable porcelain boats
Refractory metals	92400-3020 → 92400-3100	90149 Crucibles 90220 Tungsten 88600-0013 High purity iron accelerator 88600-0010 Tungsten/tin accelerator
Soil, rocks	92400-3020 → 92400-3100 91900-1001 → 91900-1002	90149 Crucibles 90220 Tungsten 88600-0013 High purity iron accelerator 88600-0014 Crucible lids
Copper	91000-1001 → 91000-1004	90149 Crucibles 90240 Copper accelerator
Cement industries	92400-3020 → 92400-3100 92811-3020 92550-3020 → 92550-3060	90149 Crucibles 90220 Tungsten 88600-0013 High purity iron accelerator 88600-0014 Crucible lids 90160 Disposable porcelain boats 88600-0008 Combsolid
Plastics industries	92400-3020 → 92400-3100 90810 90812-3001 → 90812-3002	90149 Crucibles 90220 Tungsten 88600-0013 High purity iron accelerator 88600-0014 Crucible lids 90153 Re-usable ceramic boats 90840 Quartz sand

C - H - S



Copper



Tungsten Carbide

CS-2000



Order data

Item Number	Price (€)	Description
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Please note: Every analyzer requires PC, monitor, balance and some consumables (crucibles, chemicals) which have to be ordered separately

ELTRA CS-2000

10)

Measuring ranges at 500 mg sample weight (further measuring range combinations on request)
induction furnace || resistance furnace

Item Number	Country	Description	Induction furnace	Resistance furnace
88100-1009	DE	CS-2000 1xC	0.1–12% C	0.3–40% C
88100-1010	DE	CS-2000 1xS	0.001–0.3% S	0.005–2% S
88100-1011	DE	CS-2000 2xC	0.0002–0.1% C 0.1–12% C	0.005–0.3% C 0.3–40% C
88100-1012	DE	CS-2000 2xS	0.001–0.3% S 0.3–6% S	0.005–2% S 0.3–13% S
88100-1013	DE	CS-2000 1xC + 1xS	0.1–12% C 0.001–0.3% S	0.3–40% C 0.005–2% S
88100-1014	DE	CS-2000 1xC + 2xS	0.1–12% C 0.001–0.3% S 0.3–6% S	0.3–40% C 0.005–2% S 0.3–13% S
88100-1015	DE	CS-2000 2xC + 1xS	0.0002–0.1% C 0.1–12% C 0.001–0.3% S	0.005–0.3% C 0.3–40% C 0.005–2% S
88100-1016	DE	CS-2000 2xC + 2xS	0.0002–0.1% C 0.1–12% C 0.001–0.3% S 0.3–6% S	0.005–0.3% C 0.3–40% C 0.005–2% S 0.3–13% S

ELTRA CS-2000 for the use with Autoloader

Item Number	Country	Description	Induction furnace	Resistance furnace
88110-1009	DE	CS-2000 1xC	0.1–12% C	0.3–40% C
88110-1010	DE	CS-2000 1xS	0.001–0.3% S	0.005–2% S
88110-1011	DE	CS-2000 2xC	0.0002–0.1% C 0.1–12% C	0.005–0.3% C 0.3–40% C
88110-1012	DE	CS-2000 2xS	0.001–0.3% S 0.3–6% S	0.005–2% S 0.3–13% S
88110-1013	DE	CS-2000 1xC + 1xS	0.1–12% C 0.001–0.3% S	0.3–40% C 0.005–2% S
88110-1014	DE	CS-2000 1xC + 2xS	0.1–12% C 0.001–0.3% S 0.3–6% S	0.3–40% C 0.005–2% S 0.3–13% S
88110-1015	DE	CS-2000 2xC + 1xS	0.0002–0.1% C 0.1–12% C 0.001–0.3% S	0.005–0.3% C 0.3–40% C 0.005–2% S
88110-1016	DE	CS-2000 2xC + 2xS	0.0002–0.1% C 0.1–12% C 0.001–0.3% S 0.3–6% S	0.005–0.3% C 0.3–40% C 0.005–2% S 0.3–13% S

All prices ex works, excluding packaging and insurance · ELTRA price list 99000-2019/E · valid as of January 1, 2019

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Order data

Item Number	Price (€)	Description
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Required accessories

PC, monitor, balance

71015	DE	Computer with Intel Core i5-8400 Processor, 500 GB HDD; 8 GB RAM; Windows 10 operating system; keyboard; mouse
71016	DE	Monitor, TFT (21,5 inch)
88600-0002	DE	Balance (resolution 0.0001 g)
71002	DE	Printer (Inkjet, colour)

Required consumables / chemicals for first operations

88500-0002	DC	Starter-kit for 1,000 analyses (500 crucibles, 2,500 g tungsten, 908 g pure iron accelerator, 50 g glass wool, 50 g cellulose, 50 g quartz wool, 50 re-usable boats, 500 disposable porcelain boats, 100 g Combsolid)
11) 90200	DC	Anhydron (magnesium perchlorate), 454 g
11) 90210	DC	Sodium hydroxide, 500 g
88400-0535	DC	Pt/Si catalyst, 15 g

Further options and consumables

Accessories (Hardware)

36999	DE	HTF-540 crucible pre-heating furnace
72070	DE	Oxygen regulator
21000	DE	Carrier gas purification furnace, without filling (integrated in analyzer, please order filling and quartz wool separately)
38001	DE	TIC-Module
14532	DE	Autoloader for 36 crucibles
14530	DE	Autoloader for 130 crucibles

Crucibles and lids for the combustion furnace

90149	DC	Ceramic crucibles, premium, Ø 1", foil-wrapped, 1000 pieces
90148	DC	Ceramic crucibles, premium, Ø 1", bagged, 1000 pieces
88400-0176	DC	Ceramic filtering crucibles, 100 pieces
88600-0014	DC	Ceramic lids, 10 mm hole, 250 pieces
88600-0017	DC	Ceramic lids, 4 mm hole, 1000 pieces

Boats for the resistance furnace

90153	DC	Re-usable ceramic boats, premium, 58 x 22 x 14 mm, 500 pieces
90160	DC	Disposable porcelain boats, 86 x 13 x 10 mm, 1000 pieces
88600-0011	DC	Re-usable ceramic boats, 95 x 13 x 10 mm, 500 pieces
88400-0502	DC	Re-usable inconel boat, 54 x 18 x 13.5 mm, 1 piece
88400-0503	DC	Re-usable inconel boat, 54 x 18 x 9 mm, 1 piece

Accelerators for the induction furnace

90220	DC	Tungsten, premium, 2500 g
90260	DC	Iron accelerator, premium, 908 g
88600-0013	DC	Iron accelerator, high purity, 454 g
88600-0010	DC	Tungsten-tin accelerator, 750 g
90280	DC	Tin accelerator, 908 g
90240	DC	Copper accelerator, 1392 g

Combustion support for the resistance furnace

90840	DC	Quartz sand, 100 g
88600-0008	DC	Combsolid, 100 g

i Please note:

- 10 Measuring ranges may vary depending on sample weight and sample material
- 11 Hazardous material
- 12 Further calibration standards and compositions on chapter consumables. Detailed information about compositions at www.eltra.com/consumables
- 13 As long as not stated differently, the listed part number means one piece

CS-2000

Order data

Item Number	Price (€)	Description
Chemicals		
11) 90200	DC	Anhydrone (magnesium perchlorate), 454 g
11) 90210	DC	Sodium hydroxide, 500 g
88400-0535	DC	Pt/Si catalyst, 15 g
90331	DC	Glass wool, 454 g
90340	DC	Cellulose, 100 g
90341	DC	Cellulose, 50 g
90330	DC	Quartz wool, 50 g
92610	DC	Tube of high vacuum grease
88400-0122	DC	Filling for carrier gas purification furnace
91000-1005	DC	Copper, flakes, 25 g
88400-0508	DC	Steel wool, 454 g
General tools and accessories		
23110	DC	Spatula, 1 piece M size
23111	DC	Spatula, 1 piece L size
23113	DC	Spoon, 1 piece for dosing sample and accelerator in CS series
90145	DC	Tongs for ceramic crucibles and boats, 220 mm 1 piece for CS series
88400-0213	DC	Tongs for graphite crucibles, 1 piece for ONH series
88400-0229	DC	Tweezers (160 mm), curved, 1 piece
88400-0472	DC	Tweezers (145 mm), straight, 1 piece
88400-0475	DC	Set with 6 spatula and 1 tweezers for multiple weighing procedures
88400-0476	DC	Micro spatula, 1 piece, XS size for filling small capsules
Tools for storage, transporting and weighing		
36121	DC	Quartz boat, 74 x 22 x 10 mm, 1 piece for weighing pins
71010	DC	Brush, 16 mm, 1 piece for cleaning balance from dust
88400-0477	DC	Weighing boat, 1 piece for weighing and usage of granulates
88400-0509	DC	Metal pan, 1 piece for storage of used crucibles, boats
88600-0015	DC	Crucible holder for storage of crucibles
Tools for maintenance		
88400-0473	DC	Powder funnel (plastics), 1 piece for easy filling of chemical tubes
88400-0489	DC	Rubber plug 14 x 20 x 24 mm, 1 piece for sealing small glass tubes like 70230
88400-0490	DC	Rubber plug 29 x 35 x 30 mm, 1 piece for sealing small glass tubes like 09090
Tools for CS analyzers		
36216	DC	Combustion boat insertion stick, 1 piece
36217	DC	Combustion boat removing stick, 380 mm, 1 piece
36218	DC	Combustion boat removing stick, 600 mm, 1 piece recommended for SufaceC-800
88400-0332	DC	Threaded rod M4 x 150, 1 piece for removing paper filter holder
88400-0499	DC	Safety glasses, 1 piece protection when working with hot furnace
88600-0009	DC	Screen glass with edge guard, 1 piece protection when working with hot furnace



Spoon for dosing sample and accelerator in CS series (23113)



Combustion boat insertion stick (36216)

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Order data

Item Number	Price (€)	Description
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Calibration materials

Calibration materials may show slight variations depending on the current lot.
To see the current certification please visit www.ELTRA.com.

12)

Steel and cast iron

92400-3020	DC	Steel, 100 g, 0.001–0.01% C
92400-3030	DC	Steel, 100 g, 0.01–0.05% C
92400-3040	DC	Steel, 100 g, 0.05–0.1% C
92400-3050	DC	Steel, 100 g, 0.1–0.2% C
92400-3060	DC	Steel, 100 g, 0.2–0.5% C
92400-3070	DC	Steel, 100 g, 0.5–1.0% C
92400-3090	DC	Cast iron, 100 g, 2.0–3.0% C
92400-3100	DC	Cast iron, 100 g, 3.0–5.0% C
92400-4010	DC	Steel, 150g, approx. 0,1% S
92400-4020	DC	Steel, 150g, approx. 0,3% S

Steel pins

92500-1001	DC	C/S pins; 454 g; C approx. 0.2%
92500-1002	DC	C/S pins; 454 g; C approx. 0.4%
92500-2001	DC	C/S pins; 454 g; S approx. 0.2%

Copper pins

91000-1001	DC	Copper pins, approx. 10 ppm S
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Tungsten carbide

90816-3001	DC	Tungsten carbide; approx. 6,1% C
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Other calibration material suitable for resistance and induction furnace

92811-3020	DC	Cement, 100 g; 2.0–4.0% SO ₃
90812-3001	DC	Limestone, 25 g; 0.04% S
90812-3002	DC	Limestone, 25 g; 0.4% S
90812-3003	DC	Limestone, 25 g; C < 5%
90812-3004	DC	Limestone, 25 g; C = 5–10%
90817-3001	DC	Soil, 25g, C, S > 2%
90817-3002	DC	Soil, 25g, C, S < 1%
90817-3003	DC	Soil, 25g, C, S < 2%
91900-1001	DC	Ore, 30 g; ~1.4% S
91900-1002	DC	Ore, 30 g; ~4.2% S
90810	DC	Calcium carbonate, 100 g
90821	DC	Barium sulphate, 50 g

Other calibration material only suitable for resistance furnace

90710-3010	DC	EDTA, 50 g
90710-3020	DC	Acetanilid, 10 g
90824	DC	Sulfanilic acid, 50 g
92511-3010	DC	Coal, 50 g, 0.1–0.5% S
92511-3020	DC	Coal, 50 g, 0.5–1.0% S
92511-3030	DC	Coal, 50 g, 1.0–1.5% S
92511-3040	DC	Coal, 50 g, 1.5–2.0% S
92511-3050	DC	Coal, 50 g, 2.0–3.0% S
92511-3060	DC	Coal, 50 g, 3.0–4.0% S
92511-3070	DC	Coal, 50 g, 4.0–5.0% S
92511-3080	DC	Coal, 50 g, >5.0% S

C - H - S

CS-2000

Order data

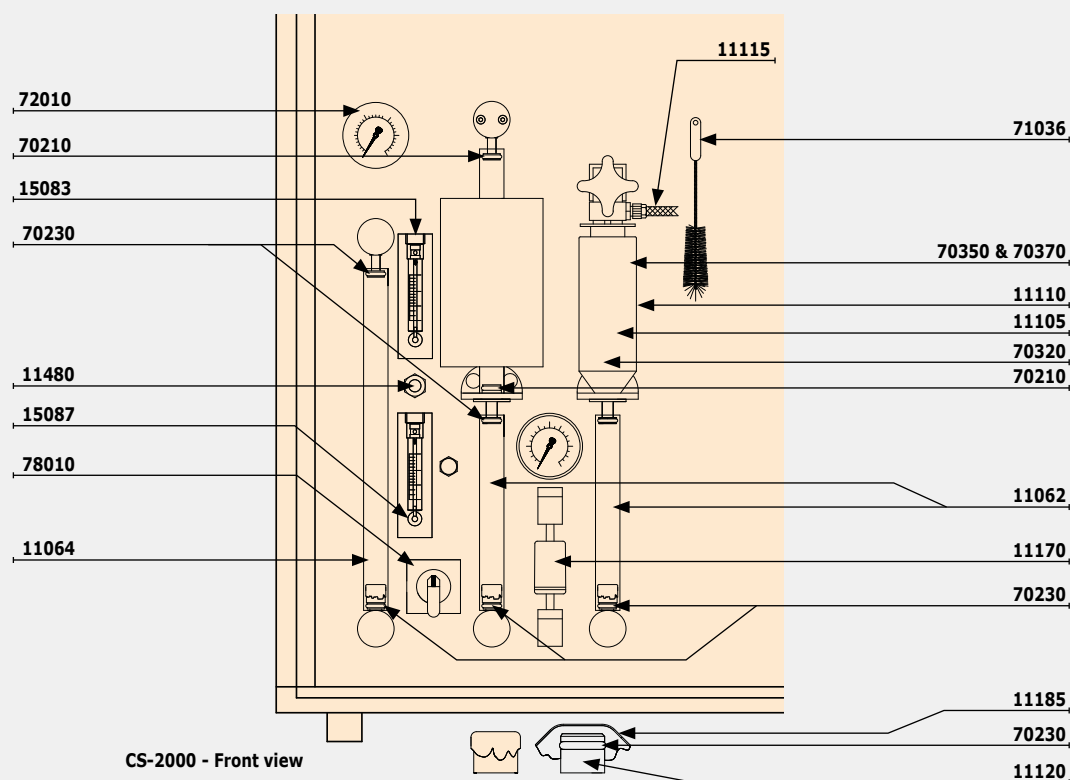
Item Number	Price (€)	Description
Coal, premium: certified C;H;N;S ; ash,volatile content		
92550-3020	DC	Coal, premium, 50 g; < 1.0% S
92550-3040	DC	Coal, premium, 50 g; 1.0–3.0% S
92550-3060	DC	Coal, premium, 50 g; > 3.0% S
Coke, premium: certified C;H;N;S ; ash,volatile content		
92560-3010	DC	Coke, premium, 50 g
Liquid calibration material		
92530	DC	Oil, 100 ml
90860	DC	Glycerine, 100 g

Spare and wear parts ELTRA CS-2000

13)

Front side induction furnace

11062	DW	Reagent tubes 160 x 16 mm, 2 pieces	
11064	DW	Reagent tubes 280 x 16 mm, 2 pieces	
11105	DW	Metal dust filter	
11110	DW	Dust filter housing	
11115	DW	Plastic tube, 75 mm	
11120	DW	Paper filter holder	
11170	DW	Balston-filter	
11185	DW	Paper filters, 10 pieces	
70210	DW	O-ring 8 x 3.5 mm	
70230	DW	O-ring 9 x 3 mm	
70320	DW	O-ring 20 x 5 mm	
71036	DW	Cleaning brush	for metal dust filter
11115	DW	Plastic tube, 75 mm	
70350	DW	O-ring, 29x5	for dust trap
70370	DW	O-ring 34x3	for metal filter



CS-2000 - Front view

All prices ex works, excluding packaging and insurance · ELTRA price list 99000-2019/E · valid as of January 1, 2019

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C - H - S

Order data

Item Number	Price (€)	Description
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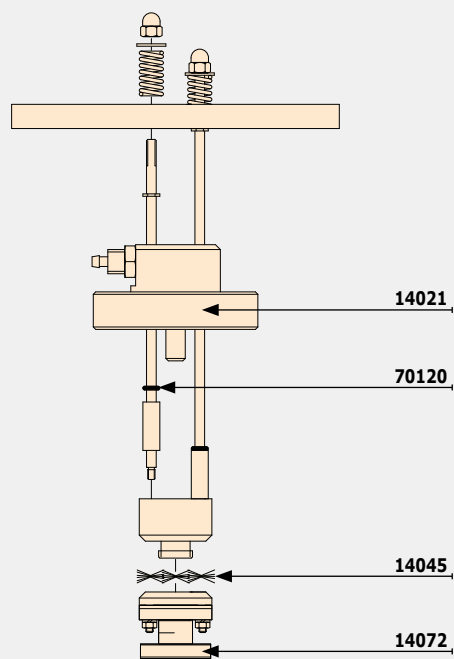
Furnace cleaning mechanism of induction furnace

14014	DW	Cleaning mechanism complete
14021	DW	Upper furnace closing
14045	DW	Cleaning brush for combustion tube
14072	DW	Ceramic heat shield for brush
14130	DW	Combustion tube, quartz glass
14168	DW	Pedestal
70380	DW	O-ring 35 x 5 mm, 2 pieces required for combustion tube
70390	DW	O-ring 38 x 5 mm

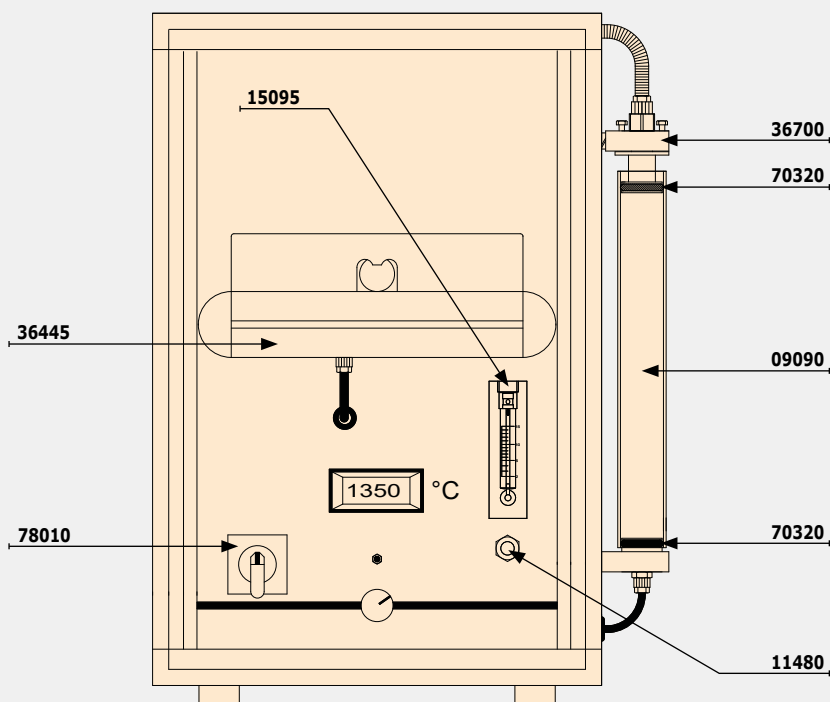
Resistance furnace of the CS-2000

09090	DW	Reagent tubes 32 x 280 mm, 1 piece
36216	DW	Combustion boat insertion stick
36217	DW	Combustion boat removing stick, 380 mm
36445	DW	Platform for combustion boat
36700	DW	Upper reagent tube connector
36914	DW	Thermocouple
70320	DW	O-ring 20 x 5 mm
70380	DW	O-ring 35 x 5 mm
70410	DW	O-ring 48 x 3 mm
77501	DW	Heating elements (set of 4)
90162	DW	Combustion tube

C - H - S



Furnace cleaning mechanism (complete 14014)



Resistance furnace - Front view

CS-580 & CHS-580

CS-580 & CHS-580

The CS-580 & CHS-580 use a resistance furnace which can be heated up to 1550°C and can be used for the simultaneous determination of carbon and sulfur (CS-580) or carbon, hydrogen and sulfur (CHS-580). Common samples are coal, coke, oil, soil, plastics, wood and ores.

- ▶ Horizontal resistance furnace (up to 1550°C)
- ▶ Fast and simultaneous CS; CHS determination
- ▶ Analysis of high sample amounts (500 mg and more)
- ▶ Gold cuvettes for higher resistance vs. halogens and acids
- ▶ Individual configuration available

More information available at www.eltra.com



General information / Analysis principle

The CS-580 & CHS-580 are combustion analyzers with a horizontal resistance furnace which can be heated up in steps of 1°C up to 1550°C. Typically organic samples are applied to a ceramic boat and introduced manually into the hot furnace. A high stream of oxygen is applied resulting in the release of CO₂, SO₂ and H₂O. The CHS-580 series measures the released gaseous water first,

followed by its absorption and SO₂ and CO₂ measurement. All gases are measured in element-specific IR cells. The CS-580 does not support water measurement.

The CHS-580 can be configured with up to three IR cells, whereas the CS-580 can be equipped with up to four IR Cells.

The following table illustrates typical configurations and measuring ranges:

ELEMENTRAC configuration	Measures elements	Number of measuring cells	Working range (500mg sample)
CS-580 (1C)	C	1 for Carbon	0.05 – 100% C
CS-580 (2C;2S)	C, S	2 for Carbon 2 for Sulfur	0.005 – 100% C 0.005 – 20% S
CS-580 (2C;1S)	C, S	2 for Carbon 1 for Sulfur	0.005 – 100% C 0.005 – 2% S
CHS-580 (1C, 1H, 1S)	C, H, S	1 for Carbon 1 for Hydrogen 1 for Sulfur	0.01 – 100% C 0.01 – 15% H 0.005 – 2% S
CHS-580 (1H)	H	1 for Hydrogen	0.01 – 15% H

C - H - S

How to read the given measuring ranges?

The working range of the 88100-4007 configuration is indicated as 0.005–12% / 12%–100% for carbon and 0.005 – 2% for sulfur, with a nominal weight of 500 mg. Two working ranges are given for carbon detection because two IR cells are used. The sensitive one is limited to 12%, whereas the robust one can measure up to 100%.

The one sulfur cell in the 88100-4007 configuration is limited to 2% with a sample weight of 500 mg. This means an absolute maximum amount of 10 mg. Hence, 50 mg of sample with 20% of sulfur can be measured reliably.

TOC analysis of soil, waste...

Some standards (e.g. DIN EN 15936) require the determination of a special carbon fraction (TOC = Total Organic Carbon) which is usually lower than the total carbon content (TC). This parameter is important for soil, waste and other samples. ELTRA's CS-580 analyzer is suitable to measure this kind of parameter after acidification of the sample.

The following equation is valid: TC (Total Carbon) = TOC (Total Organic Carbon) + TIC (Total Inorganic Carbon)

Parameter	Suitable ELTRA analyzer	Comments
TC	CS-580 analyzer with 1 or 2 IR carbon cells	TC can be measured in typical samples like soil, waste without limitations
TOC	CS-580 analyzer with 1 or 2 IR carbon cells; steel wool and/or copper flakes are necessary for acid absorption	The TOC content is available after acidification. Acid traps are recommended
TIC	CS-580 analyzer with 1 or 2 IR carbon cells & optional TIC module	The TIC content can be measured with the optional TIC module.

Remark: CHS configurations are not recommended for TOC analysis

Exemplary analyzer recommendations

Additionally to the configurations in this price list also other cell configurations are available on request. Please contact ELTRA.

Application	Analyzer and part number	Working range (500mg sample)
C;H;S analysis in fuels (low and medium sulfur)	CHS-580 : 88100-4009	0.01 – 100% C 0.01 – 15% H 0.005 – 2%
C;S in all kind of fuels; ores	CS-580: 88100-4008	0.005 – 100% C 0.005 – 20% S
TOC & TIC analysis	CS-580: 88100-4003 TIC module: 38001	0.005 – 100% C

Descriptions and recommendation for major accessories

For ELTRA C(H)S 580 analyzers some major accessories are available which are suitable for some applications.

Part number	Name and description	Useful for
38001	TIC Module external module which can be coupled to the analyzer	Customers which require TIC analysis
72070	Oxygen regulator reduces the pressure of an oxygen bottle	Laboratories without centralized gas supply
36400	Support for low carbon measurement add in which reduces the inlet diameter of the combustion tube	Analysis of low carbon samples (e.g. 1%)

Delivery content, required accessories and consumables which has to be ordered separately

All ELTRA analyzers are equipped with the necessary tools for operation like tongs or spatula for applying samples. To run a CS-580 & CHS-580 it is necessary to purchase also a PC, TFT and a balance to weigh the sample.

These accessories have to be ordered separately. Additionally some consumables and chemicals have to be ordered to assure the correct working of the analyzer.

Part Number	Description
71015	PC
71016	TFT
88600-0002	Balance
Optional: 71002	Printer
88500-0003	Starter kit CS-580 for 500 analysis (porcelain boats, glas wool,combsolid)
88400-0004	Starter kit CHS-580 for 500 analysis (porcelain boats, glas wool,combsolid)
90200	Anhydrone
90210	Sodium hydroxide

Recommended consumables for selected applications

The following tables summarizes the typically used consumables for some applications:

Application	Suitable calibration material	Consumables
Coal, coke	92511-xxxx Coal (S) 92550-xxxx Coal (C;H;S) 92560-xxxx Coke (C;H;S)	90260 Porcelain boats (for C; S analysis) 88600-0011 Porcelain boats (for C;H;S analysis) 90153 Reusable boats (for alternative fuels)
Oil	92530 Oil (S) 90860 Glycerine (C;H)	90153 Reusable boats 90840 Quartz sand 88400-0517 Transfer pipettes
TOC in soil	90817-xxxx Soil (C;S) 90810 Calcium carbonate (C)	90153 Reusable boats For acid absorption 91000-1005 Copper flakes Or 88400-0508 Steel wool
Building materials	92811-3020 Cement (S) 90812-xxxx Limestone (C;S) 90810 Calcium carbonate (C)	Porcelain boats 90260 or 88600-0011 As accelerator 88600-0508 Combsolid
Ores	90810 Calcium carbonate (C) 90821 Barium sulfate (S) 91900-2001 Zinc Sulfide (S) 91900-xxxx Ores (C;S)	Porcelain boats 90260 or 88600-0011
Synthetic materials, plastics	90710-3010 EDTA (C;H) 90824 Sulfanilic acid (C;H;S)	90153 Reusable boats Or 90260 Porcelain boats 90840 Quartz sand

Example: Carbon, hydrogen and sulfur in rubber

Small volumes of rubber samples can be analyzed easily and reproducibly with the CHS-580 for their carbon, hydrogen and sulfur concentrations. For sample preparation, the samples are homogenized to a fineness of 300 microns.

Sample	Weight	% C	% H	% S
Rubber	40.0 mg	84.16% C	5.88% H	2.15% S
Rubber	44.3 mg	84.02% C	5.76% H	2.12% S
Rubber	43.5 mg	83.40% C	5.77% H	2.14% S



Rubber

CS-580 & CHS-580



Order data

Item Number	Price (€)	Description
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Please note: Every analyzer requires PC, monitor, balance and some consumables (crucibles, chemicals) which have to be ordered separately)

ELTRA CS-580

¹⁰⁾

Measuring ranges at 500 mg sample weight (further measuring range combinations on request)

Item Number	Country	Configuration	Measuring Ranges	Options
88100-4001	DE	CS-580 1xC	0.05-100% C	
88100-4002	DE	CS-580 1xS	0.005-2% S	
88100-4003	DE	CS-580 2xC	0.005-12% C 12-100% C	
88100-4004	DE	CS-580 2xS	0.005-2% S 2-20% S	
88100-4005	DE	CS-580 1xC	0.05-100% C	+ 1xS 0.005-2% S
88100-4006	DE	CS-580 1xC	0.05-100% C	+ 2xS 0.005-2% S 2-20% S
88100-4007	DE	CS-580 2xC	0.005-12% C 12-100% C	+ 1xS 0.005-2% S
88100-4008	DE	CS-580 2xC	0.005-12% C 12-100% C	+ 2xS 0.005-2% S 2-20% S

ELTRA CHS-580

Item Number	Country	Configuration	Measuring Ranges	Options
88100-4014	DE	CHS-580 1xH	0.01-15% H	
88100-4012	DE	CHS-580 1xC	0.01-100% C	+ 1xH 0.01-15% H
88100-4013	DE	CHS-580 1xS	0.005-2% S	+ 1xH 0.01-15% H
88100-4010	DE	CHS-580 2xC	0.001-5% C 5%-100% C	+ 1xH 0.01-15% H
88100-4011	DE	CHS-580 2xS	0.005-2% S 2-20% S	+ 1xH 0.01-15% H
88100-4009	DE	CHS-580 1xC	0.01-100% C	+ 1xH 0.01-15% H + 1xS 0.005-2% S

Required accessories

PC, monitor, balance

Item Number	Country	Description
71015	DE	Computer with Intel Core i5-8400 Processor, 500 GB HDD; 8 GB RAM; Windows 10 operating system; keyboard; mouse
71016	DE	Monitor, TFT (21.5 inch)
88600-0002	DE	Balance (resolution 0.0001 g)
71002	DE	Printer (Inkjet, colour)

Required consumables / chemicals for first operations

Item Number	Country	Description
88500-0003	DC	Starter-kit for 500 analyses (500 disposable porcelain boats, 50 g glass wool, 50 re-usable boats, 100 g Combsolid)
88500-0004	DC	Starter-kit for 500 analyses (500 disposable porcelain boats, 50 g glass wool, 50 re-usable boats, 100 g Combsolid)
¹¹⁾ 90200	DC	Anhydron (magnesium perchlorate), 454 g
¹¹⁾ 90210	DC	Sodium hydroxide, 500 g

Order data

Item Number	Price (€)	Description
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Further options and consumables

Accessories (Hardware)

38001	DE	TIC-Module
72070	DE	Oxygen regulator
36400	DE	Support for low carbon measurement

Chemicals (fillings for glass and quartz tubes)

11) 90200	DC	Anhydrone (magnesium perchlorate), 454 g
11) 90210	DC	Sodium hydroxide, 500 g
90331	DC	Glass wool, 454 g
90332	DC	Glass wool, 50 g
92610	DC	Tube of high vacuum grease, 35 g
11) 88600-0008	DC	Combsolid, 100 g
91000-1005	DC	Copper, flakes, 25 g
90840	DC	Quartz sand, 100 g
88400-0508	DC	Steel wool

Boats

90160	DC	Disposable porcelain boats 86 x 13 x 10 mm, 1000 pieces
90153	DC	Re-usable ceramic boats, premium, 58 x 22 x 14 mm, 500 pieces
88600-0011	DC	Re-usable ceramic boats, 95 x 13 x 10 mm, 500 pieces
88400-0502	DC	Re-usable inconel boat, 54 x 18 x 13.5 mm, 1 piece
88400-0503	DC	Re-usable inconel boat, 54 x 18 x 9 mm, 1 piece

Tools for operation: Spatulas, tweezers, tongs and other

88400-0229	DC	Tweezers (160 mm), curved, 1 piece
88400-0472	DC	Tweezers (145 mm), straight, 1 piece
88400-0475	DC	Set with 6 spatula and 1 tweezers for multiple weighing procedures
90145	DC	Tongs for crucibles, 220 mm
88600-0009	DC	Screen glass with edge guard
88400-0499	DC	Safety glasses
36216	DC	Combustion boat insertion stick
36217	DC	Combustion boat removing stick, 380 mm



Tongs for ceramic crucibles and boats (90145)



Disposable porcelain boats (90160)

i Please note:

- 10 Measuring ranges may vary depending on sample weight and sample material
- 11 Hazardous material
- 12 Further calibration standards and compositions on chapter consumables. Detailed information about compositions at www.eltra.com/consumables
- 13 As long as not stated differently, the listed part number means one piece

All prices ex works, excluding packaging and insurance · ELTRA price list 99000-2019/E · valid as of January 1, 2019

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CS-580 & CHS-580

Order data

Item Number	Price (€)	Description
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Tools for storage, transporting and weighing

88400-0477	DC	Weighing boat, 1 piece for weighing and usage of granulates
88400-0517	DC	Transfer pipettes for applying liquids, 3 ml, 500 pieces
88400-0509	DC	Metal pan, 1 piece for storage of used crucibles, boats

Tools for maintenance

88400-0473	DC	Powder funnel (plastics), 1 piece for easy filling of chemical tubes
88400-0490	DC	Rubber plug 29 x 35 x 30 mm, 1 piece for sealing big glass tubes like 09090
71010	DC	Brush, 16 mm, 1 piece for cleaning balance from dust

Calibration materials

Calibration materials may show slight variations depending on the current lot.
To see the current certification please visit www.ELTRA.com.

12)

Coal: certified sulfur content

92511-3010	DC	Coal, 50 g, 0.1–0.5% S
92511-3020	DC	Coal, 50 g, 0.5–1.0% S
92511-3030	DC	Coal, 50 g, 1.0–1.5% S
92511-3040	DC	Coal, 50 g, 1.5–2.0% S
92511-3050	DC	Coal, 50 g, 2.0–3.0% S
92511-3060	DC	Coal, 50 g, 3.0–4.0% S
92511-3070	DC	Coal, 50 g, 4.0–5.0% S
92511-3080	DC	Coal, 50 g, >5.0% S

Coal, premium: certified C;H;N;S ; ash,volatile content

92550-3020	DC	Coal, premium, 50 g; < 1.0% S
92550-3040	DC	Coal, premium, 50 g; 1.0–3.0% S
92550-3060	DC	Coal, premium, 50 g; > 3.0% S

Coke, premium: certified C;H;N;S ; ash,volatile content

92560-3010	DC	Coke, premium, 50 g
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Other

92811-3020	DC	Cement, 100 g; 2.0-4.0% SO ₃
90812-3001	DC	Limestone, 25 g; 0.04% S
90812-3002	DC	Limestone, 25 g; 0.4% S
90812-3003	DC	Limestone, 25 g; C < 5%
90812-3004	DC	Limestone, 25 g; C = 5 -10%
90817-3001	DC	Soil, 25g, C, S > 2%
90817-3002	DC	Soil, 25g, C, S < 1%
90817-3003	DC	Soil, 25g, C, S < 2%
91900-1001	DC	Ore, 30 g; ~1.4% S
91900-1002	DC	Ore, 30 g; ~4.2% S

Primary substances for calibration

90710-3010	DC	EDTA, 50 g
90710-3020	DC	Acetanilid, 10 g
90810	DC	Calcium carbonate, 100 g
90821	DC	Barium sulphate, 50 g
90824	DC	Sulfanilic acid, 50 g
91900-2001	DC	Zinc sulfide, 50 g; S 32%

Liquid calibration material

92530	DC	Oil, 100 ml
90860	DC	Glycerine, 100 g

Order data

Item Number	Price (€)	Description
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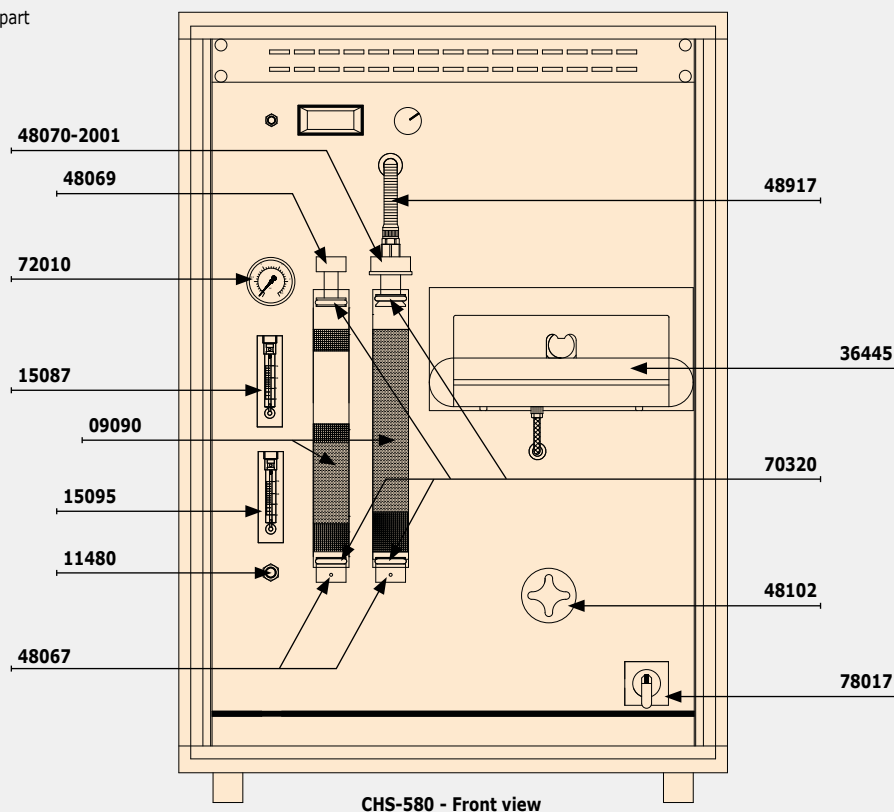
Spare and wear parts

13)

Front side & filter			CS-580	CHS-580
09090	DC	Reagent tube	0	0
11170	DC	Dust cartridge	0	-
11480	DC	Adjustable restrictor	0	0
15087	DC	Flow meter 300l/h	0	0
15095	DC	Flow meter 600l/h	-	0
35361	DC	Lower cartridge connector	0	-
35363	DC	Upper cartridge connector	0	-
36445	DC	Platform for combustion boats	0	0
36700	DC	Upper reagent tube connector	0	-
48067	DC	Lower reagent tube connector	0	0
48069	DC	Upper reagent tube connector	0	0
48070-2001	DC	Upper reagent tube holder	-	0
48102	DC	Filter unit for CHS analyzer	-	0
48105	DC	Filter support	-	0
48917	DC	Heated tube 850 mm for CHS analyzer	-	0
70300	DC	O-ring	-	0
70320	DC	O-ring 20 x 5 mm	0	0
70370	DC	O-ring	-	0
70390	DC	O-ring	-	0
72010	DC	Pressure gauge	0	0
77510	DC	Heater	-	0
78017	DC	Mains power switch	0	0
82130	DC	Filter	-	0

Key

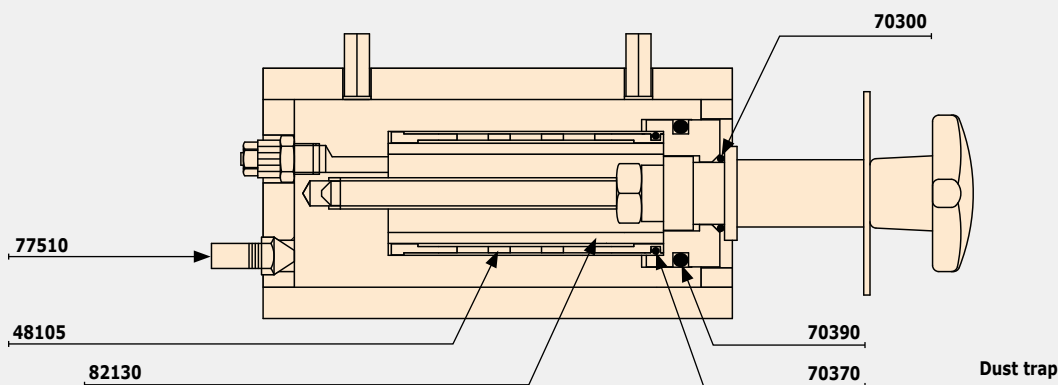
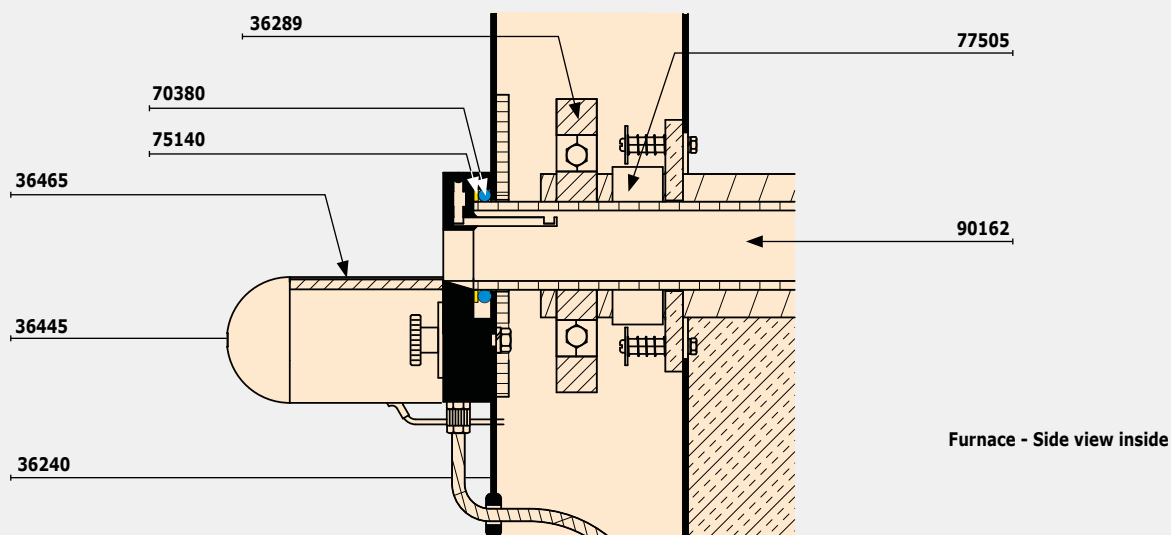
- 0 = Recommended spare part
- = Not applicable

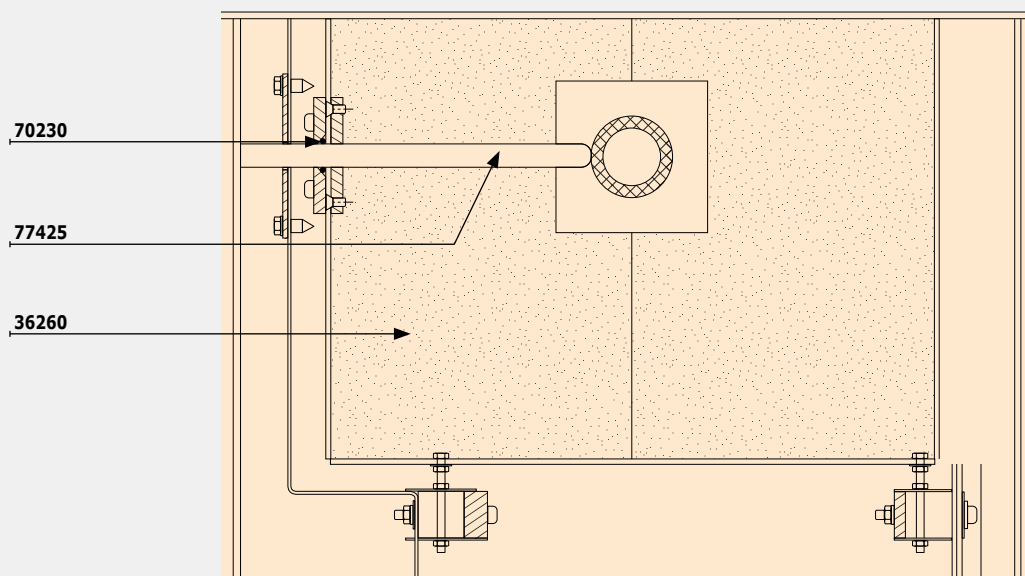
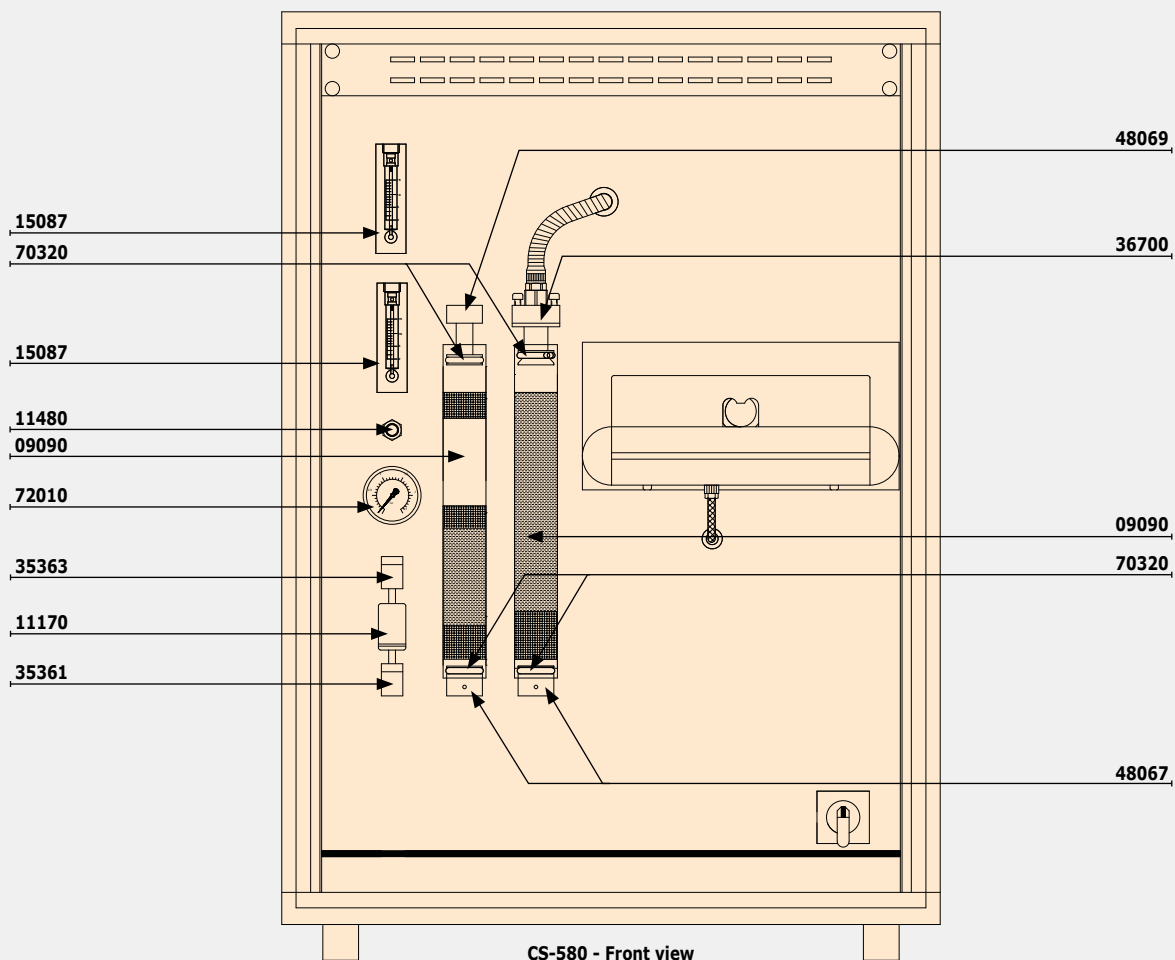


C - H - S

Order data

Item Number	Price (€)	Description	CS-580	CHS-580
Furnace				
36101	DC	Boat stop	0	0
36216	DC	Combustion boat insertion stick	0	0
36217	DC	Combustion boat removing stick	0	0
36240	DC	Ceramic plate	0	0
36260	DC	Fibre block	0	0
36283	DC	Heating element connector (Long)	0	0
36289	DC	Clamp	0	0
36445	DC	Platform for the combustion boat	0	0
36465	DC	Ceran plate	0	0
36620	DC	Dust trap	0	0
70230	DC	O-ring 9 x 3 mm	0	0
70380	DC	O-ring 35 x 5 mm	0	0
70410	DC	O-ring 48 x 3 mm	0	0
75140	DC	Coil spring washer	0	0
77425	DC	Thermocouple	0	0
77450	DC	Thermoswitch	0	0
77501	DC	Heating elements (1set 4 pcs)	0	0
77505	DC	Ceramic spacer for heating elements	0	0
90153	DC	Combustion boats	0	0
90162	DC	Combustion tube	0	0





C - H - S

CS-580A & CHS-580A „HELIOS“

CS-580A & CHS-580A

The CS-580A & CHS-580A use a resistance furnace which can be heated up to 1550 °C and can be used for the simultaneous determination of carbon and sulfur (CS-580A) or carbon, hydrogen and sulfur (CHS-580A). Common samples are coal, coke, oil, soil, plastics, wood and ores.

- ▶ Vertical resistance furnace (up to 1550 °C)
- ▶ Optional autoloader with 36 or 130 positions
- ▶ Fast and simultaneous CS; CHS determination
- ▶ Analysis of high sample amounts (500 mg and more)
- ▶ Gold cuvettes for higher resistance vs. halogens and acids
- ▶ Individual configuration available

More information available at www.eltra.com



Comparison of CS/CHS-580 and CS/CHS-580A

Main differences of the C(H)S-580A series in comparison to the C(H)S-580 series are the different arrangement of the furnace, different sample carrier and the possibility to use an autoloader. The C(H)S-580A series uses ceramic crucibles instead of boats (C(H)S-580 series) which can be fed to the analyzer from a 36 or 130 position autoloader or manually.

Topic	C(H)S-580	C(H)S-580A
Furnace	Horizontal, up to 1550 °C	Vertical, up to 1550 °C
Sample carrier	Ceramic boats	Ceramic crucibles
Available Autoloader	-	36 130 130 acid resistance
Advantages	- Requires less space - Samples with special shapes and lengths can be applied (tubes, discs.)	- Autoloader capable - More smooth combustion for intensive burning samples (oil, plastics)

General information / Analysis principle

The CS-580A & CHS-580A are combustion analyzers with a vertical resistance furnace which can be heated up in steps of 1 °C up to 1550 °C. Typically, organic samples are applied to a ceramic crucible which is placed either by hand or by an autoloader on a ceramic pedestal. The pedestal with crucible is introduced into the furnace automatically and a high stream of oxygen is applied, resulting in

the release of CO₂, SO₂ and water. The CHS-580 A series measures the released gaseous water first, followed by its absorption on magnesium perchlorate and SO₂ and CO₂ measurement. All gases are measured in element selective IR cells. The CHS-580A can be configured with up to three IR cells, whereas the CS-580A can be equipped with up to four IR Cells.

The following table illustrates typical configurations and measuring ranges:

ELEMENTRAC configuration	Measures elements	Number of measuring cells	Working range (500mg sample)
CS-580A (1C)	C	1 for Carbon	0.05 – 100% C
CS-580A (2C;2S)	C, S	2 for Carbon 2 for Sulfur	0.005 – 100% C 0.005 – 20% S
CS-580A (2C;1S)	C, S	2 for Carbon 1 for Sulfur	0.005 – 100% C 0.005 – 2% S
CHS-580A (1C;1H;1S)	C, H, S	1 for Carbon 1 for Hydrogen 1 for Sulfur	0.01 – 100% C 0.01 – 15% H 0.005 – 2% S
CHS-580A (1H)	H	1 for Hydrogen	0.01 – 15% H

C - H - S

How to read the given measuring ranges?

The 88100-4021 configuration states a working range for carbon of 0.005 – 12% / 12% – 100% and for sulfur 0.005 – 2% with a nominal weight of 500 mg. For carbon two working ranges are given, because two IR cells are used for carbon detection. The sensitive one is limited to 12%, whereas the robust one can measure up to 100%.

The one sulfur cell in the 88100-4021 configuration is limited to 2% with a sample weight of 500 mg. This means an absolute amount of 10 mg is maximum. In consequence also 50 mg of sample with 20% of sulfur can be measured in a reliable way.



CS-580A & CHS-580A „HELIOS“

TOC analysis for soil, waste...

Some standards (e.g. DIN EN 15936) require the determination of a special carbon fraction (TOC = Total Organic Carbon) which is usually lower than the total carbon content (TC). This parameter is important for soil, waste and other samples. ELTRA CS-580A analyzer are suitable to measure this kind of parameter.

The following equation is valid: $TC \text{ (Total Carbon)} = TOC \text{ (Total Organic Carbon)} + TIC \text{ (Total Inorganic Carbon)}$

Parameter	Suitable ELTRA analyzer	Comments
TC	CS-580A analyzer with 1 or 2 IR carbon cells	TC can be measured in typical samples like soil, waste without limitations
TOC	CS-580A analyzer with 1 or 2 IR carbon cells; steel wool and/or copper flakes are necessary for acid absorption	The TOC content is available after acidification. Acid traps are recommended
TIC	CS-580A analyzer with 1 or 2 IR carbon cells & optional TIC module	The TIC content can be measured with the optional TIC module.

Remark: CHS configurations are not recommended for TOC analysis

Exemplary analyzer recommendations

Additionally to the configurations in this price list also other cell configurations are available on request. Please contact ELTRA.

Application	Analyzer and part number	Working range (500mg sample)
C;H;S analysis in fuels (low and medium sulfur)	CHS-580A: 88100-4023	0.01 – 100% C 0.01 – 15% H 0.005 – 2% S
C;S in all kind of fuels; ores	CS-580A: 88100-4022	0.005 – 100% C 0.005 – 20% S
TOC & TIC analysis	CS-580A: 88100-4017 TIC module: 38001	0.005 – 100% C

Descriptions and recommendation for major accessories

For ELTRA C(H)S-580A analyzers some major accessories are available which are suitable for some applications. The C(H)S-580A can be operated with or without autoloader

Part number	Name and description	Useful for
38001	TIC Module external module which can be coupled to the analyzer	Laboratories which require TIC analysis
72070	Oxygen regulator reduces the pressure of an oxygen bottle	Laboratories without centralized gas supply
14535	Autoloader for 36 crucibles	Laboratories with medium sample throughput
14533	Autoloader for 130 crucibles	Laboratories with high sample throughput
14533-1001	Autoloader for 130 crucibles, acid resistance	Laboratories with high sample throughput of TOC analysis

Delivery content, required accessories and consumables which has to be ordered separately

All ELTRA analyzers are equipped with the necessary tools for operation like tongs or spatula for applying samples. To run a CS-580A & CHS-580A it is necessary to purchase also a PC, monitor and a balance to weigh the sample. These accessories have to be ordered separately.

Additionally some consumables and chemicals have to be ordered to assure the correct working of the analyzer.

Required parts for ELTRA CS-580A & CHS-580A:

Part number	Description
71015	PC
71016	TFT
88600-0002	Balance
Optional: 71002	Printer
88500-0005	Starter kit CS-580A for 500 analysis (ceramic crucibles, glas wool, combsolid)
88400-0006	Starter kit CHS-580A for 500 analysis (ceramic crucibles , glas wool, combsolid)
90200	Anhydrone
90210	Sodium hydroxide

Recommended consumables for selected applications

The following table summarizes the typically used consumables for some applications:

Application	Suitable calibration material	Consumables
Coal, coke	92511-xxxx Coal (S) 92550-xxxx Coal (C;H;S) 92560-xxxx Coke (C;H;S)	Ceramic crucibles 90148 or 90149
Oil	92530 Oil (S) 90860 Glycerine (C;H)	Ceramic crucibles 90148 or 90149 90840 Quartz sand 88400-0517 Transfer pipettes
TOC in soil	90817-xxxx Soil (C;S) 90810 Calcium carbonate (C)	Ceramic crucibles 90149 For acid absorption 91000-1005 Copper flakes Or 88400-0508 Steel wool
Building materials	92811-3020 Cement (S) 90812-xxxx Limestone (C;S) 90810 Calcium carbonate (C)	Ceramic crucibles 90149 As accelerator 88600-0508 Combsolid
Ores	90810 Calcium carbonate (C) 90821 Barium sulfate (S) 91900-2001 Zinc Sulfide (S) 91900-xxxx Ores (C;S)	Ceramic crucibles 90149 As accelerator 88600-0508 Combsolid
Synthetic materials, plastics	90710-3010 EDTA (C;H) 90824 Sulfanilic acid (C;H;S)	Ceramic crucibles 90149 90840 Quartz sand

CS-580A & CHS-580A „HELIOS“



Order data

Item Number	Price (€)	Description
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Please note: Every analyzer requires PC, monitor, balance and some consumables (crucibles, chemicals) which have to be ordered separately)

ELTRA CS-580A

10)

Measuring ranges at 500 mg sample weight (further measuring range combinations on request)

Item Number	Country	Description	Measuring Ranges
88100-4015	DE	CS-580A 1xC	0.05–100% C
88100-4016	DE	CS-580A 1xS	0.005–2% S
88100-4017	DE	CS-580A 2xC	0.005–12% C 12–100% C
88100-4018	DE	CS-580A 2xS	0.005–2% S 2–20% S
88100-4019	DE	CS-580A 1xC	0.05–100% C + 1xS 0.005–2% S
88100-4020	DE	CS-580A 1xC	0.05–100% C + 2xS 0.005–2% S 2–20% S
88100-4021	DE	CS-580A 2xC	0.005–12% C 12–100% C + 1xS 0.005–2% S
88100-4022	DE	CS-580A 2xC	0.005–12% C 12–100% C + 2xS 0.005–2% S 2–20% S

ELTRA CHS-580A

Item Number	Country	Description	Measuring Ranges
88100-4028	DE	CHS-580A 1xH	0.01–15% H
88100-4026	DE	CHS-580A 1xC	0.01–100% C + 1xH 0.01–15% H
88100-4027	DE	CHS-580A 1xS	0.005–2% S + 1xH 0.01–15% H
88100-4024	DE	CHS-580A 2xC	0.001–5% C 5%–100% C + 1xH 0.01%–15% H
88100-4025	DE	CHS-580A 2xS	0.005–2% S 2–20% S + 1xH 0.01–15% H
88100-4023	DE	CHS-580A 1xC	0.01–100% C + 1xH 0.01–15% H + 1xS 0.005–2% S

Required accessories

PC, monitor, balance

Item Number	Country	Description
71015	DE	Computer with Intel Core i5-8400 Processor, 500 GB HDD; 8 GB RAM; Windows 10 operating system; keyboard; mouse
71016	DE	Monitor, TFT (21.5 inch)
88600-0002	DE	Balance (resolution 0.0001 g)
71002	DE	Printer (Inkjet, colour)
14535	DE	Autoloader for 36 crucibles
14533	DE	Autoloader for 130 crucibles
14533-1001	DE	Autoloader for 130 crucibles, acid resistant

i Please note:

- 10 Measuring ranges may vary depending on sample weight and sample material
 11 Hazardous material
 12 Further calibration standards and compositions on chapter consumables. Detailed information about compositions at www.eltra.com/consumables
 13 As long as not stated differently, the listed part number means one piece

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Order data

Item Number	Price (€)	Description
Required consumables / chemicals for first operations		
88500-0005	DC	Starter-kit for 500 analyses CS 580A (500 crucibles, 50 g glass wool, 100 g Combsolid)
88500-0006	DC	Starter-kit for 500 analyses CHS 580A (500 crucibles, 50 g glass wool, 100 g Combsolid)
11) 90200	DC	Anhydrone (magnesium perchlorate), 454 g
11) 90210	DC	Sodium hydroxide, 500 g

Further options and consumables

Accessories (Hardware)		
38001	DE	TIC-Module
72070	DE	Oxygen regulator
88600-0015	DE	Crucible holder

Chemicals (fillings for glass and quartz tubes)		
11) 90200	DC	Anhydrone (magnesium perchlorate), 454 g
11) 90210	DC	Sodium hydroxide, 500 g
90331	DC	Glass wool, 454 g
90332	DC	Glass wool, 50 g
92610	DC	Tube of high vacuum grease, 35 g
11) 88600-0008	DC	Combsolid, 100 g
91000-1005	DC	Copper, flakes, 25 g
90840	DC	Quartz sand, 100 g
88400-0508	DC	Steel wool

Crucibles		
90149	DC	Ceramic crucibles, premium, Ø 1", foil-wrapped, 1000 pieces
90148	DC	Ceramic crucibles, premium, Ø 1", bagged, 1000 pieces
88400-0176	DC	Ceramic filtering crucibles, 100 pieces
88400-0142	DC	Filtering crucibles, 100 pieces, small version

Reagent tubes		
09090	DC	Reagent tube S size, 32 x 280 mm
09092	DC	Reagent tube XL size, 54 x 36 x 280 mm
09093	DC	Reagent tube XXL size, length 280 mm



Combsolid (88600-0008)



Ceramic crucibles (90149)

C - H - S

Order data

Item Number	Price (€)	Description
Tools for operation: Spatulas, tweezers, tongs and other		
88400-0229	DC	Tweezers (160 mm), curved, 1 piece
88400-0472	DC	Tweezers (145 mm), straight, 1 piece
88400-0475	DC	Set with 6 spatula and 1 tweezers for multiple weighing procedures
90145	DC	Tongs for crucibles, 220 mm
88400-0477	DC	Weighing boat, 1 piece for weighing and usage of granulates
88400-0517	DC	Transfer pipettes for applying liquids, 3 ml, 500 pieces
88400-0509	DC	Metal pan, 1 piece for storage of used crucibles, boats
90146	DC	Steel pot for pre-heated crucibles

Tools for maintenance

88400-0473	DC	Powder funnel (plastics), 1 piece for easy filling of chemical tubes
88400-0490	DC	Rubber plug 29 x 35 x 30 mm, 1 piece for sealing glass tubes like 09090
71010	DC	Brush, 16 mm, 1 piece for cleaning balance from dust

Calibration materials

Calibration materials may show slight variations depending on the current lot.
To see the current certification please visit www.ELTRA.com.

12)

Coal: certified sulfur content

92511-3010	DC	Coal, 50 g, 0.1–0.5% S
92511-3020	DC	Coal, 50 g, 0.5–1.0% S
92511-3030	DC	Coal, 50 g, 1.0–1.5% S
92511-3040	DC	Coal, 50 g, 1.5–2.0% S
92511-3050	DC	Coal, 50 g, 2.0–3.0% S
92511-3060	DC	Coal, 50 g, 3.0–4.0% S
92511-3070	DC	Coal, 50 g, 4.0–5.0% S
92511-3080	DC	Coal, 50 g, >5.0% S

Coal, premium: certified C;H;N;S ; ash,volatile content

92550-3020	DC	Coal, premium, 50 g; < 1.0% S
92550-3040	DC	Coal, premium, 50 g; 1.0–3.0% S
92550-3060	DC	Coal, premium, 50 g; > 3.0% S

Coke, premium: certified C;H;N;S ; ash,volatile content

92560-3010	DC	Coke, premium, 50 g
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Other

92811-3020	DC	Cement, 100 g; 2.0–4.0% SO ₃
90812-3001	DC	Limestone, 25 g; 0.04% S
90812-3002	DC	Limestone, 25 g; 0.4% S
90812-3003	DC	Limestone, 25 g; C < 5%
90812-3004	DC	Limestone, 25 g; C = 5–10%
90817-3001	DC	Soil, 25g, C, S > 2%
90817-3002	DC	Soil, 25g, C, S < 1%
90817-3003	DC	Soil, 25g, C, S < 2%
91900-1001	DC	Ore, 30 g; ~1.4% S
91900-1002	DC	Ore, 30 g; ~4.2% S

primary substances for calibration

90710-3010	DC	EDTA, 50 g
90710-3020	DC	Acetanilid, 10 g
90810	DC	Calcium carbonate, 100 g
90821	DC	Barium sulphate, 50 g
90824	DC	Sulfanilic acid, 50 g
91900-2001	DC	Zinc sulfide, 50 g; S 32%

Order data

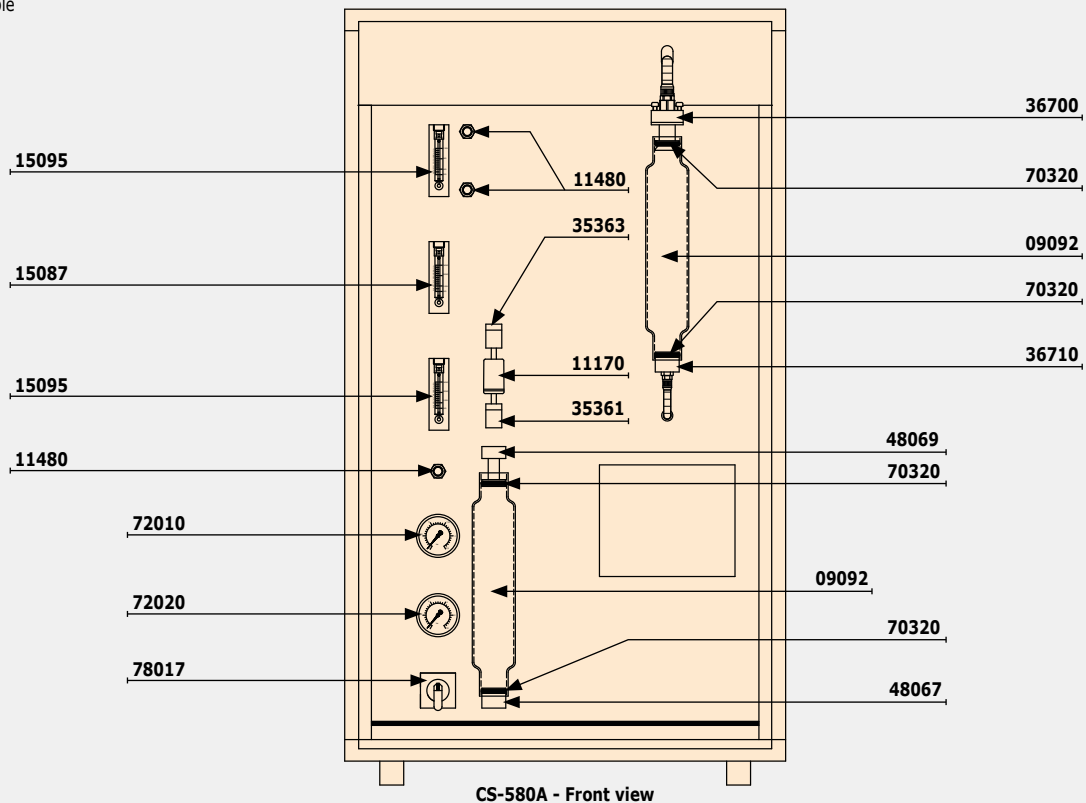
Item Number	Price (€)	Description
Liquid calibration material		
92530	DC	Oil, 100 ml
90860	DC	Glycerine, 100 g

Spare and wear parts

13)

Front view CS-580A and CHS-580A				CS-580A	CHS-580A
09090	DC	Reagent tube		o	o
09092	DC	Alternative reagent tube with bigger capacity		o	o
09093	DC	Alternative reagent tube with maximum capacity		o	o
11170	DC	Dust filter cartridge		o	o
11480	DC	Adjustable restrictor		o	o
15087	DC	Flow meter 300l/h		o	o
15095	DC	Flow meter 600l/h		o	o
35542	DC	Pedestal		o	o
36700	DC	Upper reagent tube holder		o	-
36710	DC	Lower reagent tube connector		o	-
48067	DC	Lower reagent tube connector		o	o
48069	DC	Upper reagent tube connector		o	o
48070-2001	DC	Upper reagent tube holder		-	o
48102	DC	Heated dust filter (complete)		-	o
48933	DC	Heated tube		-	o
70320	DC	O-ring		o	o
72010	DC	Pressure gauge 2.5 bar	for oxygen	o	o
72020	DC	Pressure gauge 10 bar	for compressed air	o	o
78017	DC	Mains power switch		o	o

Key
 o = Recommended spare part
 - = Not applicable



C - H - S

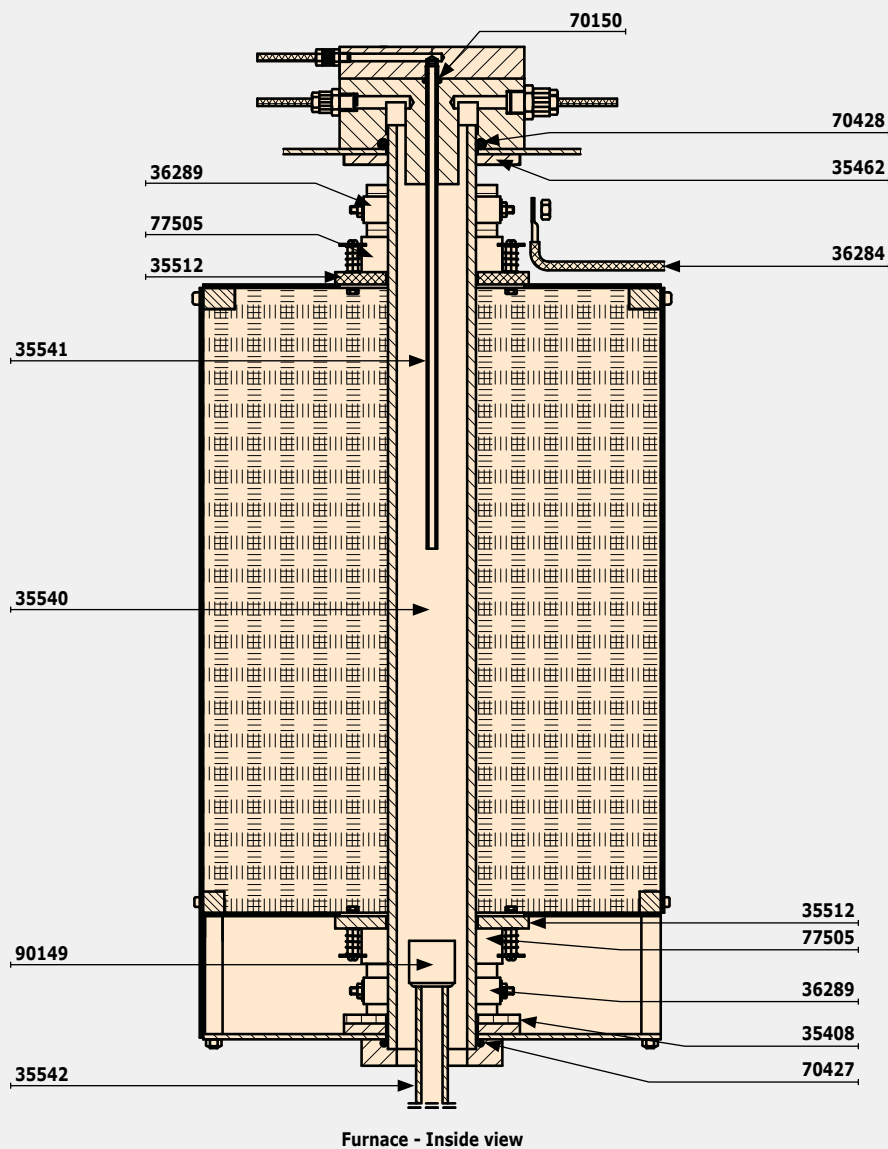
CS-580A & CHS-580A „HELIOS“

Order data

Item Number	Price (€)	Description	CS-580A	CHS-580A
Furnace CS-580A and CHS-580A				
35408	DC	Lower plate insulation	o	o
35462	DC	Upper plate	o	o
35512	DC	Ceramic plate	o	o
35540	DC	Combustion tube	o	o
35541	DC	Ceramic lance	o	o
35542	DC	Pedestal	o	o
36284	DC	Heating element connector	o	o
36289	DC	Heating element clamp	o	o
70150	DC	O-ring	o	o
70427	DC	O-ring	o	o
70428	DC	O-ring	o	o
77501	DC	Heating elements, 4 pcs	o	o
77505	DC	Ceramic spacer	o	o
90149	DC	Ceramic crucibles, premium, Ø 1", foil-wrapped, 1000 pieces	o	o

Key

o = Recommended spare part







Analysis of CO₂, TOC, TIC, Surface Carbon, Moisture, Ash, Volatile

CW & SC series and TIC module

Introduction **66**

CW-800

Carbon & water analysis via combustion

Available analyzers & options and accessories **70**

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CW-800 M

Fractional carbon & water analysis via combustion

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Suitable calibration materials **76**

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Surface C-800

Surface carbon analysis

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Suitable calibration materials **80**

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TGA Thermostep

Thermogravimetric analysis (moisture, volatile, ash)

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TIC module

TIC determination via acidification

Module, accessories, calibration material, spare and wear parts **86**

CW & SC series and TIC module

The CW-800 series supports fractional analysis and is used to analyze the carbon & water content in various samples by combustion under different carrier gases and temperatures. The Surface C-800 is exclusively designed for surface carbon determination on sheets and tubes and the TIC model allows the direct TIC measurement by acidification.

- ▶ Simultaneous CO₂ and water determination (CW series)
- ▶ Resistance furnace up to 1000 °C
- ▶ Quartz tube for sensitive measurements

More information available at www.eltra.com



General information / Analysis principle

For some applications not only the total carbon and water contents are of interest, but also their fractions which are released under different conditions regarding temperature and atmosphere. Typical samples for this kind of application encompass soil, building material and waste for the CW series and TIC module. The Surface C-800 analyzes any kind of sheets and tubes (e.g. steel, copper) for surface carbon.

The CW-800 uses nitrogen as carrier gas and measures the TIC (Total Inorganic Carbon) and water content typically in building materials by decomposing the sample at a constant high temperature (e.g. 1000 °C). The released CO₂ and water are measured with infrared cells.

Whereas the CW-800 always operates with a constant temperature and atmosphere the CW-800 M can change both during measurement. In consequence organic carbon (TOC) and inorganic carbon (TIC) can be separated from each other in one measurement. Of course the CW-800 M can also operate at a constant temperature (e.g. for moisture determination in welding fluxes).

The following table summarizes the features of the CW & SC series:

Analyzer	Measured elements	Carrier gas	Temperature during measurement	Internal catalyst	Inner diameter combustion tube
CW-800	C and/or water	Nitrogen	Constant	No	24 mm
CW-800 M	C and/or water	Nitrogen or oxygen	Variable or constant	Yes	24 mm
Surface C-800	C (as surface C)	Oxygen	constant	Yes	38 mm

The Surface C-800 uses a reduced flow of oxygen in comparison to the CW-800 series for a sensitive determination of the surface carbon content. Additionally the Surface C-800 combustion tube has a bigger diameter than the CW-800 series to allow the application of bigger samples. The analysis temperature (max. 1000 °C) is always lower than the melting point of the analyzed material and the applied sheet or tube sample stays solid.

An internal catalyst in the CW-800 M and Surface C-800 oxidizes traces of released carbon monoxide to assure a reliable carbon determination. Due to the complete decomposition of TIC to CO₂ a catalyst is not required in the CW-800.

The TIC module is a flexible module which can be connected to every ELTRA analyzer with a resistance furnace (CW series; C(H)S-580 (A) series; CS-2000). In the TIC module a sample is treated with acid and the released CO₂ (TIC content) is measured with the IR cells of the coupled analyzer.

How to read the given measuring ranges

For the TIC module no measuring range is available because it uses the IR cells of the connected analyzer. For CW series and the SurfaceC-800 the working ranges are given in different units due to different applications. For the CW series the given working range depends on the applied sample weight, for the SurfaceC-800 the working range depends on the applied surface of the sample.

When two working ranges for one element are shown the analyzer uses two IR cells for one element. In this case the first mentioned data describes the working range of the sensitive cell and the second data are related to the robust IR cell.

The following table illustrates the working range for some examples:

Analyzer	Nominal sample weight or area	Working range	Maximum amount
CW-800 88100-4029	200 mg	0.1–20% H ₂ O	20% of 200 mg = 40 mg H ₂ O
CW-800 M 88100-4041	200 mg	0.1–70% CO ₂	70% of 200 mg = 140 mg CO ₂ = 50 mg of carbon
Surface C-800 88100-4045	50 cm ²	10–1000 µg C/cm ²	50 cm ² * 1000 µg C/cm ² = 50.000 µg C = 50 mg C

Exemplary analyzer recommendations

The following table gives some recommendations for typical applications

Application	Recommended analyzer	Recommended configuration
Moisture and/or CO ₂ in limestone, cement, building materials	CW-800	88100-4029: only for H ₂ O measurement 88100-4030: for H ₂ O and CO ₂ measurement
Fractional analysis of building materials, soil, waste	CW-800 M	88100-4041 for H ₂ O and CO ₂ measurement
Welding fluxes	CW-800 M	88100-4042 only for H ₂ O measurement
Surface carbon on tubes and sheets	Surface C-800	88100-4032 Surface C measurement over a wide concentration range

Descriptions and recommendation for major accessories

Part number	Name and description	Useful for
38001	TIC module Direct TIC determination via acidification	Laboratories which require TIC measurement
72080	Nitrogen regulator reduces gas bottle pressure to applicable 2–4 bar	Useful for laboratories with no central gas supply
72070	Oxygen regulator reduces gas bottle pressure to applicable 2–4 bar	Useful for laboratories with no central gas supply

Delivery content, required accessories and consumables which have to be ordered separately

Part Number	Description
71015	PC
71016	TFT
88600-0002	Balance
Optional: 71002	Printer
Analyzer	Required chemicals and consumables
CW-800	88500-0010 Starter kit for CW-800 (porcelain boats, glass wool) 90200 Anhydrone 90210 Sodium hydroxide
CW-800 M	88500-0014 Starter kit for CW-800 M (porcelain boats, quartz boats, glass wool, quartz wool) 90200 Anhydrone 90210 Sodium hydroxide 90289 Copper oxide
Surface C-800	88500-0011 Starter kit Surface C-800 (quartz boats, glass wool, quartz wool) 90200 Anhydrone 90210 Sodium hydroxide 90289 Copper oxide

All ELTRA analyzers are equipped with the necessary tools for operation like tweezers for applying a sample or tools to insert or remove a combustion boat into the furnace.

To run the CW-800 series or the SurfaceC-800 series it is necessary to purchase also a monitor, a PC and a balance to weigh the sample. These accessories have to be ordered separately, as well as the required chemicals.

Recommended consumables for selected applications

Application	Calibration material	Required consumables
Surface carbon on copper tubes and steel sheets	90814 Synthetic C (1% C)	90160 Porcelain boats
Moisture and CO ₂ in building materials	90810 CaCO ₃ (12% C) 90700-1040 Calcium oxalate (12.2% water)	36121 Quartz boat 88400-0502 Inconel boat
Moisture in welding fluxes	90700-1040 Calcium oxalate (12.2% water)	36121 Quartz boat 88400-0502 Inconel boat
Fractional analysis of carbon and water in soil, waste	90810 CaCO ₃ (12% C) 90700-1040 Calcium oxalate (12.2% water)	36121 Quartz boat 88400-0502 Inconel boat

CW-800



Order data

Item Number	Price (€)	Description
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Please note: Every analyzer requires PC, monitor, balance and some consumables (crucibles, chemicals) which have to be ordered separately)

ELTRA CW-800

¹⁰⁾ **Measuring ranges at 200 mg sample weight (further measuring range combinations on request)**

88100-4029	DE	CW-800 H2O 0-20% H2O
88100-4030	DE	CW-800 1x CO2 0-70% CO2 + H2O 0-20% H2O

Required accessories

PC, monitor, balance

71015	DE	Computer with Intel Core i5-8400 Processor, 500 GB HDD; 8 GB RAM; Windows 10 operating system; keyboard; mouse
71016	DE	Monitor, TFT (21.5 inch)
88600-0002	DE	Balance (resolution 0.0001 g)
71002	DE	Printer (Inkjet, colour)

Required consumables / chemicals for first operations

88500-0010	DC	Starter-kit for 1000 analyses (1000 disposable porcelain boats, 3 quartz boats, 50 g glass wool)
¹¹⁾ 90200	DC	Anhydron (magnesium perchlorate), 454 g
¹¹⁾ 90210	DC	Sodium hydroxide, 500 g

Further options and consumables

Accessories (Hardware)

38001	DE	TIC-Module
72080	DE	Nitrogen regulator

Chemicals (fillings for glass and quartz tubes)

¹¹⁾ 90200	DC	Anhydron (magnesium perchlorate), 454 g
¹¹⁾ 90210	DC	Sodium hydroxide, 500 g
90331	DC	Glass wool, 454 g
90332	DC	Glass wool, 50 g
92610	DC	Tube of high vacuum grease, 35 g
90840	DC	Quartz sand, 100 g

Please note:

- ¹⁰ Measuring ranges may vary depending on sample weight and sample material
- ¹¹ Hazardous material
- ¹² Further calibration standards and compositions on chapter consumables. Detailed information about compositions at www.eltra.com/consumables
- ¹³ As long as not stated differently, the listed part number means one piece

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Order data

Item Number	Price (€)	Description
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Boats

36120	DC	Quartz boat, 75x16x7.5 mm, 1 piece
90160	DC	Disposable porcelain boats 86 x 13 x 10 mm, 1000 pieces

Tools for operation: Spatulas, tweezers, tongs and other

88400-0229	DC	Tweezers (160 mm), curved, 1 piece
88400-0472	DC	Tweezers (145 mm), straight, 1 piece
88400-0475	DC	Set with 6 spatula and 1 tweezers for multiple weighing procedures
90145	DC	Tongs for crucibles, 220 mm
88400-0477	DC	Weighing boat, 1 piece for weighing and usage of granulates
88400-0509	DC	Metal pan, 1 piece for storage of used crucibles, boats
90146	DC	Steel pot for pre-heated crucibles

Tools for maintenance

88400-0473	DC	Powder funnel (plastics), 1 piece for easy filling of chemical tubes
88400-0490	DC	Rubber plug 29 x 35 x 30 mm, 1 piece for sealing glass tubes like 09090
71010	DC	Brush, 16 mm, 1 piece for cleaning balance from dust

Calibration materials

Calibration materials may show slight variations depending on the current lot.
To see the current certification please visit www.ELTRA.com.

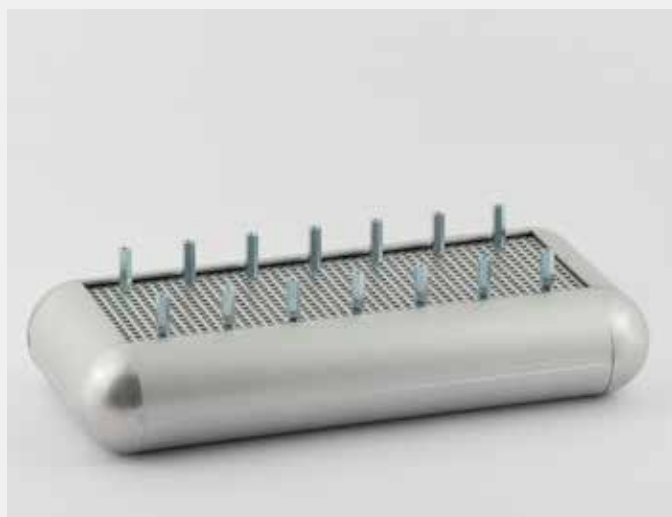
12)

Limestone

90812-3003	DC	Limestone, 25 g; C < 5%
90812-3004	DC	Limestone, 25 g; C = 5-10%

Primary substances for calibration

90810	DC	Calcium carbonate, 100 g
90700-1040	DC	Calcium oxalate, 50 g



Storage of used quartz boats (46245)



Spatula (23110)

CW-800

Order data

Item Number	Price (€)	Description
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Spare and wear parts

13)

Front

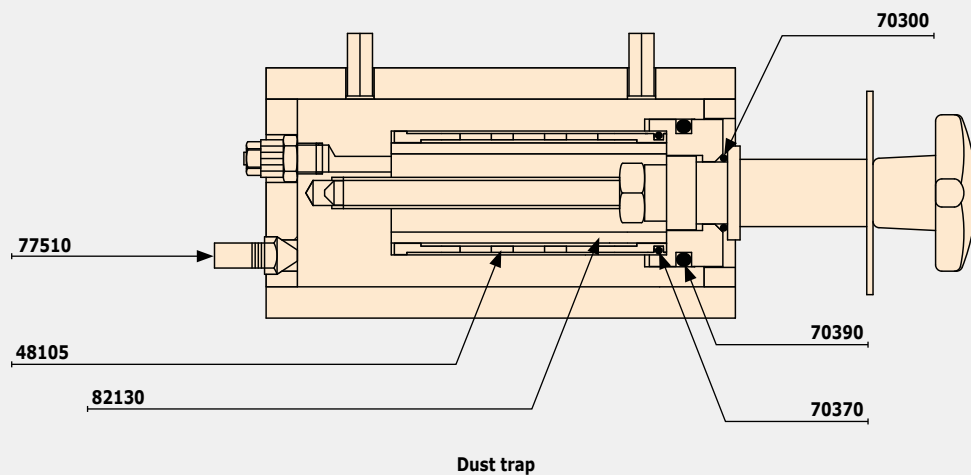
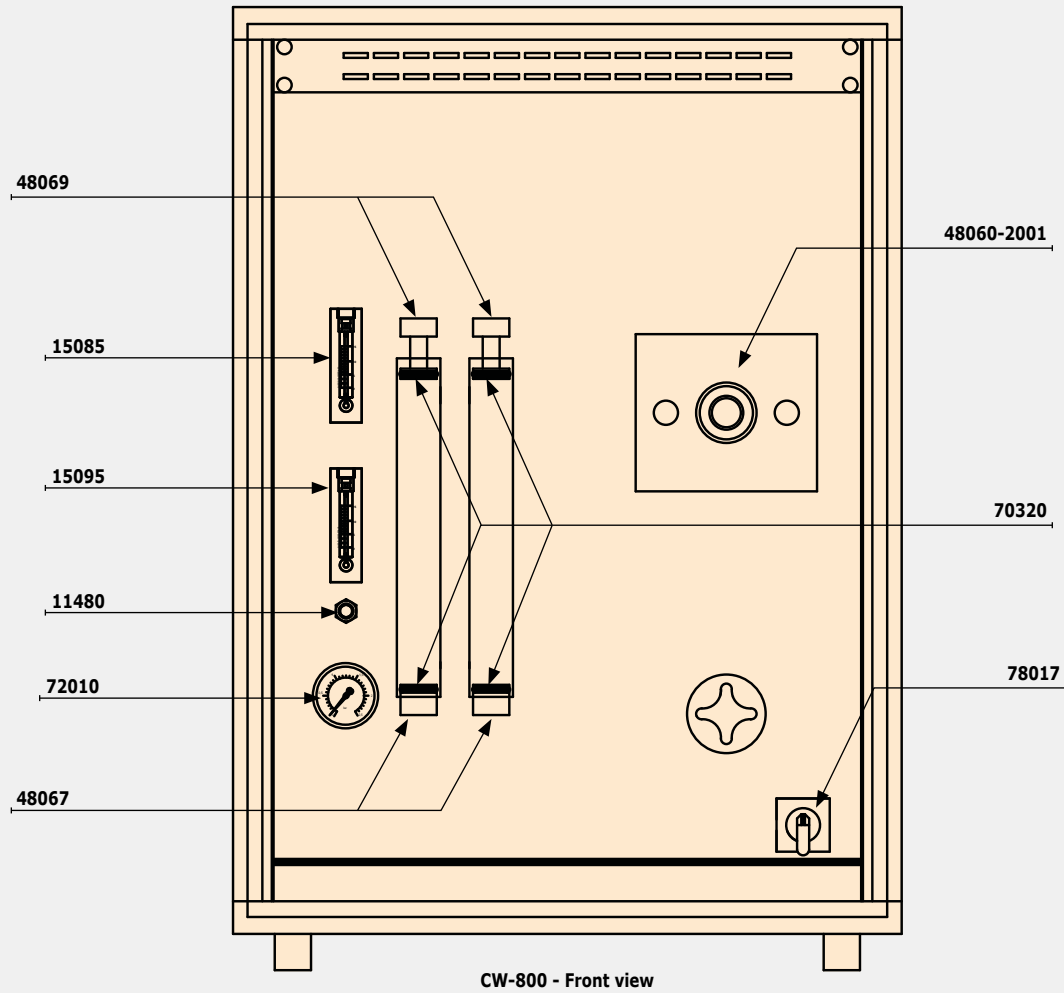
11480	DC	Adjustable restrictor
15085	DC	Flow meter 130l/h
15095	DC	Flow meter 600l/h
48060-2001	DC	CW Slide mechanism
48067	DC	Lower reagent tube connector
48069	DC	Upper reagent tube connector
48750	DC	Combustion tube
70320	DC	O-ring
72010	DC	Pressure gauge 2.5 bar
78017	DC	Mains power switch

Filter Unit

48105	DC	Filter support
48750	DC	Combustion tube
70300	DC	O-ring
70370	DC	O-ring
70390	DC	O-ring
77510	DC	Heater
82130	DC	Filter element (pressed micro fibre)

Other

11170	DC	Balston filter
48758	DC	Ceramic plate
48765	DC	Ceramic spacer
48767	DC	Thermo couple
88400-0283	DC	Gas pump



CW-800M



Order data

Item Number	Price (€)	Description
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Please note: Every analyzer requires PC, monitor, balance and some consumables (crucibles, chemicals) which have to be ordered separately)

ELTRA CW-800M

¹⁰⁾

Measuring ranges at 200 mg sample weight (further measuring range combinations on request)

Item Number	Country	Description
88100-4042	DE	CW-800M H ₂ O 0–20% H ₂ O
88100-4041	DE	CW-800M 1x CO ₂ 0–70% CO ₂ + H ₂ O 0–20% H ₂ O
88100-4055	DE	CW-800M 1x CO ₂ 0–1% CO ₂ + 1x CO ₂ 1–70% CO ₂

Required accessories

PC, monitor, balance

Item Number	Country	Description
71015	DE	Computer with Intel Core i5-8400 Processor, 500 GB HDD; 8 GB RAM; Windows 10 operating system; keyboard; mouse
71016	DE	Monitor, TFT (21.5 inch)
88600-0002	DE	Balance (resolution 0.0001 g)
71002	DE	Printer (Inkjet, colour)

Required consumables / chemicals for first operations

Item Number	Country	Description
88500-0014	DC	Starter-kit for 1000 analyses (1000 disposable porcelain boats, 3 quartz boats, 50 g glass wool, 50 g quartz wool)
¹¹⁾ 90200	DC	Anhydron (magnesium perchlorate), 454 g
¹¹⁾ 90210	DC	Sodium hydroxide, 500 g
¹¹⁾ 90289	DC	Copper II oxide, 100 g

Further options and consumables

Accessories (Hardware)

Item Number	Country	Description
38001	DE	TIC-Module
72070	DE	Oxygen regulator
72080	DE	Nitrogen regulator

i Please note:

¹⁰ Measuring ranges may vary depending on sample weight and sample material

¹¹ Hazardous material

¹² Further calibration standards and compositions on chapter consumables. Detailed information about compositions at www.eltra.com/consumables

¹³ As long as not stated differently, the listed part number means one piece

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Order data

Item Number	Price (€)	Description
Chemicals (fillings for glass and quartz tubes)		
11) 90200	DC	Anhydrone (magnesium perchlorate), 454 g
11) 90210	DC	Sodium hydroxide, 500 g
11) 90289	DC	Copper II oxide, 100 g
90331	DC	Glass wool, 454 g
90332	DC	Glass wool, 50 g
90330	DC	Quartz wool, 50 g
92610	DC	Tube of high vacuum grease, 35 g
90840	DC	Quartz sand, 100 g
Boats		
36120	DC	Quartz boat, 75 x 16 x 7.5 mm, 1 piece
90160	DC	Disposable porcelain boats 86 x 13 x 10 mm, 1000 pieces
88400-0502	DC	Re-usable inconel boat, 54 x 18 x 13.5 mm, 1 piece
88400-0503	DC	Re-usable inconel boat, 54 x 18 x 9 mm, 1 piece
Tools for operation: Spatulas, tweezers, tongs and other		
36216	DC	Combustion boat insertion stick
36217	DC	Combustion boat removing stick, 380 mm
88400-0229	DC	Tweezers (160 mm), curved, 1 piece
88400-0472	DC	Tweezers (145 mm), straight, 1 piece
88400-0475	DC	Set with 6 spatula and 1 tweezers for multiple weighing procedures
90145	DC	Tongs for crucibles, 220 mm
88400-0477	DC	Weighing boat, 1 piece for weighing and usage of granulates
88400-0509	DC	Metal pan, 1 piece for storage of used crucibles, boats
90146	DC	Steel pot for pre-heated crucibles
Tools for maintenance		
88400-0473	DC	Powder funnel (plastics), 1 piece for easy filling of chemical tubes
88400-0490	DC	Rubber plug 29 x 35 x 30 mm, 1 piece for sealing glass tubes like 09090
71010	DC	Brush, 16 mm, 1 piece for cleaning balance from dust

SPECIALS



Re-usable ceramic boats (88600-0011)



Re-usable inconel boat (88400-0503)

CW-800M

Order data

Item Number	Price (€)	Description
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Calibration materials

Calibration materials may show slight variations depending on the current lot.
To see the current certification please visit www.ELTRA.com.

12)

Limestone

90812-3001	DC	Limestone, 25 g; 0.04% S; 12% C
90812-3002	DC	Limestone, 25 g; 0.4% S; 12% C
90812-3003	DC	Limestone, 25 g; C < 5%
90812-3004	DC	Limestone, 25 g; C = 5-10%

Soil

90817-3001	DC	Soil, 25 g, C, S > 2%
90817-3002	DC	Soil, 25 g, C, S < 1%
90817-3003	DC	Soil, 25 g, C, S < 2%

primary substances for calibration

90810	DC	Calcium carbonate, 100 g
90700-1040	DC	Calcium oxalate, 50 g

Spare and wear parts

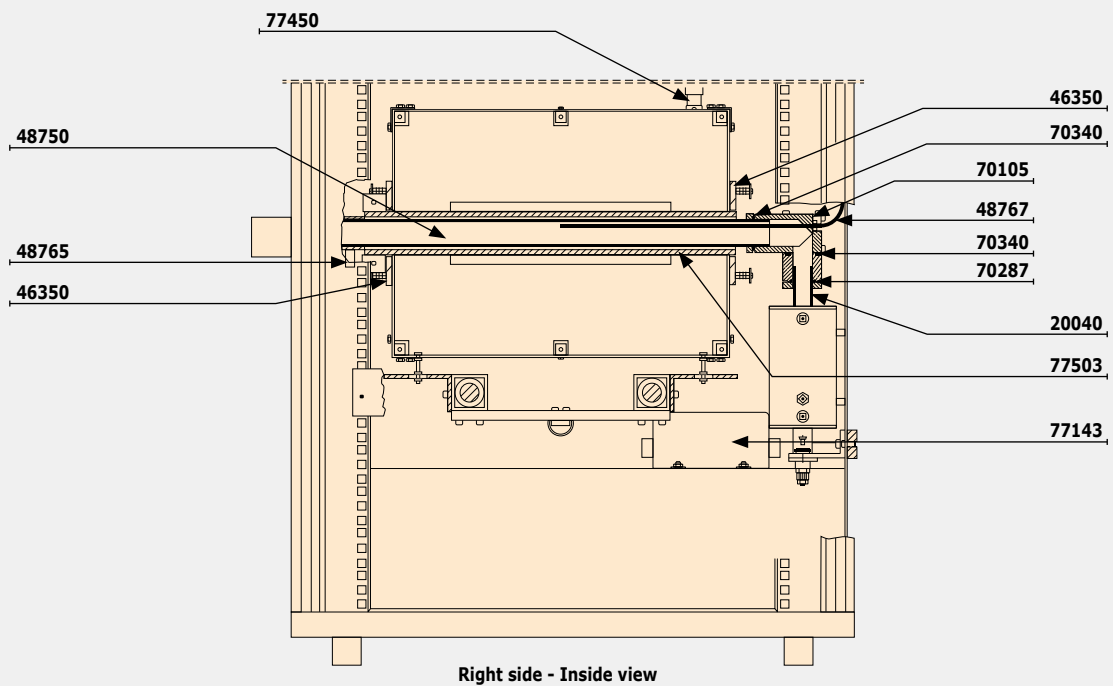
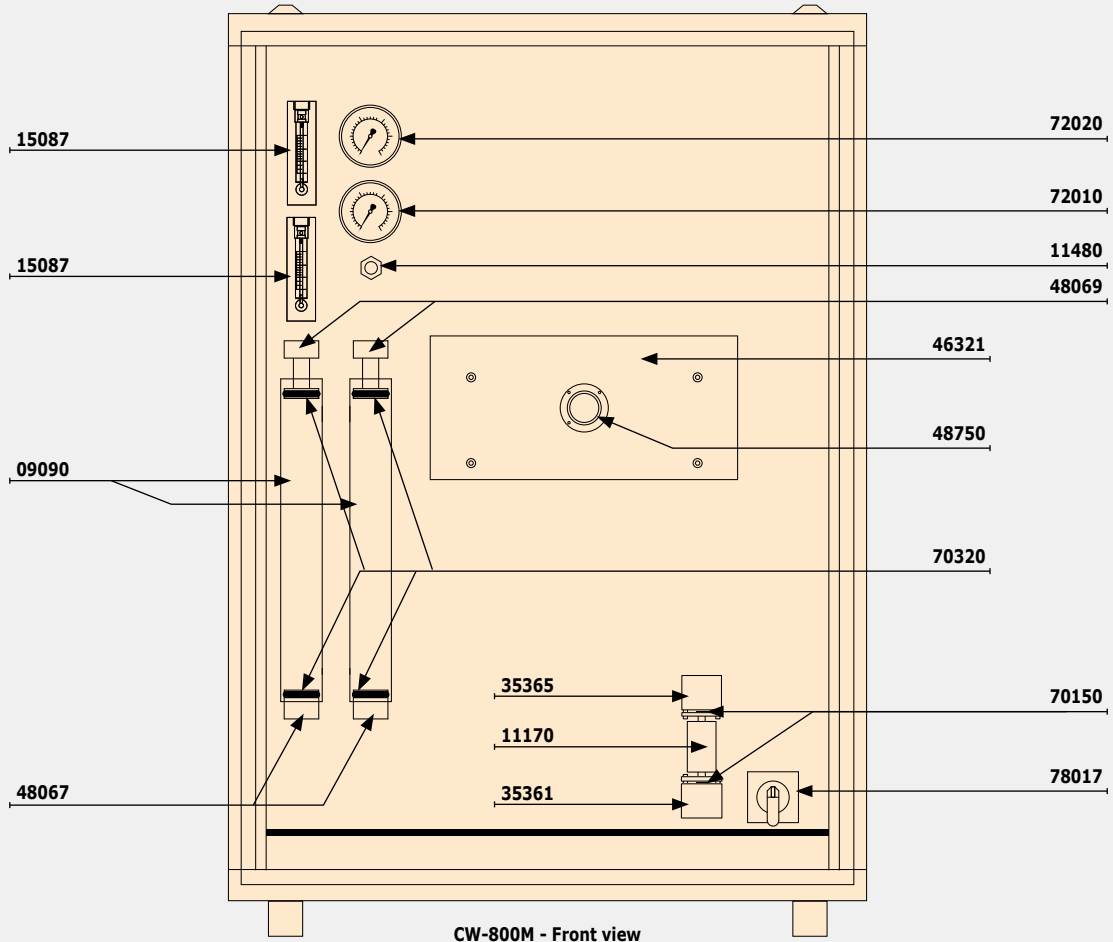
13)

Front side

09090	DC	Reagent tube
11170	DC	Dust cartridge
11480	DC	Adjustable restrictor
15087	DC	Flow meter 300l/h
35361	DC	Lower holder filter element
35365	DC	Upper holder filter element (heated)
48067	DC	Lower reagent tube connector
48069	DC	Upper reagent tube connector
48750	DC	Combustion tube
70150	DC	O-ring 6x2.5 mm
70320	DC	O-ring
72010	DC	Pressure gauge 2.5 bar
72020	DC	Pressure gauge 10 bar
78017	DC	Mains power switch

Furnace

20040	DC	Quartz reagent tube
46350	DC	Furnace sealing
48750	DC	Combustion tube
48765	DC	Ceramic distance ring (2 required)
48767	DC	Thermocouple N type
70105	DC	O-ring
70287	DC	O-ring
70340	DC	O-ring
77143	DC	Line filter
77450	DC	Thermo switch
77503	DC	Heating element CW



SURFACE C-800



Order data

Item Number	Price (€)	Description
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Please note: Every analyzer requires PC, monitor, balance and some consumables (crucibles, chemicals) which have to be ordered separately

ELTRA SurfaceC-800

¹⁰⁾

Measuring ranges for a nominal 50 cm² area (further measuring range combinations on request)

Item Number	Country	Description	Measuring Range
88100-4031	DE	SurfaceC-800 1xC	0.1 – 100 µg/cm ²
88100-4032	DE	SurfaceC-800 2xC	0.1 – 100 µg/cm ² 1 – 1000 µg/cm ²
88100-4045	DE	SurfaceC-800 1xC	10 – 1,000 µg/cm ²

Required accessories

PC, monitor, balance

Item Number	Country	Description
71015	DE	Computer with Intel Core i5-8400 Processor, 500 GB HDD; 8 GB RAM; Windows 10 operating system; keyboard; mouse
71016	DE	Monitor, TFT (21.5 inch)
88600-0002	DE	Balance (resolution 0.0001 g)
71002	DE	Printer (Inkjet, colour)

Required consumables / chemicals for first operations

Item Number	Country	Description
88500-0011	DC	Starter-kit (3 quartz boats, 50 g glass wool and quartz wool)
¹¹⁾ 90200	DC	Anhydron (magnesium perchlorate), 454 g
¹¹⁾ 90210	DC	Sodium hydroxide, 500 g
¹¹⁾ 90289	DC	Copper II oxide, 100 g

Further options and consumables

Accessories (Hardware)

Item Number	Country	Description
72070	DE	Oxygen regulator

i Please note:

- ¹⁰⁾ Measuring ranges may vary depending on sample weight and sample material
¹¹⁾ Hazardous material
¹²⁾ Further calibration standards and compositions on chapter consumables. Detailed information about compositions at www.eltra.com/consumables
¹³⁾ As long as not stated differently, the listed part number means one piece

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Order data

Item Number	Price (€)	Description
Chemicals (fillings for glass and quartz tubes)		
11) 90200	DC	Anhydrone (magnesium perchlorate), 454 g
11) 90210	DC	Sodium hydroxide, 500 g
11) 90289	DC	Copper II oxide, 100 g
90331	DC	Glass wool, 454 g
90332	DC	Glass wool, 50 g
90330	DC	Quartz wool, 50 g
92610	DC	Tube of high vacuum grease, 35 g
Boats		
36120	DC	Quartz boat, 75 x 16 x 7.5 mm, 1 piece
88400-0502	DC	Re-usable inconel boat, 54 x 18 x 13.5 mm, 1 piece
88400-0503	DC	Re-usable inconel boat, 54 x 18 x 9 mm, 1 piece
46160	DC	Combustion boat SurfaceC-800
Tools for operation: Spatulas, tweezers, tongs and other		
36216	DC	Combustion boat insertion stick
36217	DC	Combustion boat removing stick, 380 mm
36218	DC	Combustion boat removing stick, 600 mm
88400-0229	DC	Tweezers (160 mm), curved, 1 piece
88400-0472	DC	Tweezers (145 mm), straight, 1 piece
88400-0475	DC	Set with 6 spatula and 1 tweezers for multiple weighing procedures
90145	DC	Tongs for crucibles, 220 mm
88400-0477	DC	Weighing boat, 1 piece for weighing and usage of granulates
88400-0509	DC	Metal pan, 1 piece for storage of used crucibles, boats
46245	DC	Storage of used quartz boats
Tools for maintenance		
88400-0473	DC	Powder funnel (plastics), 1 piece for easy filling of chemical tubes
88400-0490	DC	Rubber plug 14 x 20 x 24 mm for sealing small glass tubes like 70230
71010	DC	Brush, 16 mm, 1 piece for cleaning balance from dust

SPECIALS



Metal pan (88400-0509)



Set with 6 spatula and 1 tweezers (88400-0475)

SURFACE C-800

Order data

Item Number	Price (€)	Description
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Calibration materials

Calibration materials may show slight variations depending on the current lot.
To see the current certification please visit www.ELTRA.com.

12)

Limestone

90812-3003	DC	Limestone, 25 g; C < 5%
90812-3004	DC	Limestone, 25 g; C = 5-10%

Soil

90817-3001	DC	Soil, 25 g, C, S > 2%
90817-3002	DC	Soil, 25 g, C, S < 1%
90817-3003	DC	Soil, 25 g, C, S < 2%

Spare and wear parts

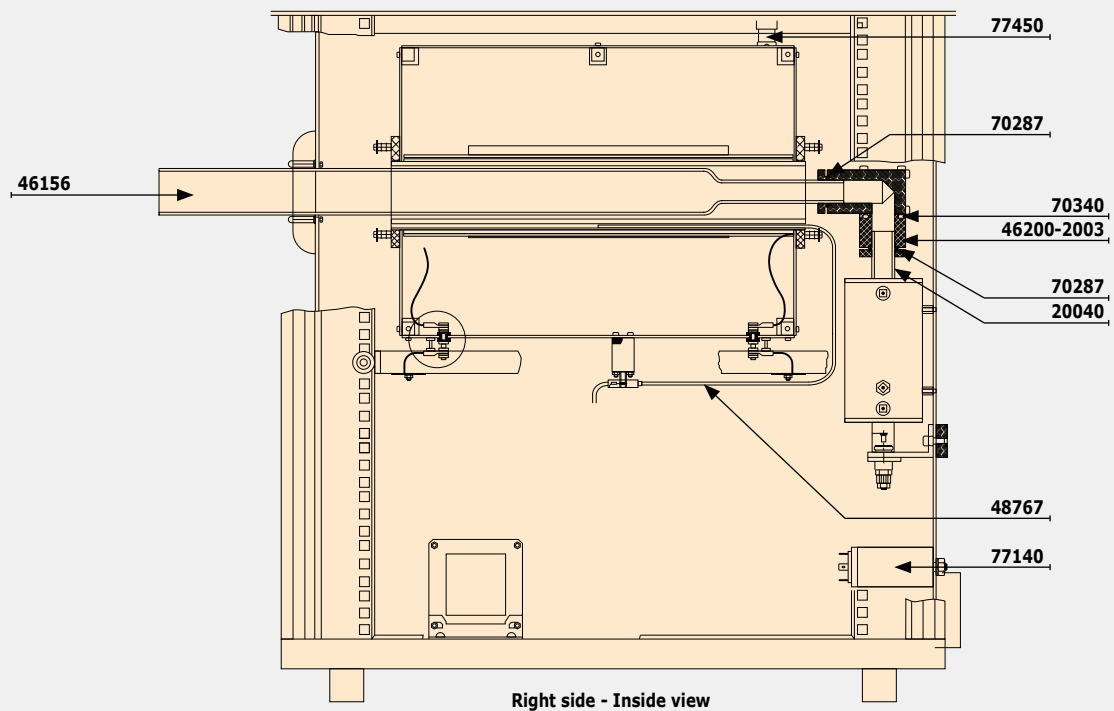
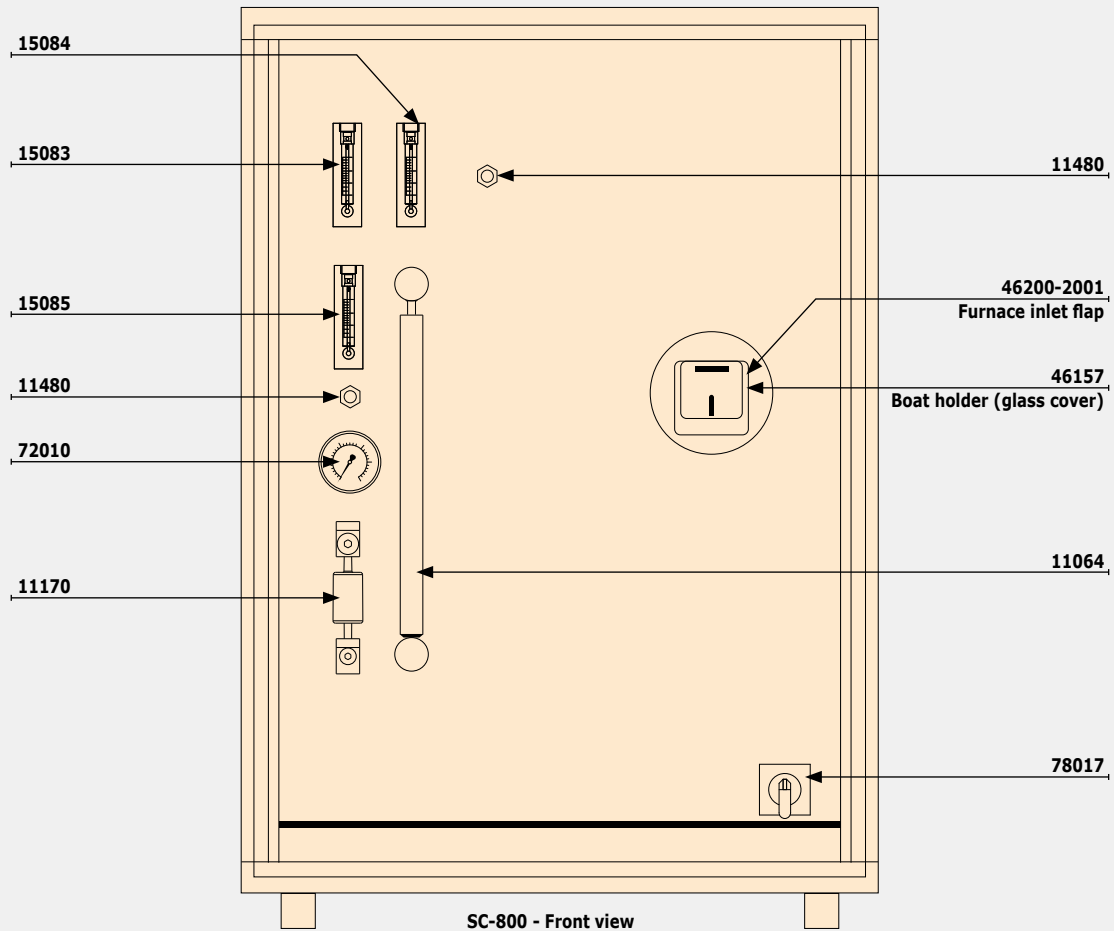
13)

Front side

11035	DC	Device fan
11064	DC	Reagent tube (2 pieces)
11170	DC	Balston tube
11480	DC	Adjustable restrictor
15083	DC	Flow meter 15 l/h
15084	DC	Flow meter 60 l/h
15085	DC	Flow meter 120 l/h
46157	DC	Boat holder (glass cover)
72010	DC	Pressure gauge
78017	DC	Main power switch

Furnace

20040	DC	Quartz reagent tube
46156	DC	Combustion tube
46209	DC	Furnace
46200-2003	DC	Angle combustion tube SC 800
48767	DC	Thermocouple
70287	DC	O-ring 19 x 5 mm
70340	DC	O-ring 27 x 5 mm
77140	DC	HF filter
77450	DC	Temperature switch



TGA THERMOSTEP

TGA Thermostep

The ELTRA TGA Thermostep is a up to 1000°C heatable furnace with integrated balance for precise and simultaneous determination of the moisture, ash and volatile content in up to 19 samples.

- ▶ Sample weight up to 5 g
- ▶ Fast heating range, accurate temperature control
- ▶ Automatic placing and lifting of crucible covers

More information available at www.ELTRA.com



General information / Analysis principle

Some applications (coal, coke, food,...) require the determination of the moisture, ash and sometimes the volatile content. The ELTRA TGA Thermostep consists of a heatable furnace with integrated balance which can apply different temperatures up to 1000°C and different atmospheres (oxygen, nitrogen, none) to up to 19 samples according to a user defined program.

Example: determination of moisture, ash, volatile in coal & coke with ELTRA TGA Thermostep according to ASTM D 7582:

Step No.	Determination of	Used temperature, atmosphere	Lid placed on crucible
1	Moisture	107°C, nitrogen	No
2	Volatile	950°C, nitrogen	Yes
3	-	Cooling down to 750°C	Yes
4	Ash	750°C, oxygen	No

A typical TGA Thermostep analysis encompasses the following steps:

1. Choose the defined application from the PC
2. Log in up to 19 samples
3. Fill in up to 5 gram into the ceramic crucibles
4. Start analysis

During analysis the crucible-filled carousel rotates and places a ceramic crucible onto a pedestal which is connected to the internal

balance. After the weighing step, the carousel rotates to the next position. A measuring cycle (e.g. moisture in coal; see step 1 in above table) is either finished when the defined maximum time has passed or when two consecutive weight measurements lie within a defined deviation factor. Beside this "sample carousel", ELTRA's TGA Thermostep may be equipped with a second "lid carousel" which places ceramic lids on the crucibles during measurement. This prevents sample loss due to intensive reactions and assures a consistent atmosphere inside the crucibles.



Weighing the sample



Option: Crucible lids



Display of analysis results

Measuring range/stability

The internal balance has a resolution of 0.1 mg and a stability of 0.02%. The stability of multiple sample measurements (e.g. moisture 10% ± 0.1%) depends on many things like sample weight, homogeneity, chemical reactions during the heating process and many others. The applied sample weight is usually limited due to the volume of the ceramic crucible. Typical sample weights are 1 g for coal/coke and 2 g for flour.

Descriptions and recommendation for major accessories

For the ELTRA TGA Thermostep the following accessories are available:

Part number	Name and description	Useful for
72080	Nitrogen regulator Reduces the pressure of a nitrogen bottle	Laboratories without centralized gas supply
72070	Oxygen regulator Reduces the pressure of an oxygen bottle	Laboratories without centralized gas supply
26085	External weighing station Allows the preparation of a second sample carousel during cooling down of the TGA. No balance for taking weight is provided.	Laboratories which would like to increase the number of analysis cycles/day
26102	External weighing station with balance Allows the preparation of a second sample carousel during cooling down of the TGA.	Laboratories which would like to increase the number of analysis cycles/day

Delivery content, required accessories and consumables which has to be ordered separately

The ELTRA TGA Thermostep is equipped with the necessary tools for operation like tweezers, spatula, 20 crucibles and lids.

It is recommended to stock additional crucibles and lids.

To run the ELTRA TGA Thermostep it is necessary to purchase also a monitor and PC These accessories have to be ordered separately.

Part number	Description
71015	PC
71016	TFT
Optional: 71002	Printer
26063	Ceramic TGA crucible
26053	Ceramic TGA crucible lid

Recommended consumables for selected applications

The following tables summarizes the typically used consumables for some applications:

Application	Required consumables
Ash, volatile, moisture in coal and coke	26063: Crucibles 26053: Lids Testing material 90700-1040 Calcium oxalate Calibration material for perfect volatile results: 92550-3020/3040/3060 Premium coal standard 92560-3010 Premium coke standard
Loss on ignition in building materials	26063: Crucibles Testing material 90700-1040 Calcium oxalate
Moisture and ash in food	26063: Crucibles 90840: Quartz sand Testing material 90700-1040 Calcium oxalate

TGA THERMOSTEP



Order data

Item Number	Price (€)	Description
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Please note: Please note: The TGA Thermostep requires PC, monitor which have to be ordered separately

ELTRA TGA Thermostep

88100-3001	DE	TGA Thermostep with 2 carousels, 20 ceramic crucibles and 20 lids
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Required accessories

PC, monitor, balance

71015	DE	Computer with Intel Core i5-8400 Processor, 500 GB HDD; 8 GB RAM; Windows 10 operating system; keyboard; mouse
71016	DE	Monitor, TFT (21.5 inch)
71002	DE	Printer (Inkjet, colour)

Further options and consumables

Accessories (Hardware)

72070	DE	Oxygen regulator
72080	DE	Nitrogen regulator
26085	DE	External weighing station
26102	DE	External weighing station with balance
26794	DE	Crucible carousel (ceramic)

Crucibles , lids

26063	DC	Ceramic crucibles
26053	DC	Ceramic lid

Tools for operation: Spatulas, tweezers, tongs and other

23111	DC	Spatula
88400-0229	DC	Tweezers (160 mm), curved, 1 piece
88400-0472	DC	Tweezers (145 mm), straight, 1 piece
88400-0475	DC	Set with 6 spatula and 1 tweezers for multiple weighing procedures
90145	DC	Tongs for crucibles, 220 mm
88400-0477	DC	Weighing boat, 1 piece for weighing and usage of granulates
88400-0509	DC	Metal pan, 1 piece for storage of used crucibles, boats

Order data

Item Number	Price (€)	Description
Tools for maintenance		
71010	DC	Brush, 16 mm, 1 piece for cleaning balance from dust

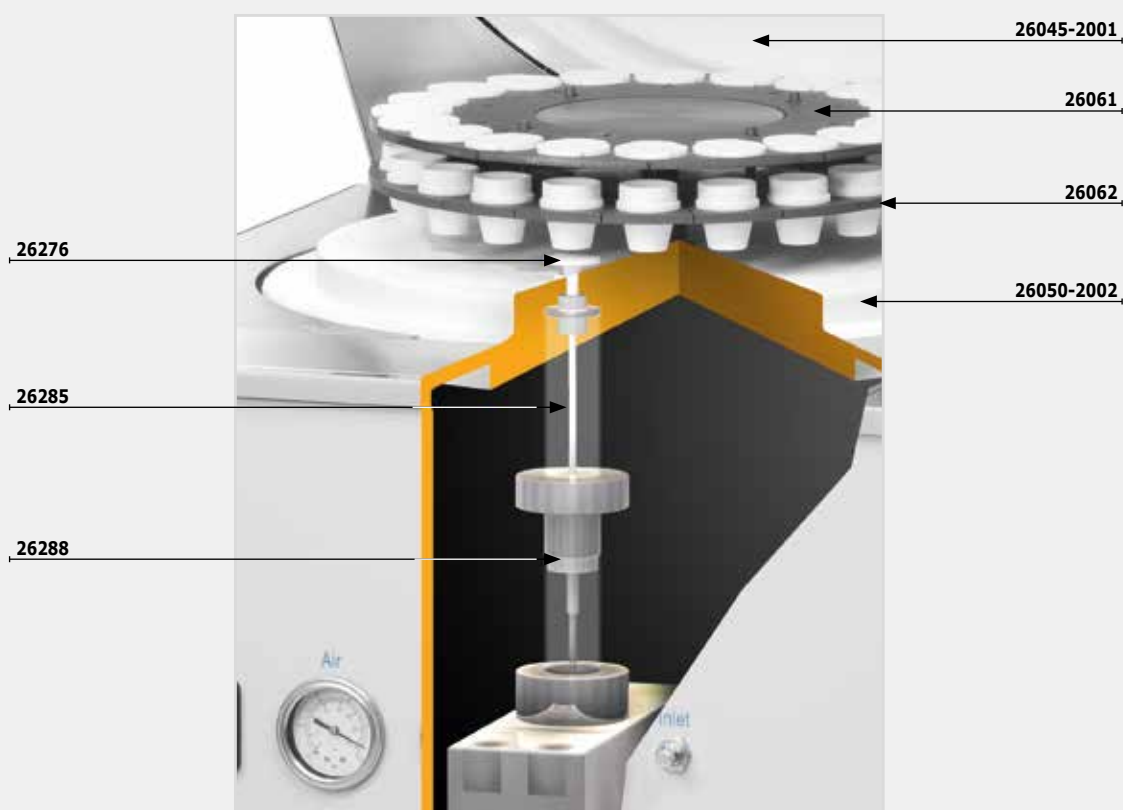
Calibration materials

Calibration materials may show slight variations depending on the current lot.
To see the current certification please visit www.ELTRA.com.

Calcium oxalate		
90700-1040	DC	Calcium oxalate, 50 g
Coal, premium: certified C;H;N;S ; ash,volatile content		
92550-3020	DC	Coal, premium, 50 g; < 1.0% S
92550-3040	DC	Coal, premium, 50 g; 1.0-3.0 % S
92550-3060	DC	Coal, premium, 50 g; > 3.0% S
Coke, premium: certified C;H;N;S ; ash,volatile content		
92560-3010	DC	Coke, premium, 50 g

Spare and wear parts

26045-2001	DC	Upper heating element
26061	DC	Carousel for lids
26062	DC	Crucible carousel
26276	DC	Crucible tray
26285	DC	Balance pedestal
26288	DC	Wind shield for balance
26050-2002	DC	Lower heating element



TIC MODULE



Order data

Item Number	Price (€)	Description
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Please note:

The TIC module is not a stand alone unit. It can be used in conjunction with a CS-2000, C(H)S-580, C(H)S-580A, CW-800, CW-800M. The TIC module requires diluted acids which are not provided by ELTRA.

ELTRA TIC Module

38001	DE	TIC Module
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Required accessories

Balance

88600-0002	DE	Balance (resolution 0.0001 g)
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Further options and consumables

Tools for operation: Spatulas, tweezers, tongs and other

90900	DC	Erlenmeyer flask, 50 ml
23111	DC	Spatula
88400-0475	DC	Set with 6 spatula and 1 tweezers for multiple weighing procedures
90145	DC	Tongs for crucibles, 220 mm
88400-0477	DC	Weighing boat, 1 piece for weighing and usage of granulates
88400-0509	DC	Metal pan, 1 piece for storage of used crucibles, boats
88400-0473	DC	Powder funnel

Tools for maintenance

71010	DC	Brush, 16 mm, 1 piece for cleaning balance from dust
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Calibration materials

Calibration materials may show slight variations depending on the current lot. To see the current certification please visit www.ELTRA.com.

12)

Calcium carbonate

90810	DC	Calcium carbonate, 100 g
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i Please note:

10 Measuring ranges may vary depending on sample weight and sample material

11 Hazardous material

12 Further calibration standards and compositions on chapter consumables. Detailed information about compositions at www.eltra.com/consumables

13 As long as not stated differently, the listed part number means one piece

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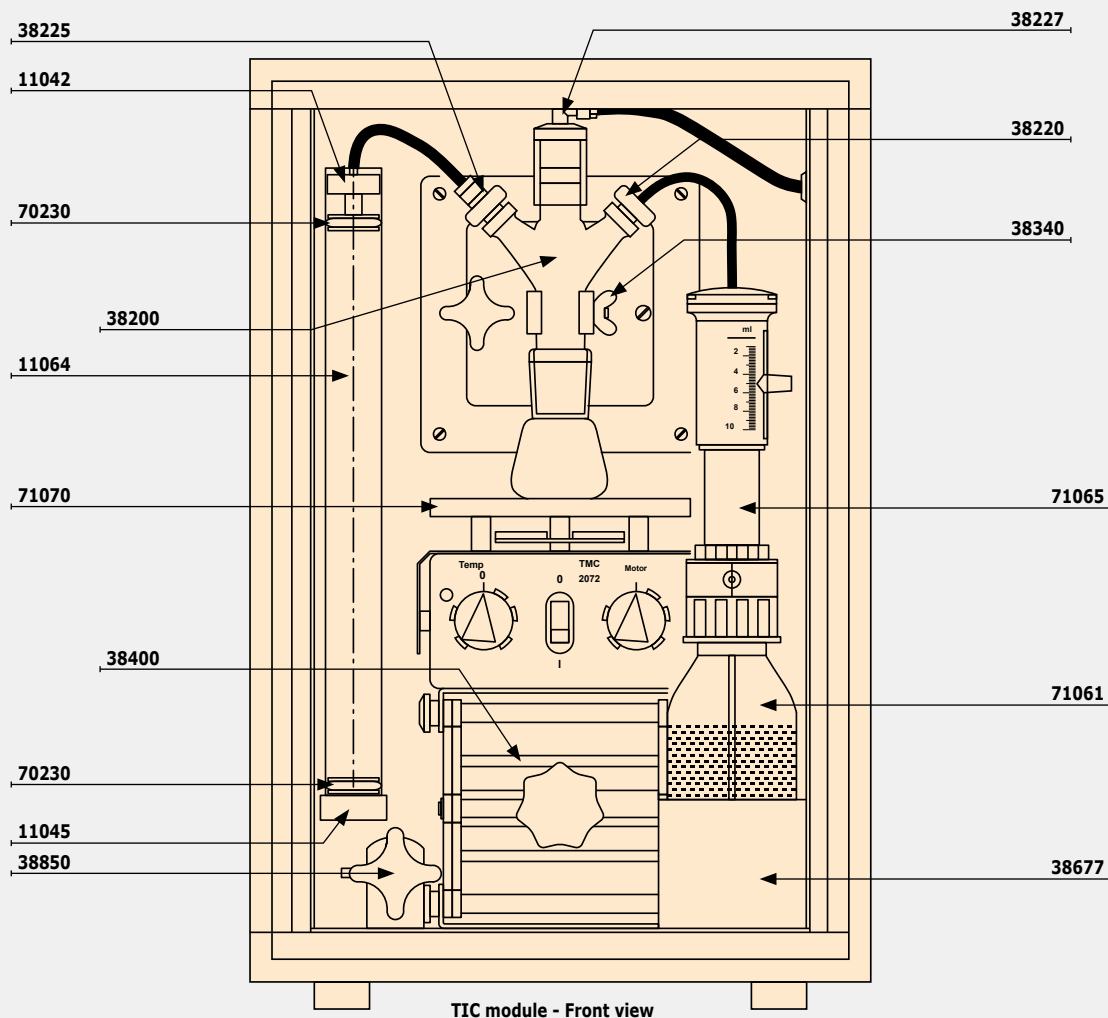
Order data

Item Number	Price (€)	Description
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Spare and wear parts

13)

11042	DC	Upper moisture trap connector
11045	DC	Lower moisture trap connector
11064	DC	Reagent tube, 2 pieces
38200	DC	Glass distributor
38220	DC	Glass stopper (connection to acid supply)
38225	DC	Glass stopper
38227	DC	Glass stopper (connection to furnace)
38340	DC	Glass support
38400	DC	Support with variable height
38677	DC	Bottle support
38850	DC	Geared mechanism
70230	DC	O-ring 9 x 3 mm
71061	DC	Acid bottle
71065	DC	Dispenser
71070	DC	Heater with magnetic stirrer



SPECIALS

ELTRA

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www.eltra.org

Cooling agent
Kühlwasserzusatz

90870

Gesundheits-
schädlich
Harmful

 Nocif
Schadelijk

500 ml.

Ethandiol



ELTRA consumables

Tongs, spatula, chemicals,
CRM's, crucibles,

General chemicals, tools	90
Consumables for C(H)S analysis	93
Consumables for ONH analysis	94
Calibration material C(H)S	95
Calibration material ONH	97
General terms & conditions of business and delivery	98

Eltra consumables

ELTRA offers a wide range of consumables for their analyzers. Most of which can also be used for the elemental analyzers from other manufacturers. In case you cannot find what you are looking for please contact ELTRA directly and maybe we can implement it in our delivery content.

- ▶ Best quality
- ▶ Fast delivery
- ▶ Wide range of consumables

More information available at www.eltra.com



Order data

Item Number	Price (€)	Description
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General chemicals, wools and fillings

Key

- = Default
- = Option available
- ⁺ = Option available at extra charge
- = Not available

Models

ONH-p / ONH-2000	ON-p / ON-900	OH-p / OH-900	H-500	CS-i / CS-800	CS-2000	C(H)S-580	C(H)S-580A	CW-800	CW-800M	SurfaceC-800	TIC Modul	TGA Thermostep
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General chemicals, wools and fillings

				ONH-p / ONH-2000	ON-p / ON-900	OH-p / OH-900	H-500	CS-i / CS-800	CS-2000	C(H)S-580	C(H)S-580A	CW-800	CW-800M	SurfaceC-800	TIC Modul	TGA Thermostep
11)	90200	DC	Anhydrone (magnesium perchlorate), 454 g	○	○	○	○	○	○	○	○	○	○	○	○	-
11)	90210	DC	Sodium hydroxide, 500 g	○	○	○	○	○	○	○	○	○	○	○	○	-
11)	90270	DC	Schuetze reagent, 100 g	○	-	○	○	-	-	-	-	-	-	-	-	-
11)	90289	DC	Copper II oxide, 100 g	○	○	-	-	-	-	-	-	-	-	-	-	-
	88400-0535	DC	Pt/Si catalyst, 15 g	-	-	-	-	○	○	-	-	-	-	-	-	-
	90331	DC	Glass wool, 454 g	○	○	○	○	○	○	○	○	○	○	○	○	-
	90332	DC	Glass wool, 50 g	○	○	○	○	○	○	○	○	○	○	○	○	-
	90340	DC	Cellulose, 100 g	-	-	-	-	○	○	-	-	-	-	-	-	-
	90341	DC	Cellulose, 50 g	-	-	-	-	○	○	-	-	-	-	-	-	-
	90330	DC	Quartz wool, 50 g	○	○	-	-	○	○	-	-	-	○	○	-	-
	92610	DC	Tube of high vacuum grease	○	○	○	○	○	○	○	○	○	○	○	-	-
11)	88400-0122	DC	Filling for carrier gas purification furnace (optional for CS analyzers)	-	-	-	-	○	○	-	-	-	-	-	-	-
11)	90426-1001	DC	Filling for carrier gas purification furnace (optional for ONH analyzers)	○	○	○	-	-	-	-	-	-	-	-	-	-
14)	91000-1005	DC	Copper, flakes, 25 g	-	-	-	-	-	-	○	○	-	-	-	-	-
14)	88400-0508	DC	Steel wool, 454 g	-	-	-	-	-	-	○	○	-	-	-	-	-
15)	90234	DC	Filling for halogen trap, potassium iodide	○	○	○	-	○	○	-	-	-	-	-	-	-
15)	90235	DC	Filling for halogen trap, antimony	○	○	○	-	○	○	-	-	-	-	-	-	-
	90870	DC	Cooling agent, 0.5 l	○	○	○	-	-	-	-	-	-	-	-	-	-

Please note:

- 11 Hazardous material
- 14 Required for TOC analysis
- 15 Required for analysis of halogen containing samples

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Order data

Item Number	Price (€)	Description																			
Accelerators for the induction furnace																					
90220	DC	Tungsten, premium, 2500 g	-	-	-	-	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-
90260	DC	Iron accelerator, premium, 908 g	-	-	-	-	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-
88600-0013	DC	Iron accelerator, high purity, 454 g	-	-	-	-	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-
88600-0010	DC	Tungsten-tin accelerator, 750 g	-	-	-	-	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-
90280	DC	Tin accelerator, 908 g	-	-	-	-	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-
90240	DC	Copper accelerator, 1392 g	-	-	-	-	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-
Combustion support for the resistance furnace																					
90840	DC	Quartz sand, 100 g	-	-	-	-	-	-	0	0	-	-	-	-	-	-	-	-	-	-	-
88600-0008	DC	Combsolid, 100 g	-	-	-	-	-	-	0	0	-	-	-	-	-	-	-	-	-	-	-
General tools and accessories																					
23110	DC	Spatula, 1 piece M size	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23111	DC	Spatula, 1 piece L size	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23113	DC	Spoon, 1 piece for dosing sample and accelerator in CS series	-	-	-	-	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-
90145	DC	Tongs for ceramic crucibles and boats, 220 mm 1 piece for CS series	-	-	-	0	0	0	0	0	0	0	0	-	0	0	0	-	0	0	0
88400-0213	DC	Tongs for graphite crucibles, 1 piece for ONH series	0	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
88400-0229	DC	Tweezers (160 mm), curved, 1 piece	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	-	0	0	0
88400-0472	DC	Tweezers (145 mm), straight, 1 piece	0	0	0	0	0	0	0	0	0	0	0	-	0	0	0	-	0	0	0
88400-0475	DC	Set with 6 spatula and 1 tweezers for multiple weighing procedures	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
88400-0476	DC	Micro spatula, 1 piece XS size for filling small capsules	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0



Crucible holder (88600-0015)



Tungsten (90220)



Copper accelerator (90240)



Tin accelerator (90280)



Tongs for ceramic crucibles and boats (90145)



Spoon for dosing sample and accelerator (23113)

CONSUMABLES

Order data

Item Number	Price (€)	Description																			
Tools for storage, transporting and weighing																					
36121	DC	Quartz boat, 1 piece, 74 x 22 x 10 mm, 1 piece	for weighing pins	0	0	0	0	0	0	-	-	-	-	0	-	-					
71010	DC	Brush, 16 mm, 1 piece	for cleaning balance from dust	0	0	0	0	0	0	0	0	0	0	0	0	0					
88400-0477	DC	Weighing boat, 1 piece	for weighing and usage of granulates	0	0	0	0	0	0	0	0	0	0	0	0	0					
88400-0509	DC	Metal pan, 1 piece	for storage of used crucibles, boats	0	0	0	0	0	0	0	0	0	0	0	0	0					
88400-0517	DC	Transfer pipettes for applying liquids, 3 ml, 500 pieces		-	-	-	-	-	0	0	0	-	-	-	-	-					
88600-0015	DC	Crucible tablet		-	-	-	-	0	0	-	0	-	-	-	-	-					
90146	DC	Steel pot for preheated crucibles and used crucibles		0	0	0	0	0	0	0	0	0	0	0	-	0					
90179	DC	Vacuum pipettes 150 x 3.5 mm ID for sampling molten steel; 1000 pieces		0	0	0	0	0	0	-	-	-	-	-	-	-					
46245	DC	Storage of used quartz boats; SC-800, CW-800 series		-	-	-	-	-	0	0	-	0	0	0	-	-					
Tools for maintenance																					
88400-0473	DC	Powder funnel (plastics), 1 piece	for easy filling of chemical tubes	0	0	0	0	0	0	0	0	0	0	0	0	-					
88400-0489	DC	Rubber plug 14 x 20 x 24 mm, 1 piece	for sealing small glass tubes like 70230	0	0	0	0	0	0	-	-	-	-	0	-	-					
88400-0490	DC	Rubber plug 29 x 35 x 30mm	for sealing big glass tubes like 09090	-	-	-	-	-	0	0	0	0	0	-	0	-					
71010	DC	Brush, 16 mm, 1 piece	for cleaning balance from dust	0	0	0	0	0	0	0	0	0	0	0	0	-					
88400-0332	DC	Threaded rod M4 x 150, 1 piece	for removing paper filter holder	-	-	-	-	0	0	-	-	-	-	-	-	-					
88400-0500	DC	Telescope mirror, 1 piece	for inspection of upper electrode of ONH-p/ONH-2000	0	0	0	-	-	-	-	-	-	-	-	-	-					
71032	DC	Composite brush, 1 piece	for cleaning upper electrode of ONH-p furnace	0	0	0	-	-	-	-	-	-	-	-	-	-					
71035	DC	Cleaning brush / furnace brush, 1 piece	for cleaning sample inlet of ONH furnaces	0	0	0	-	-	-	-	-	-	-	-	-	-					
71031	DC	Metal brush, 1 piece	for cleaning graphite tip and its holder	0	0	0	-	0	0	-	-	-	-	-	-	-					
88400-0504	DC	Cylinder brush, brass furnace	for intensive cleaning of lower furnace	0	0	0	-	-	-	-	-	-	-	-	-	-					
88400-0501	DC	Micro brush, 1 piece	for cleaning of ONH series furnace outlet tube	0	0	0	-	-	-	-	-	-	-	-	-	-					



Brush, 16 mm (71010)



Metal brush (71031)



Telescope mirror (88400-0500)

i Please note:

- 1 Hazardous material
- 2 Further calibration standards and compositions on page ??????. Detailed information about compositions at www.eltra.com/consumables
- 3 Measuring ranges may vary depending on sample weight and sample material

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CONSUMABLES

Order data

Item Number	Price (€)	Description
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Consumables for ELTRA CS, CHS and special analyzers

Crucibles and lids for the combustion furnace

90149	DC	Ceramic crucibles, premium, Ø 1", foil-wrapped, 1000 pieces	-	-	-	-	0	0	-	0	-	-	-	-
90148	DC	Ceramic crucibles, premium, Ø 1", bagged, 1000 pieces	-	-	-	-	0	0	-	0	-	-	-	-
88400-0176	DC	Ceramic filtering crucibles, 100 pieces	-	-	-	-	0	0	-	0	-	-	-	-
88400-0142	DC	Ceramic filtering crucibles, small version, 100 pieces	-	-	-	-	0	0	-	0	-	-	-	-
88600-0014	DC	Ceramic lids, 10 mm hole, 250 pieces	-	-	-	-	0	0	-	0	-	-	-	-
88600-0017	DC	Ceramic lids, 4 mm hole, 1000 pieces	-	-	-	-	0	0	-	0	-	-	-	-
26063	DC	Ceramic crucibles for TGA	-	-	-	-	-	-	-	-	-	-	-	0
26053	DC	Ceramic lid for TGA	-	-	-	-	-	-	-	-	-	-	-	0

Boats for the resistance furnace

90153	DC	Re-usable ceramic boats, premium, 58 x 22 x 14 mm, 500 pieces	-	-	-	-	-	0	0	-	-	0	-	-
90160	DC	Disposable porcelain boats, 86 x 13 x 10 mm, 1,000 pieces	-	-	-	-	-	0	0	-	0	0	-	-
88600-0011	DC	Re-usable ceramic boats, 95 x 13 x 10 mm, 500 pieces	-	-	-	-	-	0	0	-	0	0	-	-
88400-0502	DC	Re-usable inconel boat, 54 x 18 x 13.5 mm, 1 piece	-	-	-	-	-	0	0	-	-	0	-	-
88400-0503	DC	Re-usable inconel boat, 54 x 18 x 9 mm, 1 piece	-	-	-	-	-	0	0	-	-	0	-	-
36120	DC	Quartz boat, 75 x 16 x 7.5 mm, 1 piece	-	-	-	-	-	-	-	-	-	0	0	-
36121	DC	Quartz boat, 74 x 22 x 10 mm, 1 piece	-	-	-	-	-	-	-	-	-	0	0	-
46160	DC	Combustion boat SurfaceC-800	-	-	-	-	-	-	-	-	-	-	0	-

Tools

36216	DC	Combustion boat insertion stick, 1 piece	-	-	-	-	-	0	0	-	-	0	-	-
36217	DC	Combustion boat removing stick, 380 mm, 1 piece	-	-	-	-	-	0	0	-	-	0	-	-
36218	DC	Combustion boat removing stick, 600 mm, 1 piece recommended for SurfaceC-800	-	-	-	-	-	-	-	-	0	0	-	-
88400-0499	DC	Safety glasses, 1 piece protection when working with hot furnace	-	-	-	-	-	0	0	-	-	-	-	-
88600-0009	DC	Screen glass with edge guard, 1 piece protection when working with hot furnace	-	-	-	-	-	0	0	-	-	-	-	-

Consumables for ELTRA ONH analyzers



Ceramic lids (88600-0017)



Re-usable inconel boat (88400-0502)



Safety glasses (88400-0499)

Order data

Item Number	Price (€)	Description																	
Capsules, foils and fluxes for ONH analysis																			
90257	DC	Nickel capsules, 3.2 x 7 mm, 100 pieces	0	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
90256	DC	Nickel capsules, 4.5 x 10 mm, 250 pieces	0	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
88400-0066	DC	Nickel capsules, pressed, 12.5 x 5 mm, 100 pieces	0	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
90252	DC	Tin capsules, 5 x 18 mm, 100 pieces	0	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
88400-0474	DC	Foils, cupform (onyl suitable for sls, oxides analysis)	0	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Baskets (required for oxygen and nitrogen determination in refractories)																			
90250	DC	Nickel baskets, 100 pieces, 1 g each	0	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
88600-0012	DC	Nickel baskets, high purity (low oxygen), 100 pieces, 1 g each	0	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fluxes (required for some application)																			
90251	DC	Tin pellets, 454 g (for determination of hydrogen in titanium)	0	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
90800	DC	Graphite, 50 g (improves oxygen determination)	0	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
90258	DC	Nickel accelerator, 100 g (for analysis of high amount of refractories)	0	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Crucibles																			
90190	DC	Graphite crucibles, 400 pieces (for copper, brass and steel analysis)	0	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
90180	DC	Inner graphite crucibles, 100 pieces (requires outer graphite crucible 90185)	0	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
90185	DC	Outer graphite crucibles, 50 pieces	0	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
88400-0491	DC	HT crucibles, 1000 pieces, recommended for refractories (special application settings and 31360-3002 graphite tip required)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Calibration material for induction furnaces



Nickel baskets (90250)



Tin capsules (90252)



Graphite (90800)



Tin pellets (90251)



Nickel capsules (90256)



Tongs for crucibles (88400-0213)

Order data

Item Number	Price (€)	Description																			
Steel and cast iron																					
92400-3020	DC	Steel, 100 g, 0.001-0.01% C	-	-	-	-	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-
92400-3030	DC	Steel, 100 g, 0.01-0.05% C	-	-	-	-	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-
92400-3040	DC	Steel, 100 g, 0.05-0.1% C	-	-	-	-	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-
92400-3050	DC	Steel, 100 g, 0.1-0.2% C	-	-	-	-	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-
92400-3060	DC	Steel, 100 g, 0.2-0.5% C	-	-	-	-	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-
92400-3070	DC	Steel, 100 g, 0.5-1.0% C	-	-	-	-	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-
92400-3090	DC	Cast iron, 100 g, 2.0-3.0% C	-	-	-	-	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-
92400-3100	DC	Cast iron, 100 g, 3.0-5.0% C	-	-	-	-	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-
92400-4010	DC	Steel, 150 g, approx. 0.1% S	-	-	-	-	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-
92400-4020	DC	Steel, 150 g, approx. 0.3% S	-	-	-	-	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-
Steel pins; nominal weight 1 g																					
92500-1001	DC	C/S pins; 454 g; C approx 0.2%	-	-	-	-	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-
92500-1002	DC	C/S pins; 454 g; C approx 0.4%	-	-	-	-	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-
92500-2001	DC	C/S pins; 454 g; S approx 0.2%	-	-	-	-	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-
Copper pins																					
91000-1001	DC	Copper pins, approx. 10 ppm S	-	-	-	-	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-
Tungsten carbide																					
90816-3001	DC	Tungsten carbide; approx. 6.1% C	-	-	-	-	0	0	-	-	-	-	-	-	-	-	-	-	-	-	-
Other calibration material suitable for resistance and induction furnace																					
92811-3020	DC	Cement, 100 g; 2.0-4.0% SO3	-	-	-	-	0	0	0	0	-	-	-	-	-	-	-	-	-	-	-
90812-3001	DC	Limestone, 25 g; 0.04% S; 12% C	-	-	-	-	0	0	0	0	-	-	-	-	-	-	-	-	-	-	-
90812-3002	DC	Limestone, 25 g; 0.4% S; 12% C	-	-	-	-	0	0	0	0	-	-	-	-	-	-	-	-	-	-	-
90812-3003	DC	Limestone, 25 g; C < 5%	-	-	-	-	0	0	0	0	-	0	0	-	-	-	-	-	-	-	-
90812-3004	DC	Limestone, 25 g; C = 5-10%	-	-	-	-	0	0	0	0	-	-	-	-	-	-	-	-	-	-	-
90817-3001	DC	Soil, 25 g, C, S > 2%	-	-	-	-	0	0	0	0	-	-	-	-	-	-	-	-	-	-	-
90817-3002	DC	Soil, 25 g, C, S < 1%	-	-	-	-	0	0	0	0	-	-	0	-	-	-	-	-	-	-	-
90817-3003	DC	Soil, 25 g, C, S < 2%	-	-	-	-	0	0	0	0	-	-	-	-	-	-	-	-	-	-	-
91900-1001	DC	Ore, 30 g; ~1.4% S	-	-	-	-	0	0	0	0	-	-	-	-	-	-	-	-	-	-	-
91900-1002	DC	Ore, 30 g; ~4.2% S	-	-	-	-	0	0	0	0	-	-	-	-	-	-	-	-	-	-	-
90810	DC	Calcium carbonate, 100 g	-	-	-	-	0	0	0	0	0	0	-	0	0	0	-	0	0	0	0
90821	DC	Barium sulphate, 50 g	-	-	-	-	0	0	0	0	-	-	-	-	-	-	-	-	-	-	-

Please note:

- 1 Hazardous material
- 2 Further calibration standards and compositions on page ??????. Detailed information about compositions at www.eltra.com/consumables
- 3 Measuring ranges may vary depending on sample weight and sample material

Order data

Item Number	Price (€)	Description																			
Other calibration material only suitable for resistance furnace																					
90710-3010	DC	EDTA, 50 g	-	-	-	-	-	0	0	0	-	-	-	-	-	-	-	-	-	-	-
90710-3020	DC	Acetanilid, 10 g	-	-	-	-	-	0	0	0	-	-	-	-	-	-	-	-	-	-	-
90824	DC	Sulfanilic acid, 50 g	-	-	-	-	-	0	0	0	-	-	-	-	-	-	-	-	-	-	-
90700-1040	DC	Calciumoxalate	-	-	-	-	-	-	-	-	0	0	-	-	0	-	-	-	0	-	-
91900-2001	DC	Zink sulphide; 50 g; sulfur 32%	-	-	-	-	0	0	0	0	-	-	-	-	-	-	-	-	-	-	-
Coal, only sulfur certified																					
92511-3010	DC	Coal, 50 g, 0.1–0.5% S	-	-	-	-	-	0	0	0	-	-	-	-	-	-	-	-	-	-	-
92511-3020	DC	Coal, 50 g, 0.5–1.0% S	-	-	-	-	-	0	0	0	-	-	-	-	-	-	-	-	-	-	-
92511-3030	DC	Coal, 50 g, 1.0–1.5% S	-	-	-	-	-	0	0	0	-	-	-	-	-	-	-	-	-	-	-
92511-3040	DC	Coal, 50 g, 1.5–2.0% S	-	-	-	-	-	0	0	0	-	-	-	-	-	-	-	-	-	-	-
92511-3050	DC	Coal, 50 g, 2.0–3.0% S	-	-	-	-	-	0	0	0	-	-	-	-	-	-	-	-	-	-	-
92511-3060	DC	Coal, 50 g, 3.0–4.0% S	-	-	-	-	-	0	0	0	-	-	-	-	-	-	-	-	-	-	-
92511-3070	DC	Coal, 50 g, 4.0–5.0% S	-	-	-	-	-	0	0	0	-	-	-	-	-	-	-	-	-	-	-
92511-3080	DC	Coal, 50 g, >5.0% S	-	-	-	-	-	0	0	0	-	-	-	-	-	-	-	-	-	-	-
Coal, premium: certified C;H;N;S ; ash,volatile content																					
92550-3020	DC	Coal, premium, 50 g; < 1.0% S	-	-	-	-	-	0	0	0	-	-	-	-	-	-	-	-	0	-	-
92550-3040	DC	Coal, premium, 50 g; 1.0–3.0% S	-	-	-	-	-	0	0	0	-	-	-	-	-	-	-	-	0	-	-
92550-3060	DC	Coal, premium, 50 g; > 3.0% S	-	-	-	-	-	0	0	0	-	-	-	-	-	-	-	-	0	-	-
Coke, premium: certified C;H;N;S ; ash,volatile content																					
92560-3010	DC	Coke, premium, 50 g	-	-	-	-	-	0	0	0	-	-	-	-	-	-	-	-	0	-	-
Liquid calibration material																					
92530	DC	Oil, 100 ml	-	-	-	-	-	0	0	0	-	-	-	-	-	-	-	-	-	-	-
90860	DC	Glycerine, 100 g	-	-	-	-	-	0	0	0	-	-	-	-	-	-	-	-	-	-	-



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CONSUMABLES

Order data

Item Number	Price (€)	Description
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Calibration materials

Calibration materials may show slight variations depending on the current lot.
To see the current certification please visit www.ELTRA.com.

Oxygen and nitrogen in steel, pins

91100-1001	DC	Steel, 100 pins, 1 g each	25-40 ppm N	O	O	O	-	-	-	-	-	-	-	-	-	-
91100-1002	DC	Steel, 100 pins, 1 g each	30-70 ppm N	O	O	O	-	-	-	-	-	-	-	-	-	-
91100-1003	DC	Steel, 100 pins, 1 g each	150-250 ppm N	O	O	O	-	-	-	-	-	-	-	-	-	-
91100-1004	DC	Steel, 100 pins, 1 g each	50-80 ppm N	O	O	O	-	-	-	-	-	-	-	-	-	-
91100-1005	DC	Steel, 100 pins, 1 g each	300-600 ppm N	O	O	O	-	-	-	-	-	-	-	-	-	-
91100-1006	DC	Steel, 100 pins, 1 g each	80-150 ppm N	O	O	O	-	-	-	-	-	-	-	-	-	-
91100-1007	DC	Steel, 100 pins, 1 g each	70-130 ppm N	O	O	O	-	-	-	-	-	-	-	-	-	-
91100-1010	DC	Steel, 100 pins, 1 g each	> 1000 ppm N	O	O	O	-	-	-	-	-	-	-	-	-	-

Hydrogen in steel, pins

91400-1001	DC	Steel, 100 pins, 1 g each	0.5-1 ppm H	O	-	O	-	-	-	-	-	-	-	-	-	-
91400-1002	DC	Steel, 100 pins, 1 g each	1.5-4 ppm H	O	-	O	-	-	-	-	-	-	-	-	-	-
91400-1003	DC	Steel, 100 pins, 1 g each	>5 ppm H	O	-	O	-	-	-	-	-	-	-	-	-	-

Hydrogen in steel, balls

91110	DC	Steel balls; approx. 1.9 ppm H		-	-	-	O	-	-	-	-	-	-	-	-	-
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Oxygen and sulfur in copper, pins

91000-1001	DC	Copper, 100 pins, 1 g each	~500 ppm O; 10-20 ppm S	O	O	O	-	O	O	-	-	-	-	-	-	-
91000-1002	DC	Copper, 100 pins, 1 g each	~300 ppm O; 10-20 ppm S	O	O	O	-	O	O	-	-	-	-	-	-	-
91000-1004	DC	Copper, 100 pins, 1 g each	~10 ppm O; 10-20 ppm S	O	O	O	-	O	O	-	-	-	-	-	-	-

Oxygen in copper, pins

91000 (LOT 48)	DC	Copper, 100 pins, 1 g each	~180 ppm O	O	O	O	-	-	-	-	-	-	-	-	-	-
91000 (LOT 52)	DC	Copper, 100 pins, 1 g each	~800 ppm O	O	O	O	-	-	-	-	-	-	-	-	-	-

Oxygen, nitrogen and hydrogen in titanium, pins

91205-1001	DC	Titanium, 100 pins, 0.1 g each	10-35 ppm H	O	O	O	-	-	-	-	-	-	-	-	-	-
91205-1002	DC	Titanium, 100 pins, 0.1 g each	20-70 ppm H	O	O	O	-	-	-	-	-	-	-	-	-	-
91205-1003	DC	Titanium, 100 pins, 0.1 g each	30-90 ppm H	O	O	O	-	-	-	-	-	-	-	-	-	-
91205-1004	DC	Titanium, 100 pins, 0.1 g each	60-120 ppm H	O	O	O	-	-	-	-	-	-	-	-	-	-
91205-1005	DC	Titanium, 100 pins, 0.1 g each	150-250 ppm H	O	O	O	-	-	-	-	-	-	-	-	-	-

Iron powder

91500-1001	DC	Iron powder, O ₂ approx. 1%		O	O	O	-	-	-	-	-	-	-	-	-	-
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 Please note:

- 1 Hazardous material
- 2 Further calibration standards and compositions on page ??????. Detailed information about compositions at www.eltra.com/consumables
- 3 Measuring ranges may vary depending on sample weight and sample material

Eltra GmbH, Germany, General Terms and Conditions of Business and Delivery

1. General remarks

- 1.1 Deliveries and services are performed exclusively on the basis of the following General Terms and Conditions of Delivery. They form a component of all contracts entered into and also apply to all future business relationships, even if they are not expressly agreed again.
- 1.2 The Customer acknowledges these General Terms and Conditions when it places an order, and no later than upon acceptance of the delivery or service.
- 1.3 Any contrary terms and conditions or divergent counter-confirmations from the Customer will have no binding effect on us, even if we do not expressly object to them. They require our express written acknowledgement to take legal effect.
- 1.4 Any addenda, amendments or ancillary agreements require our written confirmation to take legal effect. The same applies to the revocation of the written form requirement.

2. Offer and conclusion of contract

- 2.1 Catalogues, promotional brochures, price lists, cost estimates and offers are subject to confirmation and non-binding. All documents in this respect, such as drawings, typical analyses, dimensional data etc. are to be treated as approximate unless expressly designated as binding. We reserve our right of ownership and copyright to catalogues, drawings, cost estimates and other documents; and they may not be made available to third parties.
- 2.2 The Customer is liable for the correctness and completeness of specified dimensions and Customer samples as well as the correctness of documents to be provided by it, which include drawings, instructions, samples and the like as well as other information that affects the suitability of the items ordered for the intended application. The Customer is further liable for any infringement of third-party patent rights or intellectual property rights arising from the use of these documents. In that respect the Customer will indemnify us against any liability claims brought by third parties. We are not obliged to check whether the execution of any documents provided to us in this capacity infringes any third-party rights.
- 2.3 Material samples or Customer samples are to be delivered to us by the Customer free of charge. We may destroy any material samples submitted unless an express request for their return is made at the time of their delivery or within four weeks of us receiving them. The party submitting the material samples is liable for all risks associated with their transportation, storage and processing. This applies in particular to any damage that the material sample causes itself or in combination with any substances with which it comes into contact (toxic, corrosive, explosive materials), unless liability under clause 10.1 applies. We will invoice the analysis of material samples on the basis of the effective applicable hourly rates. If the analysis leads to a sale, the analysis costs will be offset against the purchase price.
- 2.4 The contract will only come into force when we provide written confirmation of the order and in accordance with the content of this confirmation, or upon acceptance of the delivery by the Customer. If no written confirmation is made, our delivery notes or invoices will additionally serve as order confirmations.
- 2.5 We reserve the right to make technical modifications to the subject matter of the contract during the delivery period, including after issue of the order confirmation, provided this is reasonable for the Customer balanced against our interests in the modification. The same applies to standard industry variations in weights and measures.
- 2.6 Spoken promises by and arrangements with our employees shall only bind us to the extent that these have been confirmed by us.

3. Deliveries

- 3.1 The delivery times set out in the order confirmations are non-binding, approximate information. They are only binding if we have expressly designated them as binding.
- 3.2 The delivery period commences with the date of the written order confirmation; if, at this time, there are any outstanding issues requiring clarification, the delivery period only commences after all such issues have been clarified. If advance payments have been agreed, the delivery period does not start until receipt of the first payment.
- 3.3 The delivery period will be deemed to have been complied with if the item to be delivered has left our plant or readiness for dispatch has been communicated before or on the date of expiry of the agreed delivery period.
- 3.4 In justified exceptional cases, and in particular for operational reasons, part deliveries and part services may be performed subject to advance notice. These will be invoiced separately.
- 3.5 We will not be liable for any delays to deliveries and services due to force majeure or other events over which we have no influence and for which evidence that they affect the completion or delivery of the subject matter of the delivery can be adduced – these include strike, lock-out, official directives, material shortages, non-availability or non-deliverability of goods etc. – including such circumstances affecting our own suppliers, even where binding periods and dates have been agreed and also during any period of default. We will notify the Customer of the commencement and termination of such hindrances without undue delay. In the event of temporary impairments, we are entitled to postpone the deliveries or services for the duration of the hindrance plus a reasonable lead time. Should performance become permanently impossible, we have the right to withdraw from unfulfilled part of the contract in full or part. The Customer may demand a declaration from us as to whether we intend to withdraw from the contract or deliver within a reasonable period. If we do not provide such a declaration and the Customer feels that it is unreasonable to expect it to accept delivery due to the delay, the Customer may withdraw from the contract.
- 3.6 The Customer bears sole responsibility for the suitability of the installation location for the supplied goods, for procurement of all necessary permits and for compliance with all planning, building and company regulations as well as for the preparation of the installation location, including the erection of any necessary foundations and the performance of all preliminary work necessary for the delivery and assembly or installation of the goods. The Customer also bears sole responsibility for the availability of the installation location with the necessary lifting and installation tools.
- 3.7 Our performance is subject to correct and timely delivery to us by our suppliers at all times. This reservation regarding correct and timely delivery by our suppliers is subject to the proviso that we entered into a corresponding covering transaction in good time and/or we are not responsible for the delayed delivery by our suppliers.
- 3.8 If we are responsible for not meeting agreed binding deadlines or dates, or we are in default of delivery/service, the Customer is entitled to withdraw from the contract after the expiry of an appropriate grace period; any further obligation to pay compensation is governed under clause 10 of these General Terms and Conditions.
- 3.9 If the Customer is in default in acceptance, we are entitled to demand compensation for non-performance in the amount of 15% of the agreed order value, without prejudice to the option to prove a greater loss. This is subject to an appropriate grace period being set along with a notice of potential rejection and subsequent withdrawal from the contract. For its part, the Customer reserves the right to provide evidence that no loss was sustained, or that the loss was substantially lower. In the case of Customer-specific products and/or systems, the loss is in principle the contract value less any advance payments made. The option to provide evidence of a higher or lower loss is reserved.

4. Shipping and transfer of risk

- 4.1 The place of performance for delivery is the location of our respective dispatching plant (INCO terms as amended from time to time: FCA dispatching plant).
- 4.2 Shipping is always performed at the Customer's own risk, including where partial shipments are made or we are rendering other services such as payment of shipping costs or carriage.
- 4.3 In the absence of any specific instructions, packaging and the selection of the transport route and means of transport is at our discretion. If the goods are accepted by the rail company, postal service, freight carrier or other transport company with no objections, this serves as a confirmation that the packaging is in a flawless condition on dispatch and excludes any liability on our part

for any damage or loss incurred en route due to improper packaging or loading, unless we are subject to strict liability for intentional misconduct or gross negligence.

- 4.4 The risk of accidental destruction or accidental deterioration of the goods passes to the Customer no later than at the point of handover of the goods to the haulier, the railways or other freight carrier, and no later than on dispatch from our warehouse or, in the case of direct delivery, on dispatch from our dispatching plant – e.g. also for CPT and CIP transactions. If the goods are to be collected by the Customer, the risk passes to the Customer on issue of the notification informing the Customer that the goods are ready for collection.
- 4.5 Any goods accepted prior to dispatch are deemed delivered pursuant to the agreed terms.
- 4.6 If dispatch or acceptance is delayed at the Customer's request or for reasons for which it is at fault, the risk of accidental destruction or accidental deterioration passes to the Customer on the date when we communicate the first and initial notification of readiness for dispatch or notification of acceptance in writing or verbally. In this case we are entitled to charge storage costs of 1.0% of the invoice amount for each month of the delivery delay, starting one month after notification of readiness for dispatch. The Customer reserves the right to furnish proof that no costs were sustained, or that the costs were substantially lower.
- 4.7 In the event of a delay in acceptance by the Customer, we may assert our right under clause 3.9 or freely dispose of the item or items for delivery and supply an equivalent item or items at the contract terms instead
- 4.8 We are entitled to insure the transport risk and invoice these costs to the Customer unless the Customer instructs otherwise in writing.

5. Prices and payment terms

- 5.1 Prices are quoted on a strictly net basis ex works or ex warehouse – also net of the costs of packaging, insurance, export/import or other supplementary costs – and exclusive of VAT at the applicable rate.
 - 5.2 If the conclusion of the contract and the date of delivery are more than four months apart, we may invoice the prices applicable on the date of delivery, unless otherwise agreed. If this is more than a minimal price increase, the Customer may withdraw from the contract.
 - 5.3 Increase of wages, procurement prices, freight costs, taxes, charges or other costs that result in price increases between the conclusion of the contract and delivery, or the emergence of equivalent new, unforeseen costs, entitle us to adjust the purchase price accordingly to the extent permissible by law.
 - 5.4 After conclusion of the contract we are entitled to request a deposit of a reasonable amount. In the case of Customer-specific systems/apparatus, this will be at least 50% of the contract value.
 - 5.5 In the absence of any other express agreement, payment will fall due on receipt of the invoice. Payments are to be made strictly net no later than 30 days after the invoice date. For Customer-specific systems/apparatus at least 50% of the order value will fall due with the request for a deposit. The rest will be invoiced on issue of the notification of readiness for delivery and is payable immediately.
 - 5.6 In the case of default we are entitled to charge interest at the level of interest for commercial loans calculated by our company bank, and no less than interest of 5 percentage points above the base rate applicable on the day on which the event of default commenced (EURIBOR). The Customer reserves the right to provide evidence that no loss was sustained, or that the loss was substantially lower. We reserve the right to assert further claims for damages resulting from delayed payment.
 - 5.7 All of our receivables are payable immediately including where bills of exchange or cheques have been presented, if the terms of payment are breached without justification or we become aware of a substantial deterioration in the Customer's asset position after the contract is concluded. We are entitled to perform any deliveries and services outstanding at that point only against advance payment(s) or security deposit(s) or to reduce or cancel any assured commercial loans. If no advance payment(s) or security deposit(s) have been made on expiry of a reasonable grace period, we are entitled to withdraw fully or partly from the contract. In such a case we expressly reserve the right to assert claims for any expenditure incurred unnecessarily, loss of profits and other losses.
 - 5.8 The Customer is only entitled to assert a right of set-off or retention, including in claims for defects or counterclaims, if the counterclaims are undisputed or established at law.
- ## 6. Commissioning Customer-specific systems/apparatus
- 6.1 Compliance with the agreed service features is always inspected at the place of manufacture.
 - 6.2 If our services include assembly and commissioning, the Customer is required to prepare all installations, facilities and/or other factors necessary for the assembly of the system and its proper commissioning in full and in good time unless these preparatory tasks are included in our scope of services under an express written agreement. In this respect the duties set out at clause 3.6 also apply.
 - 6.3 The provision at 6.2 notwithstanding, the Customer will be liable for the following during assembly and commissioning:
 - a) that our employees can commence their work as soon after their arrival as possible and can perform their tasks expeditiously during regular working hours and, if we deem such to be necessary, also outside regular working hours;
 - b) all statutory stipulations and safety regulations are complied with and the necessary facilities for the performance of the installation work are available;
 - c) the access routes to the installation location are suitable for deliveries to be performed;
 - d) the planned location for the assembly and operation of the system is suitable;
 - e) the necessary lockable storage facilities for material, tools and other accessories are available and accessible;
 - f) other auxiliary personnel, additional standard tools, industrial auxiliary materials (e.g. fuel, oils and lubricants, cleaning and other incidentals, gas, water, electricity, compressed air, heating, light etc.) and the Customer's standard measuring and test equipment are available promptly and at no charge;
 - g) the goods and products delivered by us for the assembly are at the correct location at the beginning of and during the assembly work.
 - 6.4 The Customer bears sole liability for the risk of a breach of the duties set out at clause 6.3.

7. Retention of title

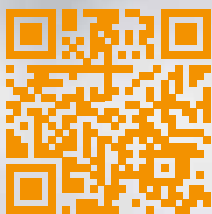
- 7.1 We reserve title to all goods supplied by us until the Customer has settled all claims arising under the business relationship, including any future claims from contracts entered into at the same time or subsequently, from any current account balance as well as until the absolute release from any contingent liabilities entered into in the Customer's interest.
- 7.2 The Customer must handle and store any goods subject to the retention of title with care and perform any standard inspection, servicing and maintenance work required at its own expense. The Customer may neither pledge the goods subject to the retention of title nor transfer them by way of security during the period of retention of title. Any access to the goods subject to the retention of title by third parties, for example by way of pledging or confiscation, as well as any damage or destruction must be reported to us in writing without undue delay.
- 7.3 If the Customer acts in a manner that is in breach of contract, in particular in the case of delayed payment of securitised claims, we are entitled to repossess the goods subject to the retention of title. Such repossession only represents a withdrawal from the contract if we confirm this in writing. Following repossession we are entitled to sell the goods and the proceeds will be set off against the Customer's liabilities after deduction of reasonable sales expenses.
- 7.4 a) The Customer is entitled and authorised to sell the goods subject to the retention of title in the course of ordinary business, which does not include what is known as the cheque-bill-of-exchange procedure. If the Customer is in default in respect of payments arising under the business relationship with us, we may forbid that the goods be sold on. If the Customer allows

- its purchaser delayed payment of the purchase price, it may only sell the goods on if it, too, retains title to the goods sold.
- b) The Customer hereby assigns to us the purchase price claims or other claims for consideration accruing to it against its purchaser under the selling-on of the goods or other selling business including all ancillary rights. These serve as security to the same extent as the goods subject to the retention of title. The Customer is only entitled and authorised to sell on or otherwise dispose over the goods subject to the retention of title if it has been established that the claims arising thereunder are transferred to us, and in particular that no prohibition on assignment exists between the Customer and its purchaser.
- c) If the Customer sells the goods subject to the retention of title along with other goods not supplied by us, the assignment of the claim from the sale only applies to the level of the invoice value of the respective goods subject to the retention of title sold. Where goods in which we have a co-ownership share are sold, the claim will be assigned to the value of this co-ownership share. If the assigned claim is included in a current account, the Customer hereby assigns to us a proportion of the balance corresponding to this claim—including a corresponding share of the closing balance—from the current account. If an interim balance is drawn up and it is agreed for this to be carried forward, the claim accruing to us per se under the foregoing provision is to be treated as if assigned to us for the purposes of the next balance.
- d) The Customer is authorised to collect the claims assigned to us until we revoke such authorisation. We may not exercise this right of revocation as long as the Customer fulfils its payment obligations under the business relationship with us and provided we do not become aware of any circumstances which might substantially reduce the Customer's creditworthiness. If the prerequisites for exercising the right of revocation apply, we may request that the Customer assign to us any claims for surrender vis-à-vis its purchaser or notify us of the assigned claims and their debtors, provide all information necessary for collecting these claims, hand to us the associated paperwork and notify the debtors of the assignment. Additionally, we are authorised to give notice of the assignment to the debtors.
- 7.5 The Customer is entitled to process the goods subject to the retention of title in the ordinary course of its business, provided it is not in default of payment. Where the goods subject to the retention of title are processed or remodelled, we will be deemed the manufacturer of the newly created goods without being subject to any obligations. The processed or remodelled goods are deemed goods subject to the retention of title as set out at clause 7.1. Where the Customer processes the goods subject to the retention of title in combination with other items not belonging to us, we acquire co-ownership in the new item in the proportion of the value of the goods subject to the retention of title to the total value of the other items used; the time of processing is authoritative. If the goods subject to the retention of title are mixed, blended or combined with other items, and as a consequence our ownership of the goods subject to the retention of title is extinguished, the Customer hereby transfers to us the rights of ownership of the mixed or combined items accruing to it, or of the unified item in the proportion of the value of the goods subject to the retention of title to the total values of the other mixed, blended or combined items; the time at which the event occurs is authoritative. The Customer will also store the items co-owned by us under the foregoing provisions at no cost to us. The co-ownership shares arising under this clause are subject to the provisions of the whole of clause 7. in the context of goods subject to the retention of title.
- 7.6 At our request the Customer is obliged to provide information on the whereabouts of the goods subject to the retention of title at any time and on any claims arising from the selling-on of the goods or other further disposal.
- 7.7 Should the value of the existing security assigned to us exceed the secured claims by a total of more than 10%, we are obliged, if requested by the Customer, to release securities of our choosing to the same level.
- 7.8 If the retention of title set out in the foregoing provisions is not legally valid under the law of the country in which the goods subject to the retention of title are located, such security as most closely resembles this and is allowed under the law of this country will be deemed agreed. If the Customer is required to act in this context, the Customer is required to perform such acts at our request.
- 8. Warranty**
- 8.1 The Customer must inspect the delivered goods upon receipt, and no later than within ten working days, for defects and, if agreed, to examine any guaranteed characteristics and report any identified defects without undue delay, and no later than within a further five working days. Where goods are delivered, the goods must be inspected immediately on receipt in respect of transport and packaging damage as well as variations in terms of quantity and dimensions. Any variations must be noted on the bill of lading or delivery note. Concealed defects must be reported in writing as soon as they are discovered. If the Customer fails to report defects within the stipulated time, the goods will be deemed defect-free and contractually compliant. In terms of quality, only our description of services in the order confirmation or the manufacturer's product description is deemed agreed. Public statements, testimonials or advertisements do not count as contractually binding information about the quality of the goods. Any deviations from an instruction manual, specification or other functionality described in the contract will only be recognised as a defect if they result in a substantial impairment of use. We must be notified of any returns in advance. The rectification of defects caused by normal wear and tear, other influences or operator error are excluded from the warranty unless covered by binding statutory claims. The same applies to any defects arising that are attributable to a modification of the goods not performed by us. We provide no warranty that the products supplied correspond to the Customer's specific application scenarios, or work together with other of the Customer's goods, or other manufacturers' goods, without failure or impairment. We accept no liability for advisory obligations. Consequently, any liability for assisted calculations, recommendations, suggested solutions etc. which are dependent on the Customer's systems or relate thereto is excluded.
- 8.2 The Customer has a right to subsequent performance for defective products by way of rectification of the defect or delivery of a defect-free replacement item at our discretion. If subsequent performance is unsuccessful, the Customer may choose to demand either a reduction in the consideration or the rescission of the contract. In the event of a minor contractual breach, in particular minor defects, the Customer will have no right of rescission. If the Customer exercises its right to rescission following unsuccessful subsequent performance, it has no additional claim to compensation due to the defect. If the Customer brings any claims for compensation following unsuccessful subsequent performance, the Customer will retain the goods if it is reasonable for it to do so. The claim for compensation is limited to the difference between the purchase price and the value of the defective goods. This does not apply if we breached the contract in bad faith. We may choose whether to render the subsequent performance at the place of installation or at our head office. If the subsequent performance is rendered at the place of installation, the Customer must provide our representative with unrestricted access to the purchased item both as regards time and place of access. Clause 6.3 applies in this respect. The Customer may further demand that warranty work is only performed during the regular business hours for the respective location. If the Customer requests that we perform warranty work outside our regular business hours, the Customer must pay any additional costs.
- 8.3 In the event of third party products, our liability is limited to the assignment of the warranty claims against our own supplier accruing to us. The warranty period is limited accordingly to the term that we are granted by our own supplier.
- 8.4 Warranty claims will expire within 24 months from the transfer of risk or the acceptance of the service. The warranty period relates to goods deployed in a laboratory that operates a single shift. If multiple shifts are worked, this period will be reduced accordingly to a minimum of twelve months. For customer-specific systems/apparatus, as well as for repairs and spare parts the warranty period is limited to twelve months.
- 8.5 The foregoing paragraphs contain the full extent of the warranty for our products and goods. Any further liability is governed solely by the provisions in clause 10. of these General Terms and Conditions.
- 8.6 The Customer is liable for the proper disposal of the supplied goods after the cessation of use in accordance with statutory provisions and at its own expense. The Customer will relieve the supplier of the statutory duties to take back old appliances and associated third party claims. If the Customer passes the supplied goods on to commercial third parties, it must impose on that party a contractual duty to properly dispose of the goods after the cessation of use in accordance with the statutory provisions and at that party's expense and to impose a corresponding obligation on any further parties to which the goods pass. If the Customer fails to do so when passing goods to a third party, it is obliged to take back the goods at its expense after the cessation of use and to properly dispose of them in accordance with the statutory provisions. The manufacturer's claim for the Customer to take on the goods and relieve it from its obligations will not expire until two years after the Customer ultimately ceases to use the appliance. The two-year period during which expiry is postponed begins no earlier than upon written notification by the Customer to the manufacturer regarding the cessation of use.
- 9. Software**
- 9.1 The warranty for software is based on the above provisions in clause 8 with the following modifications: We will provide a warranty for the compliance of the software provided to the purchaser with our program specifications provided the software was installed on the systems envisaged by us in accordance with our stipulations. The warranty only covers software defects that can be readily reproduced. We undertake to rectify all non-insubstantial defects affecting usage in accordance with the contract; however, we reserve the right to select the method of rectification (installation of an improved software version or instructions on working around the defect).
- 9.2 The Customer is granted a non-exclusive and non-transferrable usage right over programs and associated documentation that are required for proper and internal use of the delivered product. The purchaser will accrue no further rights to programs and documentation, and in particular we will remain the copyright holder. The Customer is not permitted to provide third parties with access to programs, documentation and any subsequent amendments, or to copy, otherwise reproduce, decompile, disassemble or reverse-engineer such without our prior written consent.
- 10. Liability**
- 10.1 We accept liability for any losses attributable to wilful misconduct or gross negligence on the part of our statutory representatives or vicarious agents or where contractually assured warranties or qualities of the goods that are intended to safeguard the Customer against atypical risks of loss are missing. In the case of ordinary negligence, we will only accept liability if material contractual duties are breached or if insurance cover is in place, and this will be limited to loss that was foreseeable at the time when the contract was entered into. No liability will be accepted for any further consequential losses. In particular, liability for any direct or indirect loss of any kind other than that set out here, including consequential loss, loss of use, income or profits and futile expenditure, additional expenditure and third-party claims is expressly ruled out, including in cases of negligence.
- 10.2 Liability is excluded in the case of defects caused by external factors such as voltage fluctuations, improper installation, wear and tear, operation and use/ maintenance/ changes to the goods by the Customer or third parties commissioned by the Customer, irrespective of the legal grounds.
- 10.3 In the absence of agreements to the contrary, any fixed compensation claims will be limited to a maximum of 5% of the purchase price.
- 10.4 The above limitations of liability have no bearing on any claims brought by the Customer under product liability legislation. Furthermore, the limitations on liability do not apply to personal injury, damage to health or death of the Customer or its vicarious agents and other third parties attributable to us.
- 11. Intellectual property rights and copyright**
- 11.1 The products, all specifications, drawings, descriptions and illustrations are protected by intellectual property rights by the seller and subject to an obligation of confidentiality, unless they have been or will be published by the seller. The buyer will not disclose this information to anyone, except for the purpose of using the products in the course of its business.
- 11.2 The sale of the products does not bestow on the purchaser any rights or licences under any patent, industrial design or copyright, except for non-exclusive use of the product in the course of its own business.
- 11.3 If a third party brings a justified claim against the Customer due to the breach of an intellectual property right or copyright (hereinafter referred to as Protective Rights) due to the goods supplied by us or the contractually compliant use thereof, we will only be liable to the Customer subject to the following conditions:
- We will choose, at our expense, either to obtain a usage right for the goods, to modify the goods such that the Protective Right is not infringed or replace the goods. If this is not possible at reasonable terms, we will take the goods back and refund the purchase price.
 - The obligations set out above shall only apply if the Customer notifies us of any claims brought by third parties in writing and without undue delay, does not acknowledge a breach of the Protective Rights to the third party and reserves all defensive measures and settlement negotiations for us. Should the Customer cease to utilise the product owing to loss mitigation or other significant reasons, the Customer will point out to the third party that the cessation of utilisation is no acknowledgement of any infringement of any Protective Rights.
- 11.4 If the use of the product causes a breach of a patent, industrial design or copyright and if this breach is based on designs, specifications or instructions made by the purchaser, on the operation of the system by the purchaser in which the products are included, or manufacturing processes applied thereto, the purchaser will defend the claim, which must be notified to it without undue delay, at its own expense or to settle the claim by mutual agreement and to reimburse all losses and costs incurred by the seller as a result of such breach. This also applies if the infringement of the Protective Right is caused by an unforeseeable application on the part of the buyer or due to the products being modified or deployed with products not supplied by us. Any further claims against us will not be acknowledged. This does not apply e.g. where mandatory liability exists due to product liability, wilful misconduct, gross negligence or the infringement of material contractual obligations. The Customer also retains the right to withdraw from the contract under the foregoing provisions.
- 12. Closing provisions**
- 12.1 The place of jurisdiction for deliveries and payments (including actions on cheques and bills of exchange) as well as all disputes arising between the parties is the competent court for Haan, Germany. However, we reserve the right to bring a claim against the Customer at any other place of jurisdiction permitted by law. The relationship between the contracting parties is governed solely by the law applicable in the Federal Republic of Germany. The UN Convention on Contracts for the International Sale of Goods (CISG) does not apply.
- 12.2 The Customer may only transfer the rights and obligations arising under this contract to third parties with our written consent. Such consent is not required if the assignment is made in the course of an effective extended retention of title that the Customer has agreed with a third party under the provisions of clause 7.
- 12.3 If individual provisions of these terms and conditions or parts thereof become invalid, this will have no bearing on the validity of the remaining provisions. An invalid provision of these terms and conditions will be replaced by a valid provision that most closely corresponds to the commercial intent of the invalid provision.

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