MERCEM300Z

Mercury gas analyzer

Trendsetting measurement of mercury in flue gases

- Reliable results of the actual measuring values of elemental Hg and Hg compounds in gases
- Very low operating expenses
- Minimum maintenance expenditure
- Long-term stability minimizes technician time requirements due to self-adjusting measuring system
- Measuring certainty using the fully automated adjustment with test gas
- Convenient and fast access for easy service and user-friendly remote diagnosis

Endress+Hauser

People for Process Automation

Proven measurement technology with reference character

Reliable measurement of mercury in flue gases is difficult and demands modern, innovative technology.

The MERCEM300Z offers reliable, accurate measurement where other measuring systems fail.

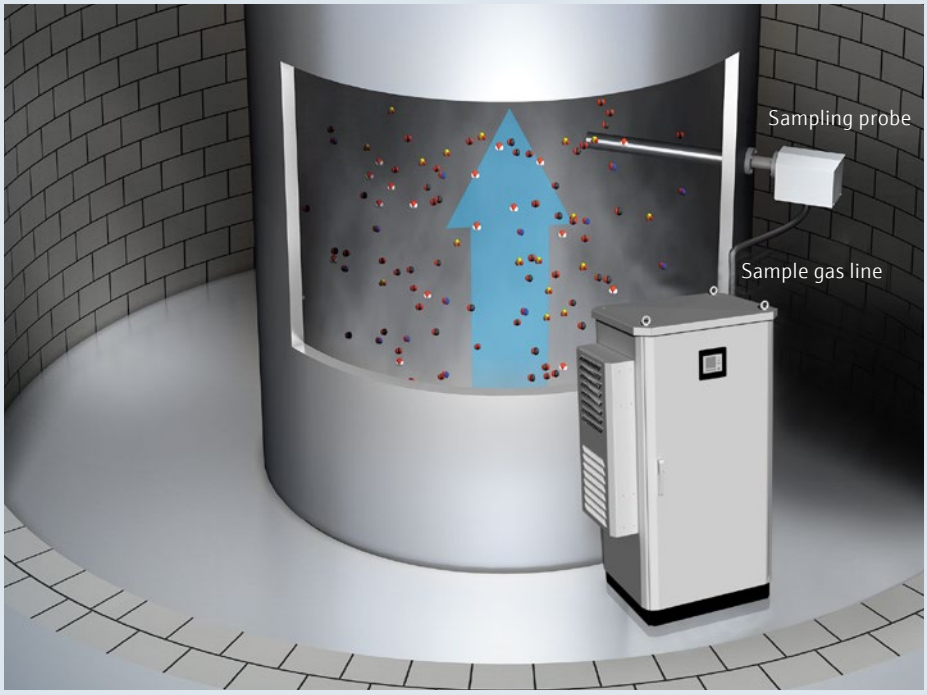
Mercury measurement challenges

Continuous mercury measurement in flue gases presents special demands on measuring systems. On the one hand, because Hg concentrations to be detected are factor 1000 smaller than other flue gas components. Very precise monitoring is required for limit values in the lower µg range. On the other hand, through reliable conversion of the chemically bound mercury to elemental mercury and adsorption effects on parts having media contact. Mercury analysis has been running successfully in waste incineration plants for many years. Measurement in cement and power plants is more difficult.

Hg emissions must be precisely monitored when secondary fuels are used. Continuous analysis systems are used in this case. Conditions existing in cement and power plants, such as high dust loads or high concentrations of interfering components SO_2, CO and CO_2, can result to conversion and measurement methods with unreliable results.

Our solution

We offer the best solution to attain measuring reliability and to avoid long downtimes, high maintenance effort and therefore high operating costs: MERCEM300Z for high precision mercury measurement.



MERCEM300Z measures hot extractive: The flue gas is extracted with a sampling probe and transported to the analyzer via a sample gas line. All components having contact with the sample gas, such as probe, sample gas line and converter in the analyzer, are heated to such a high temperature that no adsorption and no elution occur.

Reliable measuring technology thanks to a combination of conversion and photometers

With the MERCEM300Z gas analyzer, we have set a new standard hen it comes to analyzing mercury. No mercury leaks, no chemicals used – instead, we apply hot measuring technology, which has been proven over many years.

Measurement without moving parts – minimal maintenance

The production of the measuring gas is based on the low-maintenance ejector principle. What's more, taking the measurement itself does not require any moving parts. MERCEM300Z: The mercury gas analyzer characterized by its very low maintenance requirements and long maintenance intervals.

Drift check without expensive test gas

At the push of a button, the MERCEM300Z carries out a quick and effective drift check with an internal adjustment cell. Using test gas is not necessary.

Large variety of certified measuring ranges

The certified measuring ranges of the MERCEM300Z start from an extremely low 0 ... 10 µg/m³ reach 0 ... 45/ 100 µg/m³, which is the current requirement, and go right up to the unusually high 0 ... 1000 µg/m³. This range covers the requirements for both emissions and process measuring.

Internal test gas generator

To avoid the need for expensive test gases completely, an optional integrated test gas generator is available. With up to 3 predefined concentrations, this enables an automatic reference point check and adjustment (QAL3). This provides measurement certainty and means that money does not need to be spent on specialist technicians and costly, external testing equipment.

MERCEM300Z MODELS

MERCEM300Z Indoor
For measurements in air-conditioned rooms at temperatures from +5 … +35 °C (+41 °F to +95 °F)

Compact standard design for the installation in air-conditioned rooms. Possible to arrange additional cabinets on the left-hand side.

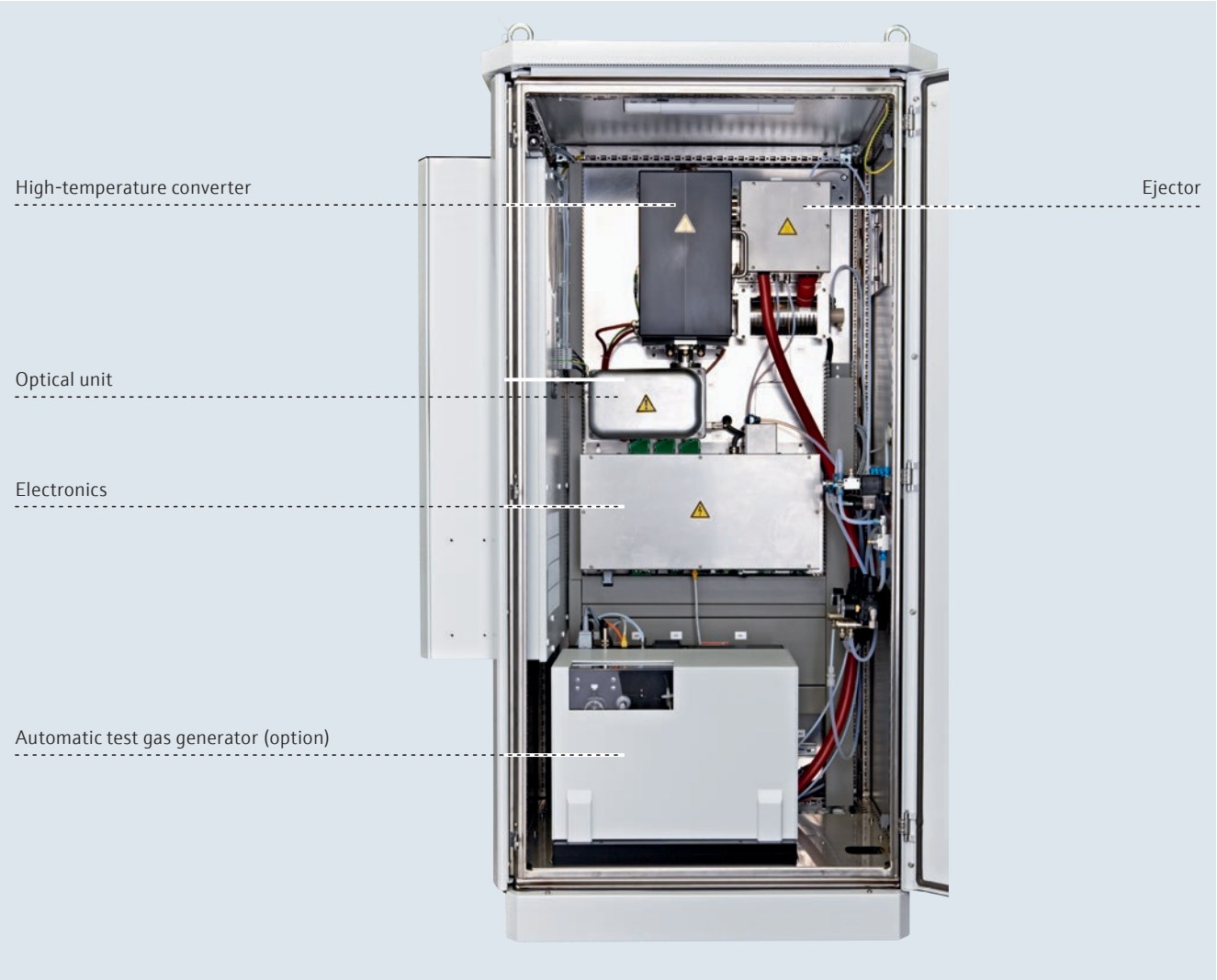
- Ambient temperature: +5°C … +35°C (+41 °F to +95 °F).

MERCEM300Z
For measurements outdoors at temperatures from −20 °… +50 °C (−4 °F to +122 °F)

Optimized industrial design for measurements in harsh ambient conditions near to where the sample is taken – with integrated air conditioning.

- Ambient temperature: −20°C … +50°C (−4 °F to +122 °F).

MERCEM300Z – proven industrial design



Hg conversion in high-temperature converter

Owing to the principles involved, mercury can only be measured in its elemental state. Therefore, it is essential to convert all mercury compounds to their elemental states before actually determining the Hg concentration. And this is where the key advantages of the MERCEM300Z really lie: The conversion is carried out using a purely thermal method, simply by using high temperatures of about 1,000 °C (1,832 °F) – no chemicals or non-durable.

Patented direct measurement: Photometric measurement direct in the hot converter

The highlight of the MERCEM300Z: The photometric determination of the mercury content occurs directly in the hot converter without the need to change the sample further. This makes the process fast and continuous, and ensures that the conversion rate is steady. This means that the overall Hg concentration in the flue gas can be determined reliably. Chemicals and catalyst materials are not necessary. This direct measurement, which is patented by , makes the MERCEM300Z a truly unique mercury gas analyzer. What's more, the resulting benefits make it exceptionally valuable for the operator.

Photometric measurement using the Zeeman effect

The MERCEM300Z measures the Hg concentration in flue gas photometrically by means of Zeeman atomic absorption spectroscopy (Zeeman AAS): An Hg discharge lamp emits light in the element-specific wavelength. A strong magnetic field generated around the lamp splits the spectral line into several components which form the measuring and reference wavelengths simultaneously (Zeeman effect). The advantage here is that there are no moving parts and that cross sensitivities, lamp deterioration, and contamination are compensated for directly.

MERCEM300Z – PREDESTINED FOR FLUE GAS MEASURING

Mercury is attracting more and more attention globally when it comes to monitoring emissions. Plant operators are faced with increasingly large challenges thanks to new annual limits in Europe and new legislation on measuring mercury in cement plants and coal-fired power plants in the USA.

In many cases, the permitted limits for flue gases are already below 10 µg/Nm³. Power plants, incineration plants, or cement kilns, which use fossil fuels or household goods as a fuel must all take responsibility.

The fuel used, e.g., lignite or bituminous coal in power plants or waste materials in waste incineration plants, is almost solely responsible for mercury entering the process. While in power plants, the level of mercury emissions is almost constant, these emissions fluctuate greatly at waste incineration plants due to the non-uniform distribution of mercury in the fuel.

However, the same requirement applies to all types of plants: In order to comply with the new limits, it is vital to invest in an optimized gas cleaning system and in even more accurate emission measuring technology. The flue gas cleaning units in the majority of existing plants do not have a cleaning stage designed specifically for mercury. As a result, an increasing number of other options are used to discharge mercury from the process, e.g., adding doped activated carbon upstream of the electrostatic precipitator or adding precipitating agents in the washer. Measuring the mercury in the raw gas, upstream of the washer or the electrostatic precipitator, offers significant benefits.

Plant safety

If high concentrations of mercury are present in the process over an extended period of time, this can cause the flue gas washer to become overloaded with mercury and can ultimately lead to the entire plant becoming contaminated. In the worst case scenario, this could bring the whole plant to a standstill. This can be avoided if high concentrations of mercury are detected in the raw gas using an accurate measurement at an early stage

Cost optimization

The use of activated carbon and precipitants to remove mercury from the process is expensive. For safety reasons, both are often fed into the process in excess. Hg measurement in the raw gas makes it possible to determine the required quantity of activated carbon and precipitant more precisely and thus save costs.

Complying with the Hg limits in clean gas

To be compliant with the new, lower emissions limits, it is vital to respond at process level. Measuring mercury in the raw gas and implementing the appropriate countermeasures in the process can ensure that the emissions limits are not exceeded.

Higher requirements in raw gas

The requirements for continuous mercury measuring systems in raw gas are significantly higher in comparison to measuring emissions:

- Higher dust loads up in flue gas
- Higher concentrations of interference components (such as SO_2 or HCl)
- Accurate detection of mercury concentration peaks (Hg peaks) up to the mg range
- Fast response times to

In the gas conditioning process, the mercury must be converted into metallic mercury safely and reliably as, if this conversion is not done correctly, this leads to results which are too low and therefore a less accurate measurement of the total mercury. At the same time, suitable processes must be implemented in order to compensate for the increased gas concentration of the cross sensitivity components. This is where an almost continuous measurement with an additional amalgamation process step is also not enough as it does not respond to possible Hg peaks quickly enough. The MERCEM300Z mercury gas analyzer offers considerable benefits thanks to its use of Zeeman absorption spectroscopy (Zeeman AAS). It is even possible to compensate for high concentrations of contaminants continuously and immediately by using this technology. The patented direct measurement enables immediate detection of Hg raw gas concentrations in the thermal converter, meaning that you can respond to fluctuating concentrations at an early stage.

For some operators, it is currently sufficient to measure the trends for Hg concentrations in the raw gas. A key factor here is the simultaneous monitoring of several plants. We also provide the ideal solution for this: With the optional measuring point switchover, up to two measuring points can be operated with one gas analyzer. It is possible to switch between the measuring points manually or in parametrized cycles if this is requested by the customer.

MERCEM300Z
Innovative measurement of mercury in flue gases

Product description

The MERCEM300Z mercury measuring system monitors Hg emissions in flue gases with high reliability within the smallest measuring ranges. Due to its rugged housing, MERCEM300Z is suitable for use in harsh industrial environments. The complete extractive system is designed to meet national and international regulations and directives.

At a glance

- Accurate measurement of “total mercury” directly in a thermal converter (patented)
- Measuring operation without using consumables
- Very low maintenance gas sampling using an ejector pump – no moving parts
- Integrated adjustment cell for automatic drift correction
- Automatic adjustment of the entire measuring system with a built-in test gas generator (optional)
- Modular design with the entire system

Your benefits

- Reliable results of the actual measuring values of elemental Hg and Hg compounds in gases
- Very low operating expenses
- Minimum maintenance expenditure
- Long-term stability minimizes technician time requirements due to self-adjusting measuring system
- Measuring certainty using the fully automated adjustment with test gas
- Convenient and fast access for easy service and user-friendly remote diagnosis

Fields of application

- Emission monitoring in incineration of domestic and hazardous waste
- Emission monitoring in combustion of sewage sludge or hospital waste
- Emission monitoring in cement plants
- Emission monitoring in power stations

More Information online
For more information, enter the link or scan the QR code to get direct access to technical data, operating instructions, software, application examples, and much more.
www.endress.com/mercem300z

Technical data

The exact device specifications and performance data of the product may deviate from the information provided here, and depend on the application in which the product is being used and the relevant customer specifications.

MERCEM300Z

Measured values	Hg
Performance tested measurands	Hg
Measurement principles	Zeeman atomic absorption spectroscopy
Gas flow rate	150 l/h ... 400 l/h (39.63 gal/h ... 105.67 gal/h)
Measuring ranges	
Hg	0 ... 1 ppb / 0 ... 100 ppb
Certified measuring ranges	
Hg	0 ... 10 µg/m³ / 0 ... 45 µg/m³ / 0 ... 100 µg/m³ / 0 ... 1,000 µg/m³
Sensitivity drift	< 3 % within the maintenance interval, relative to measuring range full scale
Zero point drift	< 3 % within the maintenance interval, relative to measuring range full scale
Detection limit	< 2 % relative to measuring range end value
Process temperature	≤ +1,300 °C (2,372 °F)
Process pressure	850 hPa ... 1,100 hPa (39.63 gal/h ... 105.67 gal/h)
Ambient temperature	MERCEM300Z: –20 °C ... +50 °C (–4 °F to +122 °F) MERCEM300Z Indoor: +5 °C ... +35 °C (+41 °F to +95 °F)
Storage temperature	–20 °C ... +40 °C (–4 °F to 104 °F)
Ambient pressure	850 hPa ... 1,100 hPa
Ambient humidity	≤ 80 %; relative humidity; non-condensing
Conformities	EN 14181 EN 15267 2001/80/EC 2000/76/EC
Electrical safety	CE
Enclosure rating	MERCEM300Z: IP 55 MERCEM300Z Indoor: IP 43
Analog outputs	2 outputs: 0/4 ... 20 mA, 500 Ω Electrically isolated; additional outputs if using I/O modules (option)
Digital outputs	4 relay contacts: 50 V, 4 A Electrically isolated; additional outputs if using I/O modules (option)
Digital inputs	4 inputs: 24 V, 0.3 A Electrically isolated; additional outputs if using I/O modules (option)
Interfaces	CAN (internal system bus) Ethernet
Bus protocol	Modbus TCP
Indication	LC display
Input	Functional keys
Operation	Via LC-display or software SOPAS ET
Model	Aluminium cabinet
Dimensions (W x H x D) MERCEM300Z with cooling device MERCEM300Z Indoor	 1,038 mm x 1,744 mm x 744 mm (40.87" x 68.66" x 29.29") 806 mm x 2,156.5 mm x 605 mm (31.73" x 84.90" x 23.82")
Weight	250 kg (551.16 lbs)

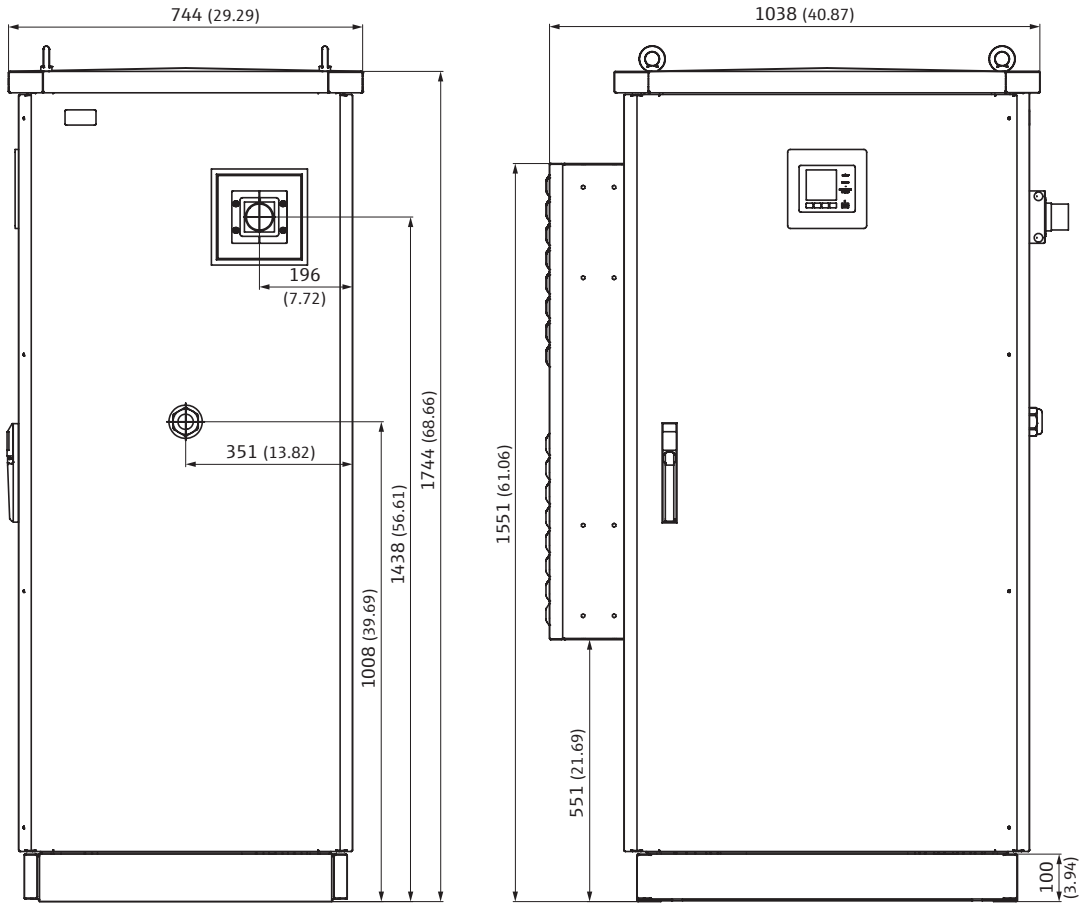
Power supply	
Power consumption	Without integrated test gas generator ≤ 2,100 W With integrated test gas generator ≤ 3,100 W
Auxiliaries	
Instrument air:	≤ 2,500 l/h (660.43 gal/h); 6 ... 7 bar (87.02 psi ... 101.53 psi); particle size max. 1 µm; oil content max. 0.1 mg/m³; pressure dew point max. −30 °C (+10 °F.)
Test gas:	≤ 500 l/h (132.09 gal/h); max. 0.5 bar (7.25 psi); accuracy ±2%; water content 5 ... 30 vol.-%
Sample connections	Sample gas inlet: Swagelok 6 mm (0.24")
Auxiliary connections	Test gas: Swagelok 6 mm (0.24") Instrument air: Swagelok 10 mm (0.39") Exhaust gas outlet: Swagelok 10 mm (0.39")
Corrective functions	Internal adjustment cuvette Integrated test gas generator (option) Drift correction (QAL3) and check of the complete system
Integrated components	Integrated instrument air conditioning (option) Integrated test gas generator (option)

Ordering information

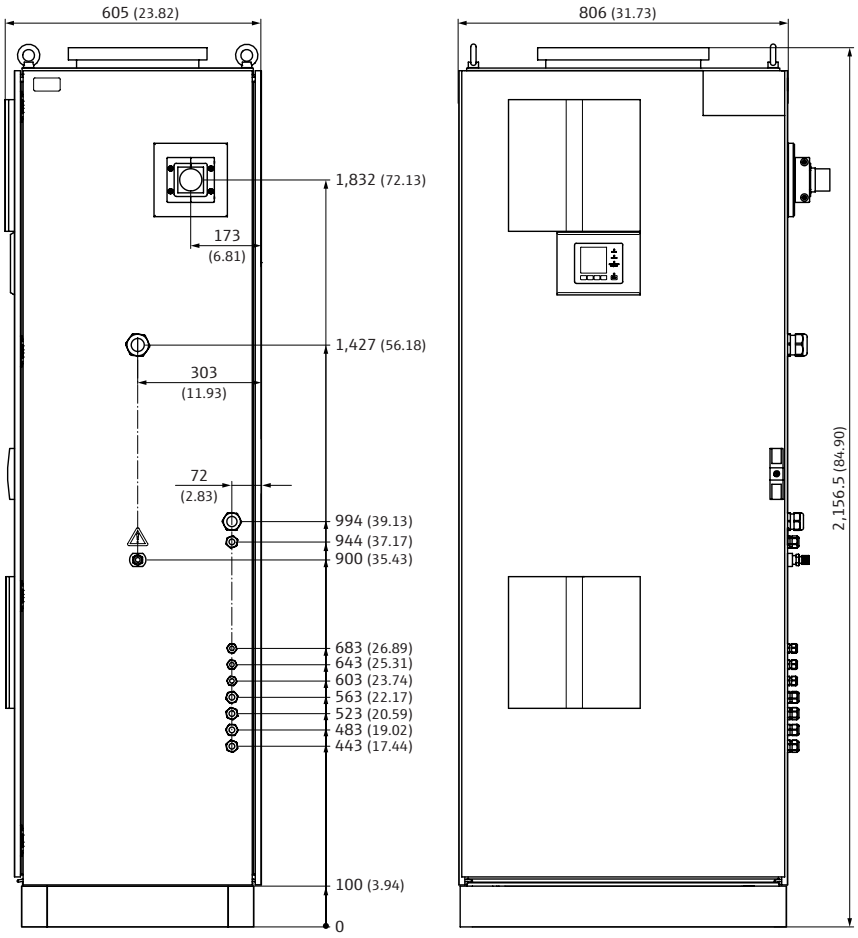
Our regional sales organization will help you to select the optimum device configuration.

Dimensional drawings

MERCEM300Z (dimensions in mm (inch))



MERCEM300Z Indoor system (dimensions in mm (inch))



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