

Technical Data Combination Probe KS1D-HT



Fig. 1 Combination probe KS1D-HT with gas extraction device GED FLEX



Fig. 2 Combination probe KS1D-HT with gas extraction device GED FLEX and T adapter

Application:

- Flue gas temperatures: depending on material up to 1.400 °C / 2,552 °F at the GED FLEX
450 °C / 842 °F at probe head for LT2/LT3
300 °C / 572 °F at probe head for LT3-F
- Flow velocities: 0,1 ... 30 m/s / 0.33 ... 98.43 ft/s
- Dust exposure: $\leq 1.000 \text{ mg/m}^3$

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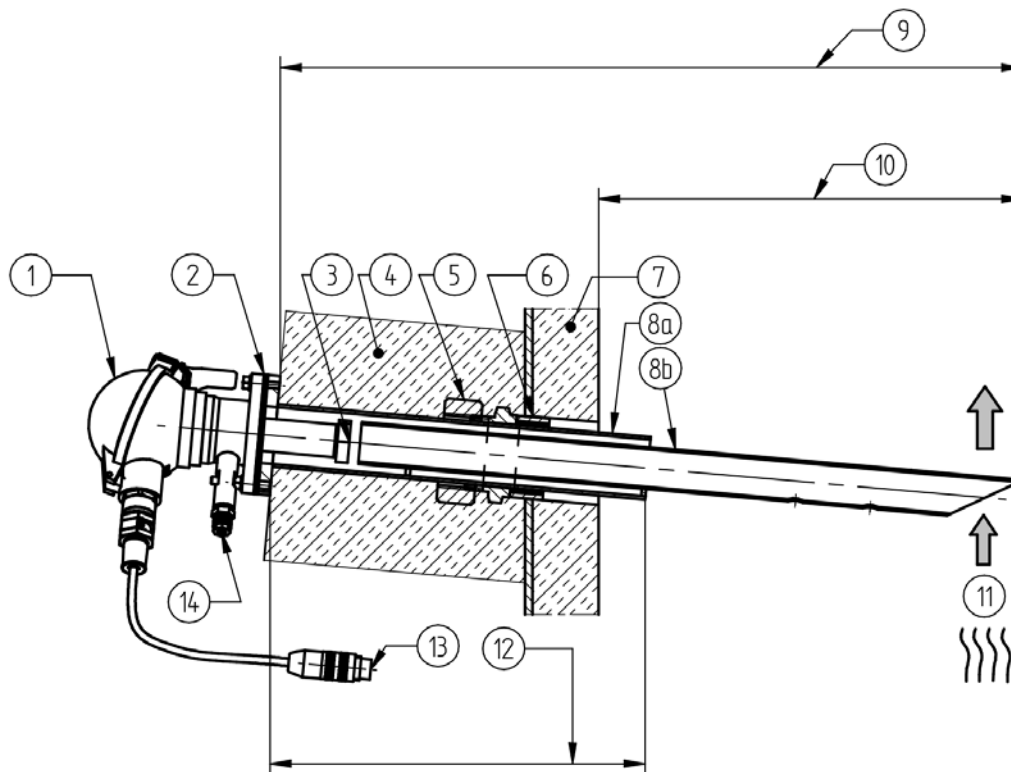


Fig. 3 GED FLEX made of Inconel or stainless steel without adapter

- | | |
|--|--|
| 1 HT probe | 8a GED FLEX outer tube |
| 2 Graphite sealing type 656P0263 | 8b GED FLEX inner tube |
| 3 Maximum measuring gas temperature at probe head
300 °C / 572 °F in connection with LT3-F
450 °C / 842 °F in connection with LT2/LT3 and NT1 | 9 Length GED FLEX |
| 4 Insulation GED FLEX (depending on the measuring gas temperature) | 10 Immersion depth GED FLEX |
| 5 Screw-in connection | 11 Flow direction measuring gas |
| 6 Half sleeve | 12 Variable range immersion depth |
| 7 Boiler wall (in this case with inner insulation) | 13 Connecting cable, length 2 m / 6.6 ft |
| | 14 Hose connection 4/6 mm / 0.16/0.24 "in for calibrating gas |

Technical Data Combination Probe KS1D-HT

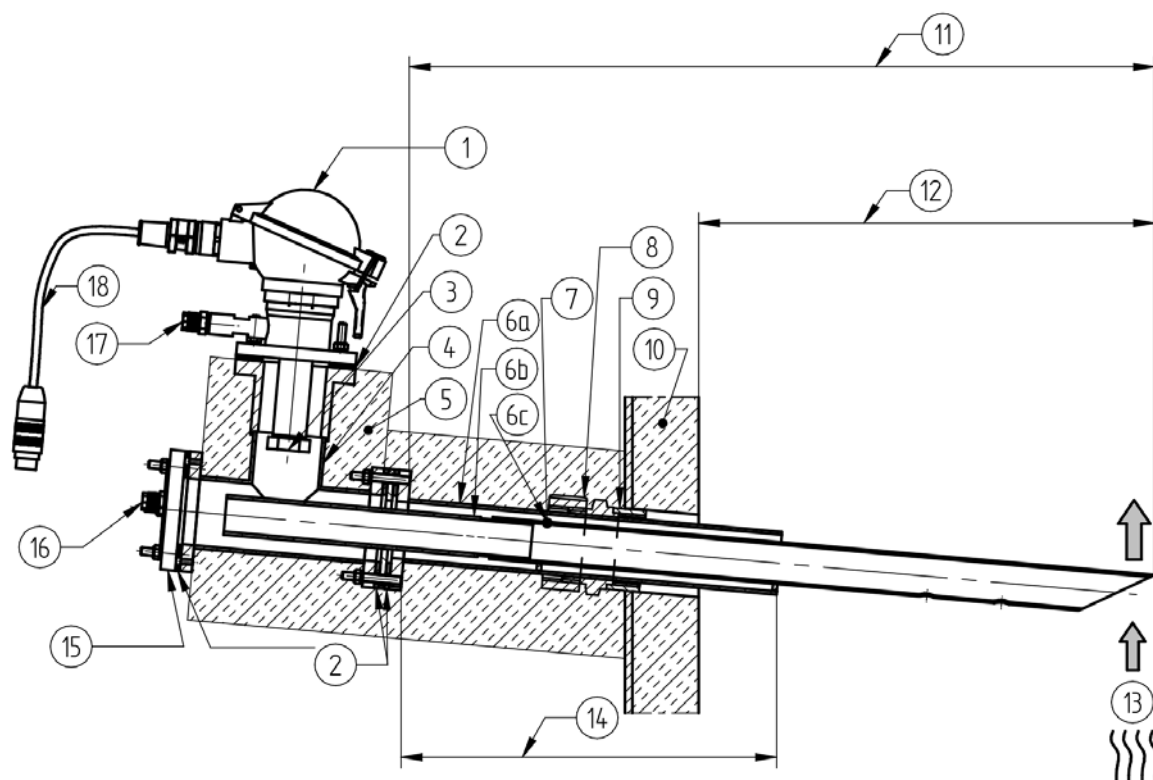


Fig. 4 GED FLEX made of Inconel or stainless steel with T-adapter

- | | |
|---|---|
| 1 HT probe | 10 Boiler wall (in this case with inner insulation) |
| 2 Graphite sealing type 656P0263 | 11 Length GED FLEX |
| 3 Maximum measuring gas temperature at probe head:
300 °C / 572 °F in connection with LT3-F
450 °C / 842 °F in connection with LT2/LT3 and NT1 | 12 Immersion depth GED FLEX |
| 4 T-adapter for the probe holder type 655R1565 ... 68 | 13 Flow direction measuring gas |
| 5 Insulation T-Adapter type 655R1569
(option, depending on the measuring gas temperature) | 14 Variable range immersion depth |
| 6a GED FLEX outer tube | 15 Sealing flange/cleaning flange with pneumatic connections |
| 6b GED FLEX extension inner tube (655R1574/
655R1575) | – For T-adapter type 655R1565:
blind flange |
| 6c GED FLEX inner tube | – For T-adapter type 655R1566:
cleaning flange with pneumatic connections (2x 12/10 mm / (0.47/0.39" in) |
| 7 Insulation GED FLEX, on site (depending on the measuring gas temperature) | – For T-adapter type 655R1567:
Ejector flange with pneumatic connection (6/4mm / 0.16/0.24" in) |
| 8 Screw-in connection | – For T-adapter type 655R1568:
Flange with all pneumatic connections |
| 9 Half sleeve | 16 Pneumatic connection |
| | 17 Hose connection 4/6 mm / 0.16/0.24" in for calibrating gas |
| | 18 Connecting cable, length 2 m / 6.6 ft |

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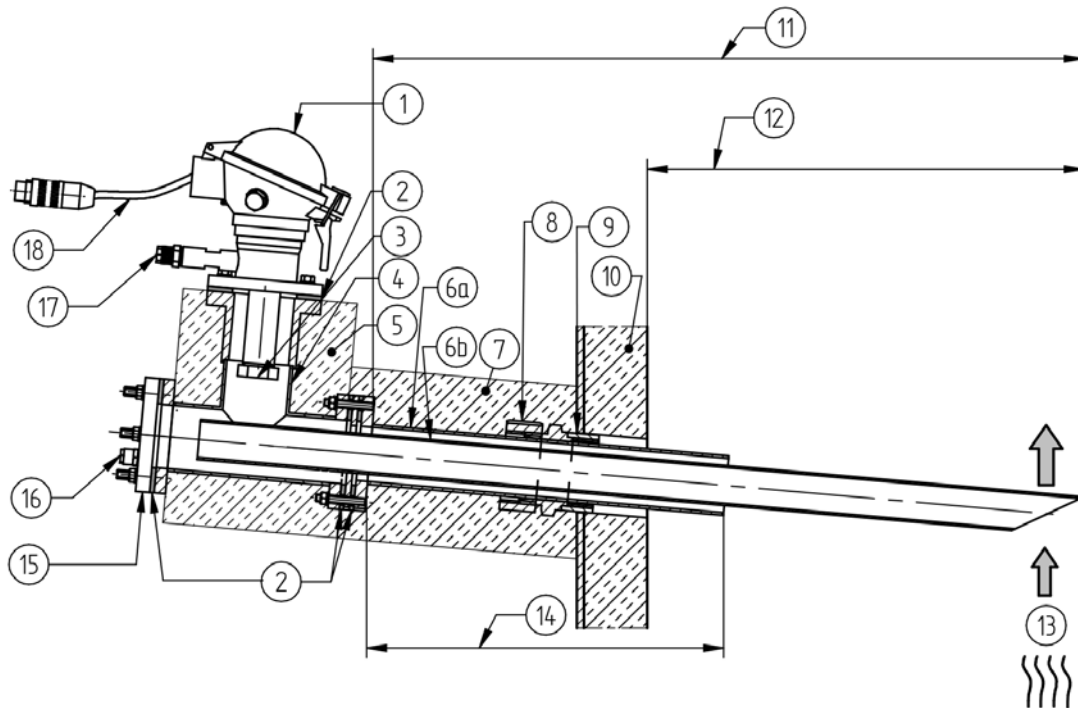


Fig. 5 GED FLEX made of Kanthal or AL203 with T-adapter

- | | |
|---|---|
| <p>1 HT probe</p> <p>2 Graphite seal type 656P0263</p> <p>3 Max. measuring gas temperature on probe head:
300 °C / 572°F in combination with LT3-F
450 °C / 842 °F in combination with LT2/LT3</p> <p>4 T-adapter for probe mount
for Injector Acceleration type 655R1565 ...68</p> <p>5 Insulation of T-adapter type 655R1569
(optional, depending on the measuring gas temperature)</p> <p>6a GED FLEX outer tube</p> <p>6b GED FLEX inner tube</p> <p>7 Insulation of GED FLEX, provided by customer
(depending on the measuring gas temperature)</p> <p>8 Male coupling</p> <p>9 Half collar</p> <p>10 Boiler wall (in this case with inner insulation)</p> <p>11 Length GED FLEX</p> | <p>12 Immersion depth of GED FLEX</p> <p>13 Flow direction of measuring gas</p> <p>14 Variable range of immersion depth</p> <p>15 Sealing flange/cleaning flange with pneumatic connections</p> <p>End flange</p> <ul style="list-style-type: none"> – For T-adapter type 655R1565: blind flange – For T-adapter type 655R1566:
cleaning flange with pneumatic connections (2x 12/10 mm / 0.47/0.39" in) – For T-adapter type 655R1567:
Ejector flange with pneumatic connection (6/4 mm / (0.16/0.24" in) – For T-adapter type 655R1568:
Flange with all pneumatic connections <p>16 Pneumatic connection</p> <p>17 Hose connection 4/6 mm (0.16/0.24" in) for calibration gas</p> <p>18 Connection cable</p> |
|---|---|

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Fig. 6 GED BASE type 655R1420 ... 1422

Application:

- Flue gas temperatures: 550 °C / 1,022 °F at GED BASE
450 °C / 842 °F at probe head for LT2/LT3
300 °C / 572 °F at probe head for LT3-F
- Flow velocities: 1 ... 10 m/s / 3.28 ft/s ... 32.81 ft/s.
- Dust exposure: $\leq 200 \text{ mg/Nm}^3$

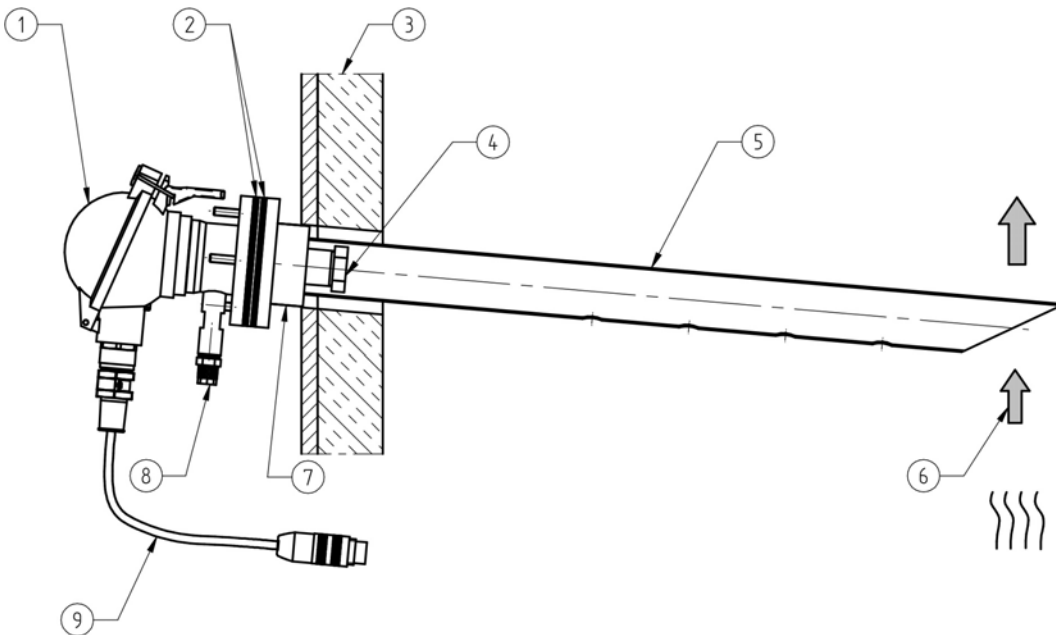
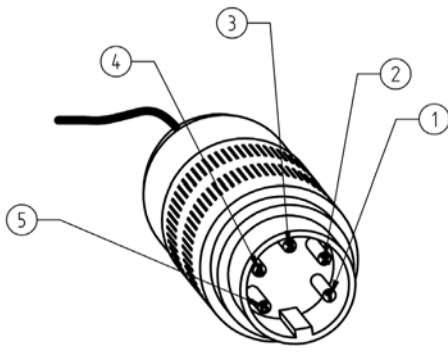


Fig. 7 Dimension drawing HT probe with gas extraction device (GED BASE)

- 1 HT probe
- 2 Graphite sealings type 656P0263
- 3 Boiler wall (in this case with inner insulation)
- 4 Probe head, maximum measuring gas temperature:
450 °C / 842 °F in connection with LT2/LT3
300 °C / 572 °F in connection with LT3-F
- 5 GED BASE type 655R1420 ... 1422
- 6 Flow direction measuring gas
- 7 Counter flange 655R1450
- 8 Hose connection 4/6 mm / 0.16/0.24" in for calibrating gas
- 9 Connecting cable, length 2 m / 6.6 ft

Technical Data Combination Probe KS1D-HT



- 1 = (+) probe signal O₂/ CO_e (black)
- 2 = (-) probe signal CO_e (grey)
- 3 = probe heating (white)
- 4 = probe heating (white)
- 5 = (-) probe signal O₂ (red or blue)

Fig. 8 Pin assignment for plug

Technical data*	
Measuring range	O ₂ : 0 - 21 % O ₂
	CO _e : 0 - 1,000 ppm (0 - 10,000 ppm upon request)
Measuring precision	O ₂ : ± 5 % of measured value - not better than ± 0.3 vol. %
	CO _e : ± 25 % of measured value- not better than ± 20 ppm after prior calibration under operating conditions with a CO reference measurement
	In measuring range ≤ 100 ppm: ± 10 ppm
Sensor signal	O ₂ : -30 ... +150 mV
	CO _e : -30 ... +800 mV
Response time	O ₂ : t ₆₀ : < 3 s t ₉₀ : < 9 s
	CO _e : t ₆₀ : < 3 s (electronically filtered at the factory < 9 s) t ₉₀ : < 4 s (electronically filtered at the factory < 13 s)
Relaxation time (measurement readiness after overload)	O ₂ : t ₉₀ : < 8 s
	CO _e : t ₉₀ : < 9 s
Offset to environment	O ₂ < 0.3 vol. %
	CO _e < 2 ppm
Hysteresis	O ₂ < 1 % from measured value
	CO _e < 1.5 % from measured value
Linearity	O ₂ < 1 % from measured value
	CO _e < 9 % from measured value
Repeating precision	O ₂ < 0.1 % deviation from measured value
	CO _e < 0.7 % deviation from measured value
Ambient pressure dependency	O ₂ < 0.1 % from measured value (of normal pressure at sea level in comparison with pressure at altitude of 2000 m (6,561.68 ft), i.e., op = -200 mbar / -2,9 psi)
	CO _e < 16 % from measured value (of normal pressure at sea level in comparison with pressure at altitude of 2000 m (6,561.68 ft), i.e., op = -200 mbar / -2,9 psi)
Differential pressure dependency	O ₂ < -1.8 mV U _{O₂} per 100 mbar / 1.45 psi overpressure in the measuring chamber in comparison with environment
	CO _e < -0.17 mV U _{CO_e} per 100 mbar / 1.45 psi overpressure in the measuring chamber in comparison with environment

Technical Data Combination Probe KS1D-HT

Technical data*	
Drift	<p>O_2 < 1.7 % from measured value (after 1000 h of operation in EL light fuel oil and 1004 switching cycles on/off)</p> <p>CO_e < 18.4 % from measured value (after 1000 h of operation in EL light fuel oil and 1004 switching cycles on/off)</p>
Cross sensitivity***	<p>O_2: to CO_2 (15 vol. %) < 0.1 vol. %</p> <p>O_2: to CO (874 ppm) < 0.1 vol. %</p> <p>O_2: to CH_4 (76 ppm) < 0.1 vol. %</p> <p>O_2: to SO_2 (76 ppm) < 0.1 vol. %</p> <p>O_2: to NO (245 ppm) < 0.1 vol. %</p> <p>CO_e: to CO_2 (15 vol. %) < 26 ppm</p> <p>CO_e: to O_2 (1 vol. %) < 38 ppm</p>
Moisture	<p>O_2: < 2.3 % from measured value</p> <p>CO_e: < 9.1 % from measured value</p>
Influence of the installation position	none, if KS1D is installed according to the information in the operating instructions.
Influence of the mains voltage	none, if KS1D is operated according to the information in the operating instructions.
Influence of leakage	none, if KS1D is operated according to the information in the operating instructions.
Influence of the measuring gas	change of -1.6 mV/100 mbar
Internal resistance of probe	15 ... 25 Ω (ZrO_2 measuring cell in the air in case of 22 W heating output)
Heating consumption	10 ... 25 W (at T_{gas} 350 °C / 662 °F approx. 18 W) (according to design, measuring gas temperature, and measuring speed)
Supply voltage for heating	AC/DC At P_H 18 VA → 11.4 V At P_H 20 VA → 12.34 V At P_H 25 VA → 14.8 V
Heating current at P_H 20 VA	approx. 1.6 A approx. 5 A short term during heating PTC characteristic
Insulation resistance	< 30 M Ω (between heating and probe connection)
Lifetime	> 3 years (in case of light fuel oil and natural gas)
Weight	1,300 g / 2.86 lb
Material of probe housing	1.4571
Material of connection housing	aluminium
Material of connecting line	nickel-plated copper strand FEP insulation
Operating temperature of the measuring cell (sensor) at 13 V heating voltage in the air (20 °C / 68 °F)	650 °C / 1,202 °F
Measuring principle	zirconium dioxide cell (ZrO_2) potentiometric (voltage probe)
Heating time	10 min until operating temperature is reached

* Information according to EN 16340:2014 D

** Test report LTC-14-IB-09-V1.0 upon request

*** O_2 : Information assumes an operating gas composition of 5 vol. % O_2 , rest is N_2
 CO_e : Information assumes an operating gas composition of 5 vol. % O_2 , 333 ppm CO_e , rest is N_2
(333 ppm CO_e = 166.5 ppm H_2 + 166.5 ppm CO)

Technical Data Combination Probe KS1D-HT

Operating Condition	
Mounting / measuring gas extraction device	directly in exhaust gas channel / in situ
Seal tightness	$q_L \leq 100 \text{ cm}^3/\text{h}^*$
Mounting position	horizontal to vertical
Permissible fuels	residue-free, gaseous hydrocarbons, light fuel oil, heavy fuel oil (HFO), lignite and coal, biomass (according to design)**
Ideal measuring gas speed	<p>without GED: $1 \text{ m/s} \leq X \leq 6 \text{ m/s}$ $3.28 \text{ ft/s} \leq X \leq 19.69 \text{ ft/s}$</p> <p>with GED BASE: $1 \text{ m/s} \leq X \leq 10 \text{ m/s}$ $3.28 \text{ ft/s} \leq X \leq 32.81 \text{ ft/s}$</p> <p>with GED FLEX: $0.1 \text{ m/s} \leq X$ depending on version $0.328 \text{ ft/s} \leq X$</p> <p>(Higher measuring gas speed increases the measurement error. Measured at measuring gas temperature $25 \text{ }^\circ\text{C} / 77 \text{ }^\circ\text{F}$. In case of smaller measuring gas temperatures it might be necessary to protect the probe from the incident flow.)</p> <p>Attention: For lengths of GED FLEX $> 1 \text{ m}$, a higher measuring gas speed ($> 30 \text{ m/s} / 98.42 \text{ ft/s}$) can lead to flutter and vibration of GED.</p>

Environmental Conditions

Probe head	permissible flue gas temperature	$< 450 \text{ }^\circ\text{C} / 842 \text{ }^\circ\text{F} \text{ ***}$
Operation	permissible temperature	$< 100 \text{ }^\circ\text{C} / 212 \text{ }^\circ\text{F}$ on cable gland $< 100 \text{ }^\circ\text{C} / 212 \text{ }^\circ\text{F}$ on connection cable
Transport	permissible temperature	$-20 \dots +70 \text{ }^\circ\text{C} / -4 \dots +158 \text{ }^\circ\text{F}$
Storage	permissible temperature	$-20 \dots +70 \text{ }^\circ\text{C} / -4 \dots +158 \text{ }^\circ\text{F}$
Degree of protection	according DIN EN 40050	IP65

* According to DIN V 18160-1:2006-01, seal tightness towards environment through housing and fastening.

** EN 16340:2014 D approval (in connection with LT3-F) only with gaseous and liquid fuels

*** In connection with LT3-F max. $300 \text{ }^\circ\text{C} (572 \text{ }^\circ\text{F})$ permissible flue gas temperature on probe head.
The flue gas temperature can be considerably higher since it is reduced by the correctly selected length of the GED.

NOTICE

The limits of the technical data must be strictly adhered to.

Technical Data Combination Probe KS1D-HT

Order Information

Combination Probe KS1D-HT for simultaneous measurement of oxygen (O₂) and unburnt residue (CO/H₂) in combination with GED FLEX or GED BASE

with connecting cable and connector

Description / Type	Order no.
Combination Probe KS1D-HT, cable length 2 m / 6.56 ft, IP65, gasket for connecting head, Novaphit SSTC	656R2015
Combination Probe KS1D-HT, cable length 5 m / 16.40 ft, IP65, gasket for connecting head, Novaphit SSTC	656R2018

Additional required:

For measurements without purge operation, without fully automatic calibration

- Lambda Transmitter LT3-F, order no. 657R50 / ... or
- Lambda Transmitter LT3, configured for KS1D, order no. 657R51 / ...
- Gas extraction device GED BASE or GED FLEX

For measurements without purge operation (cyclic triggering)

- Lambda Transmitter LT2, configured for KS1D in application "purge operation"
Order no. 657R102 / KS1D / 3A / ...
- Gas extraction device GED FLEX, T-adapter for purge operation
- Dedusting / purge unit, IP65, for T-adapter GED FLEX, order no. 657R0934

For measurements without purge operation (manual triggering)

- Lambda Transmitter LT3-F, order no. 657R50 / ... or
- Lambda Transmitter LT3, configured for KS1D, order no. 657R51 / ...
- Gas extraction device GED FLEX, T-adapter for purge operation
- Dedusting / purge unit, IP65, for T-adapter GED FLEX, order no. 657R0934

For measurements with fully automatic calibration

- Lambda Transmitter LT2, configured for KS1D in application "fully automatic calibration"
Order no. 657R102 / KS1D / V / ...
- Gas extraction device GED BASE or GED FLEX
- Dedusting / purge unit, IP65, for T-adapter GED FLEX, order no. 657R0934
- Fully automatic calibration system, order no. 657R0940

For measurements without purge operation (cyclic triggering) and fully automatic calibration

- Lambda Transmitter LT2, configured for KS1D in application "fully automatic calibration and purging"
Order no. 657R102 / KS1D / VA / ...
- Gas extraction device GED FLEX, T-adapter for purge operation
- Dedusting / purge unit, IP65, for T-adapter GED FLEX, order no. 657R0934
- Fully automatic calibration system, order no. 657R0940

Technical Data Combination Probe KS1D-HT

Accessories

Application up to 750 °C / 1382 °F, inner tube material 1.4571, outer tube material 1.4571

Designation / Type	Order no.
GED FLEX for HT/EX applications up to 750 °C / 1382 °F, stainless steel 1.4571 material, L 500 mm / 19.69 "in	655R1520
GED FLEX for HT/EX applications up to 750 °C / 1382 °F, stainless steel 1.4571 material, L 1000 mm / 39.37 "in	655R1521
GED FLEX for HT/EX applications up to 750 °C / 1382 °F, 1.4571 stainless steel material, L 1500 mm / 59.06 "in	655R1522
GED FLEX for HT/EX applications up to 750 °C / 1382 °F, 1.4571 stainless steel material, L 2000 mm / 78.74 "n	655R1523

Application up to 950 °C / 1742 °F, inner tube material INCONEL, outer tube material INCONEL

Designation / Type	Order no.
Measuring flue gas extraction tube flue gas extraction tube for HT/EX applications up to 950 °C / 1742 °F, INCONEL material, L 500 mm / 19.69 "in	655R1530
GED FLEX for HT/EX applications up to 950 °C / 1742 °F, INCONEL material, L 1000 mm / 39.37 "in	655R1531
GED FLEX for HT/EX applications up to 950 °C / 1742 °F, INCONEL material, L 1500 mm / 59.06 "in	655R1532
GED FLEX for HT/EX applications up to 950 °C / 1742 °F, INCONEL material, L 2000 mm / 78.74" in	655R1533

Application up to 1200 °C / 2192 °F, inner tube material KANTHAL, outer tube material INCONEL

Designation / Type	Order no.
GED FLEX for HT/EX applications up to 1200 °C / 2192 °F, KANTHAL material, L 500 mm / 19.69 "in	655R1540
GED FLEX for HT/EX applications up to 1200 °C / 2192 °F, KANTHAL material, L 1000 mm / 39.37 "in	655R1541
GED FLEX for HT/EX applications up to 1200 °C / 2192 °F, KANTHAL material, L 1500 mm / 59.06 "in	655R1542
GED FLEX for HT/EX applications up to 1200 °C / 2192 °F, KANTHAL material, L 2000 mm / 78.74" in	655R1543

Application up to 1400°C / 2552 °F, inner tube material Al₂O₃, outer tube material INCONEL

Designation / Type	Order no.
GED FLEX for HT/EX applications up to 1400 °C / 2552 °F, aluminium oxide material Al ₂ O ₃ , L 500 mm / 19.69 "in	655R1550
GED FLEXGED FLEX for HT/EX applications up to 1400 °C / 2552 °F, aluminium oxide material Al ₂ O ₃ , L 1000 mm / 39.37 "in	655R1551
GED FLEX for HT/EX applications up to 1400 °C / 2552 °F, aluminium oxide material Al ₂ O ₃ , L 1500 mm / 59.06 "in	655R1552

Technical Data Combination Probe KS1D-HT

Counter flanges

Description / Type	Type
Counter flange, inside tube diameter 80 mm / 3.15" in, tube length 70 mm / 2.756" in, Material: steel, EPD black, int. hole diameter in acc. to DN65 PN6	655R0179
Counter flange, inside tube diameter 80 mm / 3.15" in, special length up to 500 mm / 19.69" in, material: steel, EPD black, int. hole diameter in acc. to DN65 PN6	655R0179/S
Counter flange, inside tube diameter 80 mm / 3.15" in, tube length 70 mm / 2.756" in, Material: stainless steel 1.4571, int. hole diameter in acc. to DN65 PN6	655R0180
Counter flange, inside tube diameter 80 mm / 3.15" in, special length up to 500 mm / 19.69" in, material: stainless steel 1.4571, int. hole diameter in acc. to DN65 PN6	655R0180/S
Sealing for counter flange DN65 PN6, 3 mm / 0.118" in, material: graphite	655P4211

Gas Extraction Device (GED BASE)

Description / Type	Order no.
Gas Extraction Device GED BASE for HT- and NO _x applications up to 550 °C / 1,022 °F, material stainless steel 1.4571/1.4404, L 200 mm / 7.87 "in	655R1420
Gas Extraction Device GED BASE for HT- and NO _x applications up to 550 °C / 1,022 °F, material stainless steel 1.4571/1.4404, L350 mm / 13.78 "in	655R1421
Gas Extraction Device GED BASE for HT- and NO _x applications up to 550 °C / 1,022 °F, material stainless steel 1.4571/1.4404, L 500 mm / 19.69 "in	655R1422

Counter flange

Description / Type	Order no.
Counter flange	655R1450

The information in this publication is subject to technical changes.



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