

Employer
SAKO BRNO A.S.

Project
High-efficient combined heat and power facility utilizing renewable sources (OHB II - line K1)

Date
February 2021

PART III, APPENDIX 14.5A **MEASUREMENT** **CONNECTIONS, FLUE GAS /** **AIR SYSTEM**



**PART III, APPENDIX 14.5A
MEASUREMENT CONNECTIONS, FLUE GAS / AIR SYSTEM**

Project name **High-efficient combined heat and power facility utilizing renewable sources
(OHB II - line K1)**
Version **1**
Date **2021-02-25**
Documentation **Procurement documentation – Part III – Employer’s Requirements**

Ramboll
Hannemanns Allé 53
DK-2300 Copenhagen S
Denmark

T +45 5161 1000
F +45 5161 1001
www.ramboll.com/energy

CONTENTS

1.	General	2
1.1	Introduction	2
1.2	General	2
2.	Pressure Measurements	3
2.1	General	3
2.1.1	Measuring tap	3
2.2	Measuring arrangement	4
2.2.1	Valves	4
2.2.2	Differential Pressure Measurements	4
3.	Temperature Measurements	6
3.1	General	6
3.2	Measuring Point	6
3.2.1	Measuring Tap	6
3.2.2	Protective Pockets	7
3.3	IR Measurements	7
4.	Measuring Quantity via Differential Pressure Measurements	8
4.1	Input and Output Sections	8
4.2	Building-in of Venturi Ducts	8
4.3	Measuring Point	8
4.3.1	Venturi Duct	8
4.3.2	Taps	8
4.3.3	Shut-off Valves	9
4.4	Flue Gas Flow Measurements	9

1. GENERAL

1.1 Introduction

This specification provides requirements for the mechanical design of the connection for measuring equipment to the process equipment.

This specification covers connection of pressure, differential pressure and temperature, including flow and level measurement based on differential pressure measurements.

The design of other measuring connections shall be agreed with the Employer.

1.2 General

All parts shall be designed according to the media and design data for the ducts, on which they are mounted.

If it is not possible to establish a representative measurement at a single measuring point, the necessary number of measuring taps for set-up of a network measurement shall be established.

Detailed design of measuring taps shall be approved by the Employer.

Appropriate number and arrangement of measuring sensors to achieve a representative average value, when measuring on a duct with a certain temperature/flow profile, has to be decided in accordance with relevant standards.

Primary measurements i.e. measurements which will lead to plant shutdown, compromise personnel safety, plant security or environmental security, shall be carried out with 3 separate measuring points. In case of pressure-based measurements, the provision of interlocking arrangements shall guard against simultaneous shut-off of 2 measurements.

In pressure systems and in places where later installation is difficult, measuring points for temperature shall be installed by means of protective pockets. This shall facilitate the exchange of temperature sensor during operation of the process.

Measuring points shall be established in such a way that it is possible to inspect, clean, purge, exchange, measure and calibrate the instruments during operation of the plant.

Locations that requires use of ladders or similar are not allowed. If needed there shall be established a platform with an associated staircase or ladder. In case it is not possible to establish a permanent platform, this must be specifically agreed with the Employer prior to construction.

The placement of measurement points must take into account sufficient space for mounting / replacement of instrument, cleaning and other servicing. As a basis a minimum of 500 mm to nearest obstacle is required.

Key words for the design setup shall be redundancy, maintenance and on-line calibration.

2. PRESSURE MEASUREMENTS

2.1 General

Impulse tube connections to gas duct shall not be placed closer to each other than 300 mm.

The connected fittings, pipes and connections shall be made of non-corrosive material like stainless steel 1.4571. Impulse tubes shall be welded and made of a suitable material.

The measuring point shall be positioned as agreed with the Employer, so it is possible to carry out mounting of instruments according to the instructions.

Measuring points shall have primary and secondary shut-off valves and snap action couplings for calibration.

2.1.1 MEASURING TAP

The total length of the measuring tap shall be adjusted to the thickness of the insulation, so the primary shut-off valve is positioned approx. 100 mm away from the insulation as shown on Figure 1.

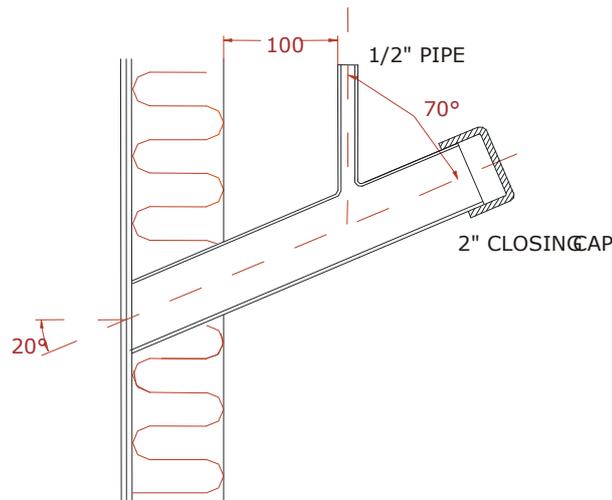


Figure 1 Design of measuring tap for pressure measurements.

The tap shall be positioned well away from bends and other obstructions to avoid faulty measurements due to dynamic pressure.

The tap shall have a smooth transition to the inside of the duct.

All measuring taps in the flue gas system shall be set up as combined measuring and cleaning taps allowing for blow-through.

All measuring taps must be insulated to prevent corrosion.

In places, where SO₃ is emitted, there shall be made special arrangements for insulation, and heated scavenging air shall be made inducible into the tap.

The Contractor must ensure that the pipe stud is elevated all the way from the tap to the primary shut-off valve.

The tap diameter shall be agreed with the Employer.

2.2 Measuring arrangement

The fundamental design of the process connection is shown in Figure 2. The Primary Shut-off Valve shall be a spherical valve with a ½" inside pipe thread. The secondary shut off valve shall be a gauge valve with separate test connection according to DIN 16272.

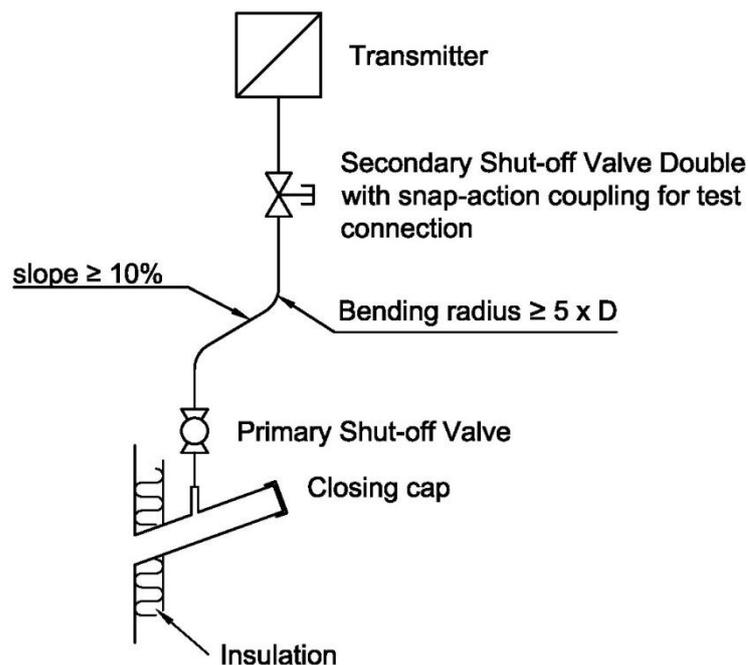


Figure 2 Design of process connection for pressure measurements.

2.2.1 VALVES

The primary shut-off valve shall be mounted as close to the measuring tap as possible.

For calibration purposes there shall be established a secondary shut-off valve with a snap-action coupling.

The valves shall be in dimension DN15, of the ball valve type with a ½" female pipe thread connection. Make and type shall be approved by the Employer.

All valves must be reachable from galleries without using ladders.

2.2.2 DIFFERENTIAL PRESSURE MEASUREMENTS

The measuring arrangement shall be furnished with two connected measuring taps with connecting pipes and shut-off valve positioned between the secondary shut-off valves as shown on Figure 3.

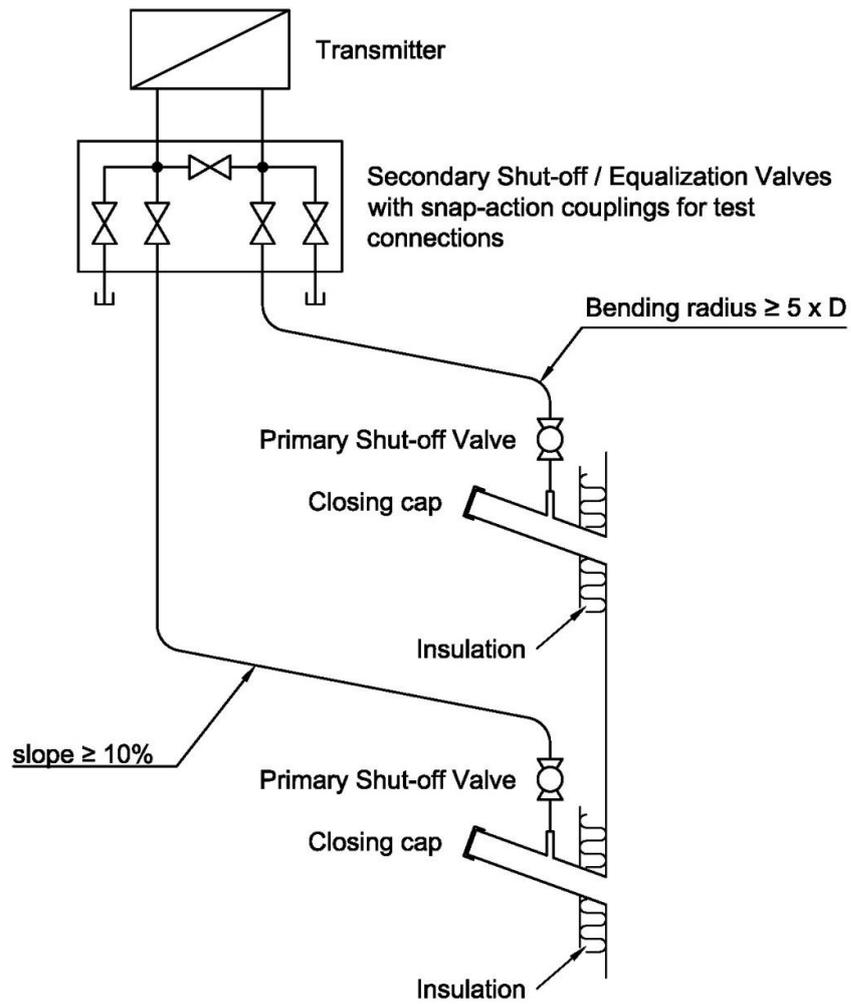


Figure 3 Full design of pressure measurements.

3. TEMPERATURE MEASUREMENTS

3.1 General

Temperature measurements shall be carried out as double measurements. In addition, there shall be placed an extra tap for control measurements. When taking special/important measurements or making comprehensive duct cross sections - the number of sensors shall be increased.

3.2 Measuring Point

The measuring point shall be equipped with complete flange sensor as shown on Figure 4. The measuring point shall be positioned, so that the sensor can be retracted and is accessible during operation without dismantling of insulation.

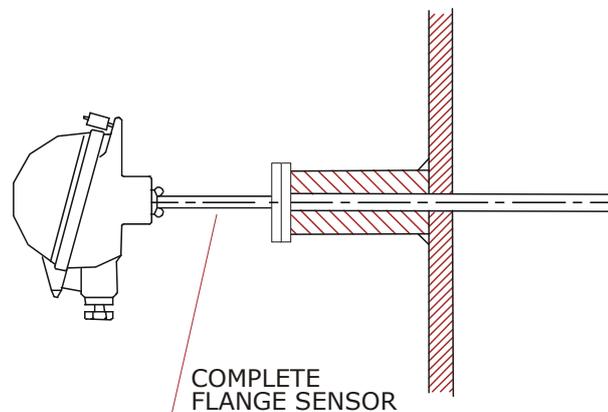


Figure 4 Measuring point equipped with complete flange sensor.

3.2.1 MEASURING TAP

The total length of the measuring tap shall be adjusted, so that the tap ends approx. 50 mm outside the insulation. If the transmitter is built into the sensor head, the above-mentioned distance shall be increased to a minimum of 100 mm.

The tap shall be set up for mounting of a screw-in sensor, a plug-in sensor, or a flange sensor.

Which type of sensor that is suitable for precise measurement shall be determined in co-operation with the Employer.

The entire flue gas system shall be equipped with flange sensors. Taps for thermo-elements shall be designed as a 3" pipe closed by a flange, so that it is made possible to carry out manual cleaning in case of blocking.

In places, where SO₃ is emitted, there shall be made special arrangements for insulation.

Taps mounted on screw-in sensors shall be closed by a ½" inside pipe thread and a washer.

Taps mounted on plug-in sensor shall be designed as DN50 pipes closed by a DN50 flange.

3.2.2 PROTECTIVE POCKETS

When using long protective pockets, there may be a need to install a support pipe to support the pocket.

3.3 IR Measurements

IR measuring units shall be equipped with quartz glass guards and made ready for servicing during operation of the plant.

Measuring method, positioning, and further instructions regarding set-up/design shall be commented by the Employer.

4. MEASURING QUANTITY VIA DIFFERENTIAL PRESSURE MEASUREMENTS

The conditions below only include measurements using a Venturi duct.

Measuring points shall have primary and secondary shut-off valves and snap action couplings for calibration, as shown and described in Section 2 *Pressure Measurements*.

4.1 Input and Output Sections

Input and output shall be designed according to the latest version of ISO 5167.

4.2 Building-in of Venturi Ducts

The building-in is normally carried out horizontally or vertically.

4.3 Measuring Point

4.3.1 VENTURI DUCT

The venturi duct shall be designed according to ISO 5167. Each measuring point shall comprise four pressure taps combined in common equalising tanks.

The pressure taps shall be equipped with shut-off valves and blow-through valves as shown in Figure 2. The shut-off valves shall be positioned near the equalising tanks.

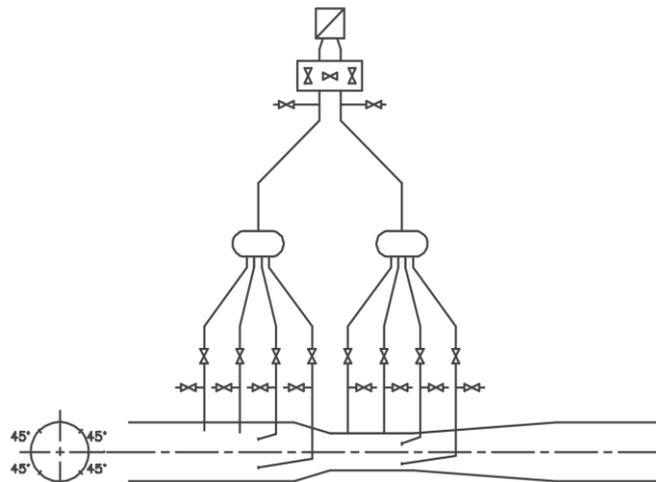


Figure 5 Design of Venturi ducts.

4.3.2 TAPS

The total length of the taps shall be adjusted to the thickness of the insulation, so that the primary shut-off valves are positioned approx. 100 mm from the insulation.

4.3.3 SHUT-OFF VALVES

The requirements for shut-off valves are the same as the requirements stated in Section 2.2.1 *Valves* of this Appendix.

4.4 Flue Gas Flow Measurements

Flue gas flow measurements shall meet the requirements below.

Flow sensors shall be placed 120° apart on the circumference of a given point on the flue gas duct.

Each flue gas flow measurement shall employ three ultrasound contrapropagating transit-time flow sensors.

The Contractor shall include the calibration using a calibration method with a higher measuring accuracy than the flue gas flow sensors.