Advance Cemas-FTIR NT
Multi-Component Analysis System for Emission and Process Monitoring

Specification Sheet

- Continuous, quantitative and selective measurement of HCl, HF, H₂O, CO, CO₂, SO₂, NOₓ, NH₃, N₂O, O₂, TOC and NMHC (other gases on request)
- Maximum 12 measuring components (standard), simple upgrade on request
- Proven hot wet extractive measurement technique
- High stability, accuracy and reliability through proven FTIR technology
- Fully integrated TOC and O₂ analyzer modules (optional)
- Unique air-driven injector pump, no moving parts, low condensate to handle
- Low ownership, maintenance and installation cost through multi-component measurement technology with only one sampling system
- Complete pre-engineered system, modest space requirement, compact and modular system design
- Clear-text status messages and user-friendly operator interface on a large back-lit display
- Measured value and status signal transmission to DCS and emission evaluators via analog and digital outputs as well as via Modbus or Profibus
- Remote control and remote maintenance via Ethernet or via modem
- Integration and display of signals from other detectors (e.g. dust, mercury, flow, pressure, temperature)
Description

As a result of the growing requirements in the field of environmental monitoring, increasing number of pollutants and with lower concentrations have to be measured from combustion processes.

World leader in stack gas monitoring systems for more than 40 years and pioneer in FTIR technology, ABB Analytical is offering an inexpensive and forward-looking system with the Advance Cemas-FTIR NT (ACF-NT) multi-component emission and process monitoring system.

Recognized by the process industries for their ruggedness, the ABB FTIR spectrometers offer a measurement technology with the highest levels of accuracy, selectivity and reliability. As a result of the FTIR measurement principle, the spectrometer is free from drift and does not require frequent calibrations, therefore there is no need to hold stocks of expensive, dangerous and toxic test gases.

Because it can easily be expanded through software to measure additional infrared-active components, the ACF-NT system is also designed to expand with your future needs.

The sampling probe, sampling line and analyzer cell are heated allowing water vapor to be measured along with extremely low detection levels of pollutant such as HCl, NH3 and HF.

The sample gas delivery is using an electronically controlled air injector, which creates a vacuum. This draws the sample gas into the analyzer cell without the use of a mechanical pump. Thus, no moving part is used resulting in less maintenance. As a beneficial side effect, the sample gas is diluted at the analyzer cell outlet, condensation is reduced and disposal of the exhaust gas is safer.

Applications

- Municipal waste incinerators
- Biomedical and sludge incinerators
- Hazardous waste incinerators at chemical plants
- Gasification and pyrolysis processes
- Cement kilns
- Solvent recovery and destruction
- DeNOx and DeSOx of power plants
- Crematoria
- Steel and Aluminum smelters
- Brick, tiles and glass manufacturing
- Catalyst protection monitoring
- Combustion research

Devices and Subassemblies of the System

Sampling System

- Probe tube, optionally heated, lengths 500 to 2500 mm for process temperature up to 500°C (optional up to 1350°C)
- Filtering device, heated to 180°C
- Sample gas lines, heated to 180°C, length up to 60 m (other lengths and temperature on request)
- Protective cover for probe (optional)
- Probe back purge module (on request)
- Automatic injection of test gases at probe for drift check (optional)

Sample Gas Conditioning Unit

- Heated sample gas conditioning block with built-in SS-micro-porous filter
- Air driven injector pump module
- Oxygen, TOC and Mercury analyzers connection ports
- Connection and automatic switchover for zero and calibration gas supply
- Flow, pressure and temperature sensors

Analyzers

- FTIR spectrometer with heated sample cell
- O2 analyzer (ZrO2 detector, optional)
- TOC analyzer (FID detector, optional)

Control and Display Units

- Display and operator control unit (LCD screen and touch-control keyboard built into cabinet door)
- Advance Optima system controller
- FTIR system controller
- Control modules for the injector pump, Oxygen and FID analyzers
- Interfaces for
  - Measured values and status signals (analog and digital outputs or Modbus)
  - Remote operation and diagnostics (Modem or Ethernet)
- Prepared for UPS for uninterrupted power supply of the most important subassemblies (optional)

Air Purification

A compressed-air purification unit (molecular sieve) is used to provide zero gas for the FTIR spectrometer and the oxygen analyzer. Purge air is also used by the spectrometer and also to purge the measurement system in the event of heating failure or loss of power.
**Operation**

The software installed in the controller operates the system completely automatically. It allows the following functions:

- Display all measured results and clear status messages
- Manual operation of the system for service and commissioning
- Remote diagnosis via Ethernet interface and/or modem
- Self-diagnosis and archival of the status signal and measured data
- Optional automatic correction for dry/wet basis and reference measurement (to a fixed O₂ value)
- The FTIR results are averaged over 120 seconds (default setting) to allow for minimal measuring ranges. Through the sliding average the analytical results refreshment time is < 40 seconds. Shorter averaging and refreshment time available (depending on the ranges).

The system controller continuously monitors the temperature, pressure and gas flow to ensure automatic correction, reliability and precise measurement. If the temperature of any heated module of the ACF-NT falls below the minimum allowed, a stream of clean air purge is triggered to protect all subassemblies that are in contact with the sample gas.

The serial communication via Ethernet interface allows the analyzer system to be coupled to the plant network and a telephone modem to the ABB Service Department for remote diagnosis and preventive maintenance scheduling which enables maximum system availability.

**Calibration**

All FTIR device-dependent factors are taken into account through the daily automatic recording of the zero spectrum. Since absorption spectra are absolute and do not drift, zero and span are effectively automatically corrected using zero gas only.

Cost of ownership reduction is achieved by using the same test gas cylinder for zero calibration of the oxygen analyzer and the TOC analyzer.

Manual calibration check with gases and water vapor can easily be done at the analyzer cell or at the sampling probe according to internationally recognized requirements.

**Certification and Compliance to International Regulations**

The ACF-NT system is approved by the TÜV Rheinland in Germany. It has been successfully tested and achieved the certification according the German and European requirements for emissions protection laws.

The ACF-NT system complies with the CEM performance standards from the UK Environment Agency, and also with the US EPA and ASTM standards issued for FTIR continuous emission monitoring systems (US EPA 40CFR Part 60-PS 15 and ASTM D6348-98).

**Technical Data**

<table>
<thead>
<tr>
<th>Measured Components and Measuring Ranges</th>
<th>FTIR 1)</th>
<th>H₂O</th>
<th>CO₂</th>
<th>H₂</th>
<th>O₂</th>
</tr>
</thead>
<tbody>
<tr>
<td>SO₂</td>
<td>0-75 mg/m³ 0.27 mg/m³</td>
<td>0-25 ppm 0.09 ppm</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NO</td>
<td>0-200 mg/m³ 1.65 mg/m³</td>
<td>0-150 ppm 1.24 ppm</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NO₂</td>
<td>0-40 mg/m³ 0.41 mg/m³</td>
<td>0-20 ppm 0.20 ppm</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>NOx</td>
<td>0-150 ppm</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N₂O</td>
<td>0-50 mg/m³ 0.25 mg/m³</td>
<td>0-25 ppm 0.13 ppm</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NH₃</td>
<td>0-15 mg/m³ 0.20 mg/m³</td>
<td>0-20 ppm 0.27 ppm</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HCl</td>
<td>0-15 mg/m³ 0.26 mg/m³</td>
<td>0-10 ppm 0.16 ppm</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HF</td>
<td>0-5 mg/m³ 0.12 mg/m³</td>
<td>0-5 ppm 0.13 ppm</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO</td>
<td>0-75 mg/m³ 0.23 mg/m³</td>
<td>0-60 ppm 0.18 ppm</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1) FTIR spectrometer performance is based on 120 seconds data acquisition time, standard deviation 3σ and optical path length 6.4 m.

Other measured components and measuring ranges on request.
Technical Data

Performances

Cross-sensitivity
< ±4 % of the smallest measuring range

Linearity
< ±2 % of the smallest measuring range

Sensitivity drift
< 4 % in 6 months

Zero drift
corrected automatically

Response time
T<sub>90</sub> < 150 seconds, display refreshment time < 40 seconds

Temperature drift
< ±2 % of the smallest measuring range per 10 K change

Air pressure influence
None (automatically controlled through the aspirator pump module)

Input, Output and Status Signals

Measured signals
4-20 mA per measured component
optional: Modbus, Profinet, Ethernet communication

Status signals
Output and status signals from the measured concentrations, gas transport, sample conditioning system and operation are displayed on the built-in LCD display

Status signals: System failure, Oxygen analyzer failure, Maintenance, Maintenance request

Input signals
Analog and digital signals possible

Power Supply

Input voltage
400/230 VAC or 200/115 VAC, 48-62 Hz

Power consumption
Analysis system incl. probe filter
at power-up approx. 2400 W
during operation approx. 1600 W
Heated sampling line approx. 90 W/m
Air conditioning unit (optional) approx. 1400 W
Prepared for UPS (optional) approx. 600 W

Sample Gas Inlet Conditions

Temperature
Controlled at 180 °C ± 2 °C via heated sample gas line

Pressure
900-1100 hPa (0.9-1.1 bar)

Flow rate
approx. 250 l/h

Gas Connections

Sample gas inlet
Special support for heated line in the right cabinet wall
Screw fitting at SC-block for heated line TBL01 (4/6 x 1 mm)

Sample gas outlet
Screw fitting (steel ) for pipe 12 mm

Test gases
Screw fittings for hose (PTFE) 4/6 x 1 mm

Instrument air
Connected to the aspirator pumps and compressed-air purification unit (hosel 4/6 x 1 mm).
Quality: Based on ISO 8573-1 Class 2 (max. particle size 1 µm, max. particle density 1 mg/m³, max. oil content 0.1 mg/m³, max. pressure dew point −20 °C). The requirement is for compressed air at 5-7 bar (70-100 psi), up to 1700 l/h (1 cfm) for the FTIR analyzer, additionally 1400 l/h (0.8 cfm) for the optional FID.

System Design

Free standing cabinet in sheet metal. Air conditioning unit optional

Protection class
IP 54/Nema 3 and 13

Dimensions
800 x 2100 x 600 mm (W x H x D)

Weight
approx. 300 kg

Color
light grey (RAL 7035)

Minimum distances for installation
Left approx. 500 mm for the cable connections
Right approx. 1000 mm for the pipe connections, air conditioning unit and air purifier

Above approx. 300 mm when using the air conditioning unit (optional).

Environmental Conditions

Ambient temperature
in operation +20 to +25 °C
in air conditioned rooms +5 to +40 °C
for short periods up to +45 °C

Relative humidity
≤ 75 % as an annual average, max. 95 % for short periods, occasional and light condensation is permissible, supposed powered and purged system

Installation site
The system should be protected against radiated heat, heavy concentrations of dust and corrosive atmospheres.
**Pneumatics Diagram**

- **Sample Conditioning Block (SC Block)**
  - Filter Unit
  - PFE2
  - Purge Gas to Probe
  - Heated Sample Gas Line TBL01

- **Probe Tube Type 42**
  - Purge Gas
  - Sample Gas Inlet
  - RGM 11 Module
  - FTIR Spectrometer
  - Analysis Cabinet

- **Bulkhead Union SS316 12mm**
  - Vent.
  - Bulkhead Union SS316 6mm
  - Bulkhead Union PVDF 4/6x1 external

- **Purge Gas Inlet**
  - Heated Sampling Cell
  - FTIR Specrometer
  - Analysis Cabinet

- **Instrument Air**
  - 5...7 bar

- **Span Gas FTIR**
  - Zero Gas O2
  - Injector Pump

- **Zero Gas Valve**
  - 2% O2/N2

- **Span Gas FID**
  - Combustion Gas FID: H2
  - Zero Gas FID

- **Advance Optima Multi-FID 14**
  - TOC Analyzer

- **Air Purifier with CO2 Separator mounted next to Analysis Cabinet**

- **Advance Cemas-FTIR NT Specification Sheet**

10/23-8.11 EN February 2006
**Ordering Information**

<table>
<thead>
<tr>
<th>Ordering No. 23916-0-</th>
</tr>
</thead>
</table>

### Gas analyzer
- Basic system with FTIR spectrometer incl. H₂O measurement component
- Built-in gas cell 6.4 m optical length for emission monitoring up to 40 Vol% H₂O
- Built-in gas cell 3.2 m optical length for emission monitoring up to 60 Vol% H₂O

### Optional sensors
- Without oxygen analyzer
- Built-in ZrO₂ sensor for O₂, measurement range 0-25 Vol%
- Without TOC analyzer
- Built-in Multi-FID 14 TOC analyzer, select measurement ranges with BA-Nos. 961/962

### Analog interface for measurement values
- Without analog outputs
- 4 outputs 4-20 mA
- 8 outputs 4-20 mA
- 12 outputs 4-20 mA

### Serial interface for measurement values and status signals RS 485
- Without
- Modbus (line length up to 1200 m)
- Modbus via fiber optic cable (line length up to 3300 m)
- Profibus

### Serial interface and software for remote control and diagnosis
- Without
- Phone modem
- Ethernet, connector RJ45
- Ethernet, connector RJ45 + phone modem
- Ethernet, fiber optic cable
- Ethernet, fiber optic cable + phone modem

### Sampling & conditioning
- Without probe tube
- Probe tube 40 not coated, stainless steel (1.4571)
  - Nominal length 500 mm
  - Nominal length 1000 mm
  - Nominal length 1500 mm
  - Nominal length 2000 mm
  - Nominal length 2500 mm
- Probe tube 40 coated, stainless steel (1.4571)
  - Nominal length 500 mm
  - Nominal length 1000 mm
  - Nominal length 1500 mm
  - Nominal length 2000 mm
  - Nominal length 2500 mm
- Probe tube 42 heated
  - Nominal length 1000 mm, with temperature controller
  - Nominal length 1500 mm, with temperature controller
  - Nominal length 2000 mm, with temperature controller
  - Prepared for heated probe tube, with temperature controller
### Ordering Information

**Filter unit**

<table>
<thead>
<tr>
<th>Without probe filter unit</th>
<th>0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Filter unit PFE2 without protection box, with heating sleeve 230 V and insulation, 1 x Pt100, with check valve for emergency purging (Catalog No. 23028-0-112231)</td>
<td>1</td>
</tr>
<tr>
<td>Filter unit PFE2 with protection box, with heating sleeve 230 V and insulation, 1 x Pt100, with check valve for emergency purging (Catalog No. 23028-0-212231)</td>
<td>2</td>
</tr>
<tr>
<td>Filter unit PFE2 without protection box, with heating sleeve 115 V and insulation, 1 x Pt100, with check valve for emergency purging (Catalog No. 23028-0-112232)</td>
<td>3</td>
</tr>
<tr>
<td>Filter unit PFE2 with protection box, with heating sleeve 115 V and insulation, 1 x Pt100, with check valve for emergency purging (Catalog No. 23028-0-212232)</td>
<td>4</td>
</tr>
</tbody>
</table>

**Heated sample gas line**

<table>
<thead>
<tr>
<th>Without sample gas line</th>
<th>0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample gas line TBL01 with heating 230 V, length up to 35 m (use BA-No. 903) (Catalog No. 23283-0-131811)</td>
<td>1</td>
</tr>
<tr>
<td>Sample gas line TBL01 with heating 230 V, length 35–60 m (use BA-No. 903)</td>
<td>2</td>
</tr>
<tr>
<td>Sample gas line TBL01 with heating 115 V, length up to 15 m (use BA-No. 903) (Catalog No. 23283-0-131812)</td>
<td>3</td>
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<tr>
<td>Sample gas line TBL01 with heating 115 V, length 15–40 m (use BA-Nr. 903)</td>
<td>4</td>
</tr>
<tr>
<td>Prepared for heated sample gas line 230 V, length up to 60 m</td>
<td>5</td>
</tr>
<tr>
<td>Prepared for heated sample gas line 115 V, length up to 40 m</td>
<td>6</td>
</tr>
</tbody>
</table>

**Power supply**

| 230/400 V, 48 to 62 Hz, without UPS | 1 |
| 115/200 V, 48 to 62 Hz, without UPS | 2 |
| 230/400 V, 48 to 62 Hz, prepared for UPS | 4 |
| 115/200 V, 48 to 62 Hz, prepared for UPS | 5 |

**Cabinet version**

| Without air conditioning unit, without base | 0 |
| Without air conditioning unit, with base | 1 |
| With air conditioning unit 230 V, without base | 2 |
| With air conditioning unit 230 V, with base | 3 |
| With air conditioning unit 115 V, without base | 4 |
| With air conditioning unit 115 V, with base | 5 |

**Measurement components**

<table>
<thead>
<tr>
<th>Emission package: Ranges pre-configured according to European Regulation</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>HCl 0 to 90 mg/m³</td>
<td></td>
</tr>
<tr>
<td>CO 0 to 300 mg/m³</td>
<td></td>
</tr>
<tr>
<td>SO₂ 0 to 300 mg/m³</td>
<td></td>
</tr>
<tr>
<td>NO 0 to 392 mg/m³ (corresponds to 0 to 600 mg/m³ NO₂)</td>
<td></td>
</tr>
<tr>
<td>H₂O 0 to 40 Vol%</td>
<td></td>
</tr>
<tr>
<td>Emission package + additional measuring components</td>
<td>2</td>
</tr>
<tr>
<td>Measuring components and ranges according to BA-No. 910–986</td>
<td>3</td>
</tr>
</tbody>
</table>

**Ordering No. 23916-0-**
## Additional Ordering Information

<table>
<thead>
<tr>
<th>Measuring component</th>
<th>BA-No.</th>
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<tbody>
<tr>
<td>HCl</td>
<td>910</td>
</tr>
<tr>
<td>Range 1: 0 to ... mg/m³ or ppm</td>
<td>911</td>
</tr>
<tr>
<td>Range 2: 0 to ... mg/m³ or ppm</td>
<td>912</td>
</tr>
<tr>
<td>CO</td>
<td>920</td>
</tr>
<tr>
<td>Range 1: 0 to ... mg/m³ or ppm</td>
<td>921</td>
</tr>
<tr>
<td>Range 2: 0 to ... mg/m³ or ppm</td>
<td>922</td>
</tr>
<tr>
<td>SO₂</td>
<td>930</td>
</tr>
<tr>
<td>Range 1: 0 to ... mg/m³ or ppm</td>
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<tr>
<td>Range 2: 0 to ... mg/m³ or ppm</td>
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<tr>
<td>NO</td>
<td>940</td>
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<tr>
<td>Range 1: 0 to ... mg/m³ or ppm</td>
<td>941</td>
</tr>
<tr>
<td>Range 2: 0 to ... mg/m³ or ppm</td>
<td>942</td>
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<tr>
<td>Measuring component</td>
<td></td>
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<tr>
<td>H₂O</td>
<td>950</td>
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<tr>
<td>Range: 0 to ... Vol%</td>
<td>951</td>
</tr>
<tr>
<td>O₂</td>
<td>955</td>
</tr>
<tr>
<td>Range: 0 to ... Vol%</td>
<td>956</td>
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<tr>
<td>Measuring component</td>
<td></td>
</tr>
<tr>
<td>org. C_total</td>
<td>960</td>
</tr>
<tr>
<td>Range 1: 0 to ... mg/m³ or ppm</td>
<td>961</td>
</tr>
<tr>
<td>Range 2: 0 to ... mg/m³ or ppm</td>
<td>962</td>
</tr>
<tr>
<td>NH₃</td>
<td>965</td>
</tr>
<tr>
<td>Range: 0 to ... mg/m³ or ppm</td>
<td>966</td>
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<tr>
<td>Measuring component</td>
<td></td>
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<tr>
<td>CO₂</td>
<td>970</td>
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<td>Range: 0 to ... Vol%</td>
<td>971</td>
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<td>Measuring component</td>
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<td>975</td>
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<td>NO₃</td>
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<td>Measuring component</td>
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<td>HF</td>
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<td>Range: 0 to ... mg/m³ or ppm</td>
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<td>Heated sample line TBL01 length ... m (observe max. length)</td>
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<td>Special version</td>
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<tr>
<td>Software parameters</td>
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<tr>
<td>Results based on dry basis</td>
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<tr>
<td>Results normalized by O₂ value</td>
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<tr>
<td>Connection of an external analyzer to the heated sampling system (e.g. Mercury)</td>
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<tr>
<td>Daily drift check</td>
<td>450</td>
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<tr>
<td>Installation</td>
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<tr>
<td>Start up</td>
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<tr>
<td>Maintenance contract</td>
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<tr>
<td>System manual: German (1 pc free)</td>
<td>G31</td>
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<tr>
<td>System manual: English (1 pc free)</td>
<td>G32</td>
</tr>
<tr>
<td>Language for user interface: German</td>
<td>451</td>
</tr>
<tr>
<td>Language for user interface: English</td>
<td>452</td>
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<tr>
<td>Drawings (layout, piping and electrical) on CD-ROM (pdf-format)</td>
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<tr>
<td>Drawings (layout, piping and electrical) on CD-ROM (dwg-format)</td>
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<tr>
<td>Drawings (layout, piping and electrical) on CD-ROM (dxf-format)</td>
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ABB has Sales & Customer Support expertise in over 100 countries worldwide.

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