SCK
Sampling system for dry gas sampling at rotary cement kiln gas exit and calciner gas exit
Measurement made easy

• Complete sampling system comprising only three pre-assembled modules
• Pre-assembled tubes and bus cables significantly reducing the system installation time
• Robust system design
• Standardized interfaces to ABB’s and third-party manufacturers’ analyzer systems
• Pneumatically driven probe retractor with dust cover and automatically or manually driven oven flap
• Robust, water cooled gas sampling probe types
• Probe type H with automatic mechanical cleaning
• Automatic probe retraction in case of compressed air or power supply failure
• Automatic cyclic cleaning of probe and filter
• Closed cooling water circuit with speed-controlled heat exchanger
• Continuous monitoring of cooling water pressure, temperature and flow
• Control unit with color touch panel featuring comprehensive operation, diagnosis and maintenance capabilities
• Graphic trend displays for predictive maintenance purposes
• Password-protected menu levels adapted for the needs of different user groups in the cement plant
• Various tools for remote operation and remote diagnosis available
• User interface in national languages available on request
**Application and system overview**

**Application**

The SCK sampling system is designed for sampling of hot cement flue gas with a high dust load for gas analysis. Usage sites are the rotary cement kiln gas exit and the calciner gas exit in dry process clinker kilns. The system is suitable for applications in rough environmental conditions.

The SCK sampling system is preferably combined with ABB’s ACX analyzer system. The combination of SCK with analyzer systems of third-party manufacturers is also possible.

**System overview**

The SCK sampling system comprises the following modules:

- Probe retractor 1 with pneumatic motor and chain-driven water-cooled probe type H or type 60S 2
- Control unit 3 with industrial controller incl. color touch panel
- Cooling unit 4 with speed-controlled heat exchanger and cooling water circulation pump
- Compressed-air tank 5 (optional)
Retractor

1 Pneumatic box
2 Emergency stop button 'probe action'
3 Pneumatic motor
4 Terminal box for system-internal electric cables connections
5 Heated connection box for sample gas line connection
6 Automatically (pneumatically) or manually driven oven flap
7 Transport brackets (dismounted at installation site)
8 Gas sampling probe type H (see p. 5) or type 60S (see p. 6)
9 Internal heated sample gas line
10 Flashing lights 'probe action'
11 Cable drag chain
12 Probe cleaning unit

Description

The retractor with its pneumatic chain driver carries the gas sampling probe in a double beam construction. It is used to insert and retract the probe to defined front or rear positions to scrape off possible material deposits or encrustations.

The integrated automatically (pneumatically) or manually driven oven flap closes the sampling opening when the probe is retraced, thus preventing hot and toxic gases to exhaust from the oven and cause damage to man and machinery.

The integrated cable drag chain bundles the tubes and cables for smooth probe movements.

The probe is automatically retracted when
- Cooling water temperature is too high
- Cooling water flow or pressure is too low
- Cooling water circulation pump failure occurs
- Compressed-air failure occurs
- Power supply failure occurs

Technical data

Double beam construction
- Chain drive
- Pneumatic motor
- Probe carrier with installed gas sampling probe
- Automatically (pneumatically) or manually driven oven flap
- Dust cover

Cable drag chain
- Cooling water tubes
- Electric cables
- Pneumatic tubes
- Self-regulating heated sample gas line

Pneumatic box
Pneumatic equipment for compressed-air conditioning and control of:
- Probe movement
- Oven flap opening/closing
- Plunger movement (for probe type H)

Connection of external compressed air

Terminal box
Connection of system-internal power supply and signal cables

Heated connection box
Connection of an external unheated or heated sample gas line (see system technical data, page 10)

Color
Light gray (RAL 7035)

Degree of protection
IP54 to EN 60529

Dimensions
see page 14
Standard retractor lengths:
4500 mm (177.2 in) for probe length L = 1.5 to 2.5 m (59.1 to 98.4 in)
5500 mm (216.5 in) for probe length L = 3.0 to 3.5 m (118.1 to 137.8 in)
Option: Retractor length adjusted to the probe length; retractor length is approx. probe length L + 2 m (L + 78.7 in).

Weight
Max. 600 kg (1322 lb) incl. probe

Mounting
- Hanging mounting (see page 16)
- 6 fixing points, required bearing capacity 10000 N each
Gas sampling probe type H

The water-cooled gas sampling probe type H is installed in kilns, where extremely hard encrustations are to be expected.

By using the probe type H, long measuring periods without interruptions are possible. The pneumatically driven plunger which is welded on the filter tip mechanically breaks the encrustations at the probe gas entry without interruption of the measurement.

After a preset number of plunger movements, the probe is automatically retracted. Thereby, possible material deposits are scraped off. After re-insertion filter and tube tip are purged with compressed air. Through the automatic probe movement and purging it is assured that the probe tube is practically free of deposits and the filter is free of dust.

Technical data

Material
Cooling tube: Stainless steel 1.4541 (AISI 321)
Inner gas pipe: Stainless steel 1.4436 (AISI 316)

Probe length
L = 1.5/2.0/2.5 m (59.1/78.7/98.4 in) preferably for use at calciner gas exit
L = 3.0/3.5 m (118.1/137.8 in) preferably for use at cement kiln gas exit

Weight
Approx. 95 kg (210 lb) for probe length L = 3.0 m (118.1 in)
Gas sampling probe type 60S

1. Sample gas inlet ports
2. Thickened shank of probe tube
3. Cooling water connections

Description

The water-cooled gas sampling probe type 60S is installed in kilns where less hard encrustations are to be expected.

By using the probe type 60S with two sample gas openings at the side of the probe tip, an effective pre-dedusting of the sample gas is achieved at the tip thus reducing the frequency of the automatic back purging actions.

After a preset number of back purging actions of the filtering unit and the sample pipe, the probe is automatically retracted. Thereby, possible material deposits are scraped off. After re-insertion filter and tube tip are purged with compressed air. Through the automatic probe movement and purging it is assured that the probe tube is practically free of deposits and the filter unit is free of dust.

Technical data

Material
- Cooling tube: Stainless steel 1.4541 (AISI 321)
- Inner gas pipe: Stainless steel 1.4571 (AISI 316Ti)

Probe length
- L = 1.5/2.0/2.5 m (59.1/78.7/98.4 in) preferably for use at calciner gas exit
- L = 3.0/3.5 m (118.1/137.8 in) preferably for use at cement kiln gas exit

Weight
- Approx. 45 kg (100 lb) for probe length L = 3.0 m (118.1 in)
Cooling unit

Description
Due to the prevailing conditions a cooling of the gas sampling probe is mandatory. The cooling unit is used to provide and monitor the cooling water supply. The cooling water circuit is completely closed thus minimizing cooling water consumption and avoiding scaling.

The cooling unit contains the speed-controlled heat exchanger and the cooling water supply pump as well as analog sensors for monitoring the cooling water temperature, flow and pressure.

Technical data

**Cooling water circuit**
- Capacity (first fill) 50 to 60 l (13 to 16 gal [US], 11 to 13 gal [UK])
- Pressure 1 to 2 bar (14.5 to 29 psi)
- Controlled temperature 75 to 85 °C (167 to 185 °F)
- Circulation 5 to 6 m³/h (2.9 to 3.5 cfm)
- Drinking water quality, anti-freeze agent necessary at ambient temperature < 0 °C (32 °F)

**Cooler block material**
Copper/brass for corrosion-proof operation

**Color**
Light gray (RAL 7035)

**Degree of protection**
IP54 to EN 60529

**Dimensions**
see page 15

**Weight**
Approx. 250 kg (550 lb)

**Mounting**
Ground mounting (see page 17)
Control unit

1 Maintenance switch (lockable)
2 Color touch panel
3 Buzzer
4 Main switches

Description
The control unit comprises the control system including the display and operator control unit for monitoring and operating the gas sampling system. Electrical power supply and all signals for the entire gas sampling system are fed-in and distributed in the control unit.

The control program offers different levels which are partly password-protected. Various locking mechanisms prevent possible sampling probe damages caused by erroneous operation or failure of single modules.

Operation
Probe movement and cleaning are controlled either in automatic mode or in manual mode. The program sequences are menu-driven and provide:

- Operation (automatic or manual probe retraction/insertion, oven flap opening/closing, probe cleaning, etc.)
- Diagnosis (cooling water parameters, trend displays, status messages, etc.)
- Set-up for process optimization (timers, limit parameters, etc.)
- Login levels to allow authorized access only (operators, technicians, etc.)
- Support via help texts

Technical data

Modules
- Industrial controller with display and operator control unit
- Color touch panel with special-hardened glass surface
- Maintenance switch (lockable)
- Buzzer
- Main switches
- Input and output terminals
- Automatic fuses
- Power supply
- Frequency controller

Material
Sheet steel

Color
Light gray (RAL 7035)

Degree of protection
IP54 to EN 60529

Dimensions
see page 15

Weight
Approx. 75 kg

Mounting
Wall mounting (see page 18)
Pneumatic and piping diagram

1. Safety relief valve outlet (bulkhead union brass with pipe connector 1 in)
2. Cooling water inlet (bulkhead union brass with pipe connector 1 in)
3. Cooling water feed (bulkhead union brass with pipe connector 1 in)
4. Cooling water return (bulkhead union brass with pipe connector 1 in)
5. Cooling water tube (25/39x7 mm 30 m incl. in delivery)
6. Compressed air tube (PA 18/14x2 mm 25 m incl. in delivery)
7. Heated sample gas line TBL-01 with PTFE bore 4/6x1 mm
8. Condensate outlet
9. Bulkhead union ‘compressed air to tank’ for tube 18/14 mm
10. Bulkhead union ‘compressed air from tank’ for tube 18/14 mm
11. Bulkhead union ‘compressed air inlet’ for tube 18/14 mm
12. Bulkhead unions ‘external pneumatic emergency stop’ for tube 6/4 mm
13. Elbow union with pipe connector 1 in ‘cooling water feed’
14. Elbow union with pipe connector 1 in ‘cooling water return’
15. Connector for sample gas line TBL-01 with SS flange ‘sample gas outlet’
System technical data

Connections

**Power supply**
- Control unit
  - 230/400 VAC supply lines: 4.0 mm² (AWG10)
  - UPS 230 VAC supply lines (option): 2.5 mm² (AWG12)
- Control unit to retractor
  - 230 VAC supply lines: 1.5 mm² (AWG14)
  - 230 VAC supply lines (for probe type 60S): 1.5 mm² (AWG14)
  - 24–30 VAC supply lines (for probe type H): 2.5 mm² (AWG12)
  - 24 VDC supply lines: 1.0 mm² (AWG18)
- Control unit to cooling unit
  - 400 VAC supply lines: 1.5 mm² (AWG14)
  - 24 VDC supply lines: 1.0 mm² (AWG18)

**Signal interfaces**
- Relay contacts (max. load 110 VDC/230 VAC, 1.5 A)
- Profibus DP slave RS485 (optional)
- Modbus (optional, for connection to ACX analyzer system)

Power supply and signal interfaces diagram see page 12

**System bus CANopen**
- 2 cables attached to the control unit and to the retractor for connection to the cooling module, length = 15 m (49.2 ft) each

**Compressed-air connections (at retractor)**
- Fittings, diameter 18 mm (0.7 in, supplied)

**Cooling water connections (at cooling unit)**
- 1 in (supplied)

Sample gas line to the analyzer system
- The sampling system can be prepared for connection of an unheated gas sample line or a self-regulating heated sample gas line, depending on application.
- Requirements on a heated sample gas line: No flange connection, outside diameter of isolation 45 to 48 mm (1.77 to 1.89 in), outside diameter of inner core 6 mm (0.24 in), length of nipple max. 30 mm (1.18 in), temperature-resistant up to 150 °C (302 °F).

Accessories

**Cooling water tube**
- 25/39x7 mm, length = 30 m (98.4 ft, can be cut as required), incl. fittings, weight approx. 40 kg (88 lb, included in delivery)

**Compressed-air tube**
- PA 18/14x2 mm, length = 25 m (82 ft, can be cut as required), incl. fittings (included in delivery of optional compressed-air tank)

Acoustic emission
- Retractor and cooling module
  - approx. 89 dB(A)

Declaration of conformity

**Electrical safety**
- The regulations of European directive 2006/95/EC for low voltage are complied with.

**Electromagnetic compatibility**
- The regulations of European directive 2004/108/EC for EMC are complied with.

**Machinery**
- The regulations of European directive 2006/42/EC for machinery are complied with.
Requirements at the installation site

**Power supply**

**Operating voltage**
- 230/400 VAC, ± 10 %, 50 Hz (fuses 3 x 20 A required), 3-phase connection (5 wires, N-conductor necessary)
- or
- 230/400 VAC, ± 10 %, 60 Hz (fuses 3 x 20 A required), 3-phase connection (5 wires, N-conductor necessary)
- or
- 3 x 208 VAC, ± 10 %, 60 Hz incl. transformer (fuses 3 x 20 A required), 3-phase connection (4 wires)

Other voltages on request

**Power consumption**
Max. 6 kVA

**Option 'UPS'**
230 VAC or 120 VAC, ± 10 %, 50 to 60 Hz (fuse 1 x 6 A required)

**Compressed air supply**

**Purpose**
For movement and cleaning of the gas sampling probe

**Requirements**
Compressed air free of dirt, oil and water droplets, 6 bar positive pressure, dried to 5 °C (9 °F) below ambient temperature

**Recommendation:** Instrument air (dew point −40 °C [−40 °F])

**Consumption**
Approx. 3 m³/h (1.7 cfm) at standard conditions

**Emergency tank**
A compressed-air tank with a capacity of at least 250 l (66 gal [US], 55 gal [UK]) must be installed near the sampling system. This emergency tank is necessary to supply sufficient compressed air for retracting the probe from the kiln in case of a compressed-air or power supply failure. The tank can be provided by the customer or by ABB.

**Cooling water supply**

**Purpose**
For cooling of the gas sampling probe

**Requirements**
Drinking-water quality
Anti-freeze agent (approx. 20 l [5.3 gal (US), 4.4 gal (UK)], without anticorrosion agent, oil-free) must be added if the ambient temperature is < 0 °C (32 °F).

**Capacity**
First fill 50 to 60 l at 1 to 2 bar (13 to 16 gal [US] or 11 to 13 gal [UK] at 14.5 to 29 psi)

**Ambient conditions**

**Ambient temperature**
5 to 45 °C (41 to 113 °F), −20 to 45 °C (−4 to 113 °F) with anti-freeze agent in the cooling water
Compressed air tank (option): −10 to 50 °C (−14 to 122 °F)

**Transport and storage temperature**
5 to 55 °C (41 to 131 °F), −20 to 55 °C (−4 to 131 °F) after draining and drying all parts in contact with cooling water or condensate

**Relative air humidity**
≤ 75 % annual average, for a short time up to 95 %, infrequent and slight condensation possible

**Installation location**
Installation location altitude max. 2000 m (6562 ft).
The control unit must be installed at a low-vibration location and protected from direct sunshine, dust and rain.

**Process gas conditions**

**Pressure**
±3 kPa (0.435 psi) related to atmospheric pressure

**Temperature**
Max. 1300 °C (2372 °F)

**Dust load**
Max. 2000 g/m³ (874 grain/ft³)

**Gas velocity at sampling point**
Max. 20 m/s (65 ft/s)
Power supply and signal interfaces
## Power supply and signal interfaces (legend)

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>-D30</td>
<td>u-REMOTE CAN COUPLER</td>
<td>-W35</td>
<td>PROFIBUS CABLE</td>
</tr>
<tr>
<td>-D60</td>
<td>u-REMOTE CAN COUPLER</td>
<td></td>
<td>AWG22/1, d=0,64mm</td>
</tr>
<tr>
<td>-D70</td>
<td>u-REMOTE CAN COUPLER</td>
<td>-W36</td>
<td>PROFIBUS Cable (OPTION &quot;PROFIBUS DP&quot;)</td>
</tr>
<tr>
<td>-E71</td>
<td>HEATER FILTER UNIT PFE3</td>
<td>-W37</td>
<td>SIGNAL CABLE</td>
</tr>
<tr>
<td></td>
<td>(OPTION &quot;605&quot;)</td>
<td></td>
<td>LYYY 2x0,5mm² OR 2xAWG22</td>
</tr>
<tr>
<td>-E72</td>
<td>HEATER GAS SAMPLE PROBE H</td>
<td>-W38</td>
<td>SIGNAL CABLE</td>
</tr>
<tr>
<td></td>
<td>(OPTION &quot;H&quot;)</td>
<td></td>
<td>LYYY 2x0,5mm² OR 2xAWG22</td>
</tr>
<tr>
<td>-E73</td>
<td>HEATER GAS SAMPLE PROBE H</td>
<td>-W39</td>
<td>SIGNAL CABLE</td>
</tr>
<tr>
<td></td>
<td>(OPTION &quot;H&quot;)</td>
<td></td>
<td>LYYY 18x0,5mm² OR 16xAWG22</td>
</tr>
<tr>
<td>-M51</td>
<td>COOLING WATER PUMP</td>
<td>-W50</td>
<td>SYSTEM BUS CABLE CANopen</td>
</tr>
<tr>
<td>-M52</td>
<td>FAN MOTOR HEAT EXCHANGER</td>
<td></td>
<td>LYCY 3x2,5mm²</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(SCOPE OF DELIVERY 15m)</td>
</tr>
<tr>
<td>-W30</td>
<td>MODBUS CABLE TO ANALYSIS</td>
<td>-W51</td>
<td>TERMINAL BOX COOLING MODULE</td>
</tr>
<tr>
<td></td>
<td>SYSTEM ACK, LYCY 3x0,25mm² (OPTION &quot;ACK&quot;)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-W31</td>
<td>CONTROL CABINET</td>
<td>-W52</td>
<td>24VDC-CABLE</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2x1,0mm² OR 2xAWG18</td>
</tr>
<tr>
<td>-W32</td>
<td>POWER SUPPLY CABLE 230/400 VAC</td>
<td>-W53</td>
<td>CABLE 230/400 VAC</td>
</tr>
<tr>
<td></td>
<td>5G4mm² OR 5xAWG10 (OPTION &quot;UPS&quot;)</td>
<td></td>
<td>TO COOLING WATER PUMP</td>
</tr>
<tr>
<td>-W33</td>
<td>UPS POWER SUPPLY CABLE 230 VAC</td>
<td>-W54</td>
<td>5G1,5mm² OR 5xAWG14</td>
</tr>
<tr>
<td></td>
<td>3G2,5mm² OR 3xAWG12 (OPTION &quot;UPS&quot;)</td>
<td></td>
<td>CABLE 230/400 VAC</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>TO FAN MOTOR HEAT EXCHANGER</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>5x2,5mm² OR 5xAWG14 WITH SHIELD</td>
</tr>
<tr>
<td>-W34</td>
<td>PROFIBUS CABLE</td>
<td>-W70</td>
<td>SYSTEM BUS CABLE CANopen</td>
</tr>
<tr>
<td></td>
<td>AWG22/1, d=0,64mm</td>
<td></td>
<td>LYCY 3x2,5mm²</td>
</tr>
<tr>
<td></td>
<td>(OPTION &quot;PROFIBUS DP&quot;)</td>
<td></td>
<td>(SCOPE OF DELIVERY 15m)</td>
</tr>
<tr>
<td>-W35</td>
<td>PROFIBUS CABLE</td>
<td>-W71</td>
<td>TERMINAL BOX RETRACTOR</td>
</tr>
<tr>
<td></td>
<td>AWG22/1, d=0,64mm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-W36</td>
<td>PROFIBUS Cable (OPTION &quot;PROFIBUS DP&quot;)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-W37</td>
<td>SIGNAL CABLE</td>
<td>-W72</td>
<td>24VDC-CABLE</td>
</tr>
<tr>
<td></td>
<td>LYYY 2x0,5mm² OR 2xAWG22</td>
<td></td>
<td>2x1,0mm² OR 2xAWG18</td>
</tr>
<tr>
<td>-W38</td>
<td>SIGNAL CABLE</td>
<td>-W73</td>
<td>24/28/30 VAC-CABLE</td>
</tr>
<tr>
<td></td>
<td>LYYY 2x0,5mm² OR 2xAWG22</td>
<td></td>
<td>4x2,5mm² OR 4xAWG14</td>
</tr>
<tr>
<td>-W39</td>
<td>SIGNAL CABLE</td>
<td></td>
<td>(OPTION &quot;H&quot;)</td>
</tr>
<tr>
<td></td>
<td>LYYY 18x0,5mm² OR 16xAWG22</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-W40</td>
<td>CABLE 230 VAC</td>
<td>-W74</td>
<td>CABLE 230 VAC</td>
</tr>
<tr>
<td></td>
<td>TO HEATER OF THE FILTER UNIT</td>
<td></td>
<td>TO HEATER OF THE FILTER UNIT</td>
</tr>
<tr>
<td>-W41</td>
<td>CABLE 230 VAC</td>
<td></td>
<td>3G1,5mm² OR 3xAWG14</td>
</tr>
<tr>
<td></td>
<td>TO RETRACTOR UNIT</td>
<td></td>
<td>(OPTION &quot;605&quot;)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Retractor: Dimensions

Gas sample probe not mounted!

All dimensions in [mm]

1) Length for 2.5 m retractor for probes 1.5 m, 2.0 m and 2.5 m
2) Length for 3.5 m retractor for probes 3.0 m and 3.5 m

- Retractor: Dimensions

- Gas sample probe not mounted!
Cooling unit: Dimensions

Control unit: Dimensions
RETRACTOR FOR MAX. 2.5m PROBE
800
10,000 N
1500
10,000 N
1500
10,000 N
700

RETRACTOR FOR MAX. 3.5m PROBE
800
2000
2000
2000
700

Mounting bolt circle 280 mm

Heat resistant steel
Dim. 219.10 x 6.30 mm
Length = 1 to 1.5m (supply by customer)

Counterflange Ø 320 mm (supply by customer)

All dimensions in [mm]

Mounting pipe

acc. EN 2573, DN 200, PN6

10,000 N
2000
800
700
5-30°
Cooling unit: Mounting
Control unit: Mounting