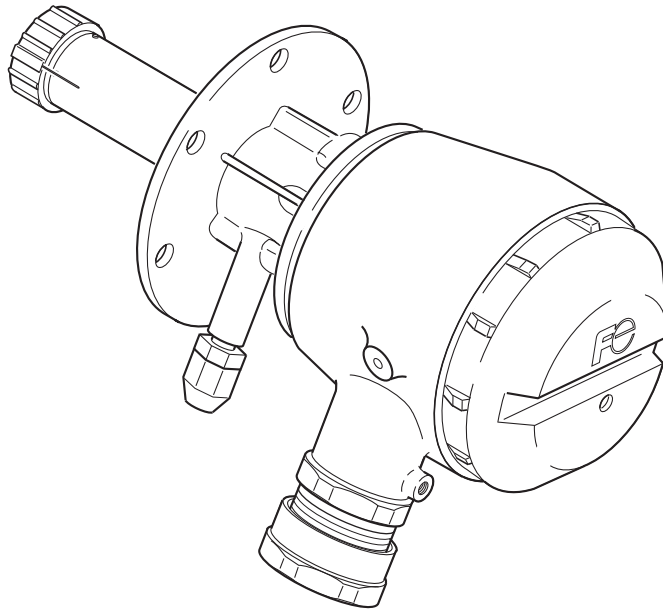




Instruction Manual

THE DIRECT INSERTION TYPE ZIRCONIA OXYGEN ANALYZER

DETECTOR TYPE: ZFK2
 ZFK5



PREFACE

Thank you very much for your kind purchase of Fuji's zirconia oxygen analyzer detector (Type ZFK 2,5).

- Read this instruction manual carefully to get a thorough understanding of how this zirconia oxygen analyzer works prior to installing, operating and maintaining the zirconia oxygen analyzer.
If abused, unnecessary troubles or failure could occur.
- The specification of this zirconia oxygen analyzer may be subject to change without previous notice for improvements of the product.
- Under no circumstances should this zirconia oxygen analyzer be modified without permission.
If any trouble should occur because of having been modified without permission, we won't be responsible for it anyway.
- This instruction manual should be kept in custody by a person who operates the zirconia oxygen analyzer actually.
- After reading this manual, it should always be kept in a place which allows the person who operates it to refer to any time as required.
- A due consideration should be given so that this instruction manual is delivered to a final user certainly.

Manufacturer : Fuji Electric Instrumentation Co., Ltd.
Type : Described in the nameplate put on the main body
Date of manufacture : Described in the nameplate put on the main body
Product nationality : Japan

Related instruction manuals

Zirconia oxygen analyzer converter (Type : ZRM)INZ-TN1ZRM
Zirconia oxygen analyzer converter (Type : ZRY)INZ-TN1ZRY
Direct insertion type zirconia oxygen analyzer-use ejector (Type : ZTA).....INZ-TN1ZTA

NOTE

- It is prohibited to transfer a part or all of the contents of this manual without permission.
- The contents of this manual may be subject to change in future without previous notice




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SAFETY PRECAUTIONS

Prior to operating this analyzer, read this “Safety precautions” carefully for correct use.

- In the precautions shown here, important contents on safety are included. So, be sure to observe them. The safety precautions have been ranked into “DANGER” and “CAUTION”.

 DANGER:	<p>If this apparatus is abused, a dangerous condition could come about and it is supposed to die or get a serious injury.</p>
 CAUTION:	<p>If the apparatus is abused, a dangerous condition could arise and it is supposed to get about medium injury or a minor injury and a physical damage is supposed to occur.</p>
 PROHIBITION:	<p>This indicates a prohibition (act which must not do).</p>

<p>Precautions used in mounting and wiring</p>	
 DANGER:	<ul style="list-style-type: none"> • This product is not made with an explosion-proof specifications. Don't use it in an explosive gas atmosphere. Otherwise, irreparable troubles including explosion or a fire could occur.
 CAUTION:	<ul style="list-style-type: none"> • Install this product in a place compatible with the conditions set forth in “instruction manual”. The use at a place not conforming to the installation conditions may result in an electric shock, a fire and incorrect operation. • When this product is mounted on a furnace which is under operation, take utmost care with blow-out from the furnace. It might get a burn. • In the case of the wiring work, be careful not to drop foreign matters including wire chips into the product. Otherwise, a fire, failure or malfunction may result. • Connect a power source compatible with the specified rating. Connection of power source different from the rating might cause a fire. • Before doing the wiring work, be sure to turn off the main power. Otherwise, it results in getting an electric shock as the case may be. • Use proper wiring materials according to the rating of apparatus. If a wiring material which is not bearable to the rating is employed, it might cause a fire.
 PROHIBITION:	<ul style="list-style-type: none"> • Never do the work at a place where rain water splashes the product directly. A failure to observe this instruction may result in getting an electric shock or failure.

Precautions used in operation, stop, maintenance and check



DANGER:

- In case where combustible gas is contained in the measured gas, check the gas composition and specifications carefully before using. Otherwise, the original performance is not displayed, and there is a fear of explosion.



CAUTION:

- Do the work in a condition where the main power has been turned off. If the work is done while current is flowing, there is a fear of getting an electric shock.
- The operating temperature of the detector (tip of ceramic heater) is about 800 °C and the surface temperature is also very high. So, never touch the detector by bare hand.
Otherwise, there is a fear of getting a burn.
- Before cleaning the flow guide tube, turn off the main power and cool the tube down fully.
There is a fear of getting a burn.
- Don't use any other renewal part than those designated by the maker. Otherwise, the original performance is not fully displayed and a trouble or failure may result.
- Dispose of the renewal parts such as the maintenance parts as an incombustible article.



PROHIBITION:

- Never do the work at a place where rain water splashes the product directly. A failure to observe this instruction may result in getting an electric shock or failure.

Other precaution



CAUTION:

- For a failure which cannot be judged even if referring to the instruction manual, be sure to ask the nearest dealer or Fuji adjustment serviceman for repair. If disassembled without a thought for the outcome, an accident or injury could result.

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1. INTRODUCTION

1.1 General description of zirconia oxygen analyzer

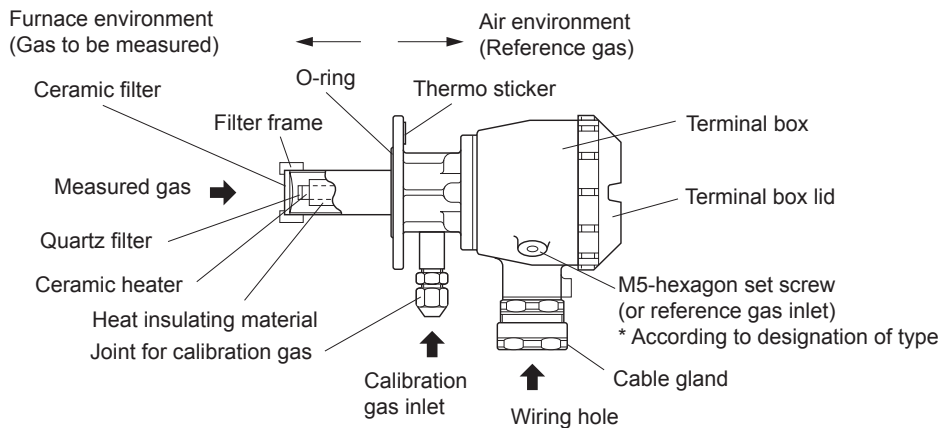
This zirconia oxygen analyzer makes use of conductivity that a solid electrolyte composed mainly of zirconia (ZrO_2) allows only oxygen ion to pass through at high temperature. This is an oxygen sensor which measures an electromotive force produced by difference in oxygen concentration between gas to be measured and reference air based on the principle of oxygen concentration cell. It is possible to measure the oxygen concentration with high accuracy by combining with a converter (Type: ZRM) or (Type : ZRY).

1.2 Description of each component

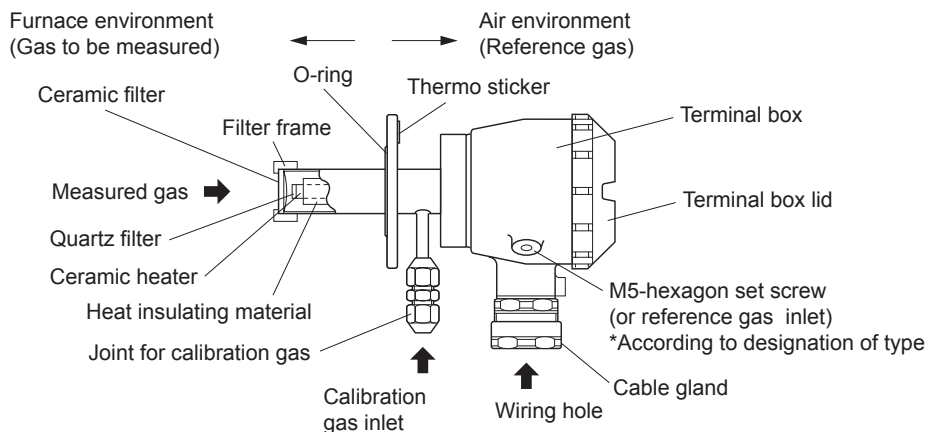
CAUTIONS

- The operating temperature of detector (tip of ceramic heater) is about 800°C and the surface temperature is also very high. So, never touch it by bare hand. Otherwise, there is a fear of getting a burn. Especially when a ceramic filter at the end of the detector is replaced, take utmost care.

(1) ZFK2



(2) ZFK5



Caution in handling

- Since the detector is made of porcelain of zirconia, there is a case where it breaks due to drop or impact. So, be sufficiently careful.
- The detector is unusable for a plant in which water droplets might run down inside a sampling pipe.
- There is no need to remove M5-hexagon set screw of the terminal box unless otherwise a reference gas inlet is used. Don't loosen the screw without thought since a waterproofing effect becomes zero.

1.3 Check of type

The name of type has been put in the specification name-plate. Make sure it is as ordered.
Refer to Item 8.2 “Desingation of type”.

1.4 Check of delivered articles

Make sure the following articles have been delivered without lack.

Description		Q'ty	Remark
Detector		1 unit	Confirmed in Item 1.3
Instruction manual (this manual)		1 copy	INZ-TN4ZFK2
Accessories (per unit)	O-ring (Viton P36)	1 pc.	See Item 2.2.1.
	Mounting screw, plain & spring washer (M5)	6 pcs each	See Item 2.2.1.
	Thermo sticker	1 sh.	See Item 2.2.1.
	Ceramic filter	1 sh.	See Item 6.2.3.
	Flow guide tube	(*)	See Item 2.2.2 and 2.2.3.
	Heat insulating cover	(*)	See Item 2.3.
	Inner (Pipe joint, accessory)	1 pc.	See Item 3.1.
	Reference gas inlet	(*)	See Item 3.3.

(*): According to “8.2 Designation of type”

2. MOUNTING

2.1 Mounting location



DANGER

- This product has no explosion-proof specification. Don't use the product in an explosive gas environment. If used, a serious trouble such as a fire or explosion might occur.



CAUTIONS

- Install this product at a place compatible with the following conditions. The use of it at a place not conforming the installation conditions specified in this manual could cause an electric shock, a fire or incorrect operation.

Mount the detector by selecting the places shwon below:

- 1 Place where there is a space which allows doing daily check and wiring work
- 2 Place where there is little vibration, dust and humidity
- 3 Place where peripheral air environment is non-corrosive.
- 4 Place where there are no electric appliances producing noise trouble (e.g., motor, transformer and appliances bringing about electromagnetic induction trouble and electrostatic induction trouble) nearby the detector
- 5 Place where ambient temperatue and humidity are -10 to +60°C and less than 95%RH .

2.2 Mounting method



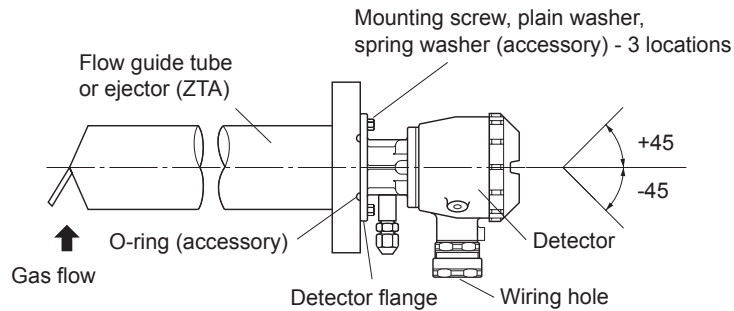
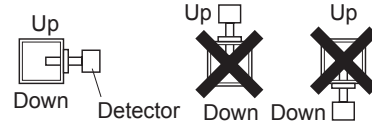
CAUTIONS

- When mounting the detector on a furnace which is under operation, take utmost care about the blowout from the furnace; otherwise, there is a fear of getting a burn.

2.2.1 Mounting method of detector

Caution in mounting

- Never mount the detector with the tip turned upward or downward. A failure of the detector may result.



- 1 Fitting O-ring (accessory) into a groove of the detector flange, use a plain washer and spring washer (both of which are an accessory) for the mounting screw and mount on the flange of flow guide tube or ejector (ZTA) at 3 locations (any desired 3 locations in 6 mounting holes).
- 2 Install so that the detector becomes a range of $\pm 45^\circ$ relative to a horizontal plane.
- 3 Mount so that the wiring hole of detector comes to downside.
- 4 Keep the temperature of detector flange below 125°C , regardless of exhaust gas temperature.

<How to check>

- With the mounting, piping and wiring work of the detector completed, make sure the color of thermo sticker [125] put on the detector flange is not changing to red in the exhaust gas measuring condition (while current is flowing to the detector and the plant is under running). (Usually, the color of thermo sticker is light pink.)
- If the color has changed to red, it means that the temperature of detector flange has been over 125°C . So, take the following steps:
 - (a) Change the existing flange packing to a thicker one.
 - (b) Use a longer mating flange.
 - (c) Mount the flow guide tube according to Item "2.2.2".

By taking the above steps, minimize heat transfer from the gas duct wall and lower the temperature.

The thermo sticker does not return to its original condition once it discolors. So, after taking the steps, re-put a thermo sticker available as an accessory on the detector flange and make certain that it does not turn red. (For the part No. for additional procurement of the thermo sticker, refer to Item "6.4".)

2.2.2 Mounting method of flow guide tube

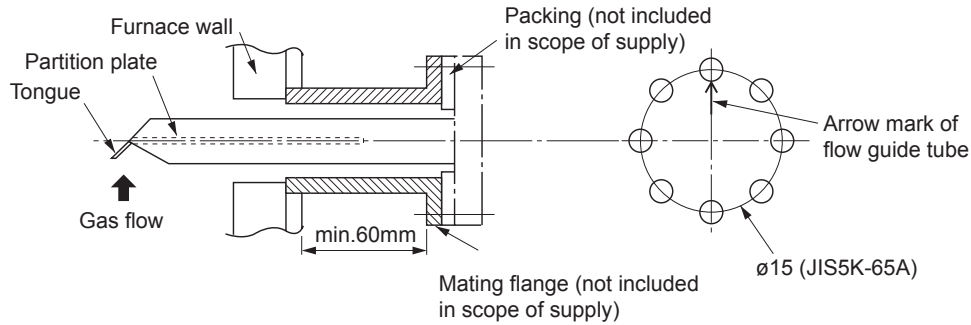
(Designation of type: When 9th to 11th digits are 5A□, 5B□ and 5C□)

The flange of flow tube has mounting holes at 8 locations. These holes are available for regulating an in-flow into the flow guide and mounting the tube correctly in the flowing direction of gas and it is enough if mounted at 4 locations.

(1) Direction of tongue and position plate of flow guide tube

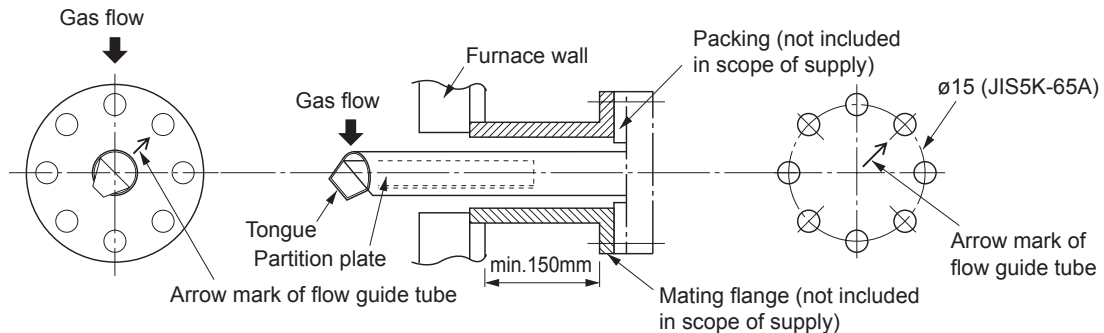
- 1 When exhaust gas temperature is under 200°C and gas flowing velocity is low

As illustrated below, set the partition plate inside the flow guide tube at a right angle to the gas flow and mount the tube so that the tongue turns to an upstream direction relative to the gas flow.



- 2 When exhaust gas temperature is 200°C or higher and gas flowing velocity is fast

As illustrated below, tilt the partition plate inside the flow guide tube 45° to the gas flow and mount the tube so that the tongue turns to a down-stream direction relative to gas flow.



(2) Inserting angle of flow guide tube

According to the temperature of exhaust gas and the amount of dust, the inserting angle of the flow guide tube differs. With reference to the following conditions, install a mating flange.

- 1 When exhaust gas temperature is under 200°C and amount of dust is under 0.2g/Nm³

(Designation of type: When 9th to 11th digits are 5A□)

- Inserting angle: within a range of -45 to +45°

- 2 When exhaust gas temperature is 200°C or higher and amount of dust is under 0.2g/Nm³

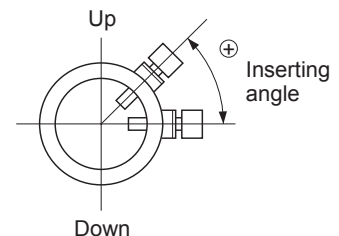
(Designation of type: When 9th to 11th digits are 5A□)

- Inserting angle: within a range of -20 to +20°

- 3 When amount of dust is over 0.2g/Nm³

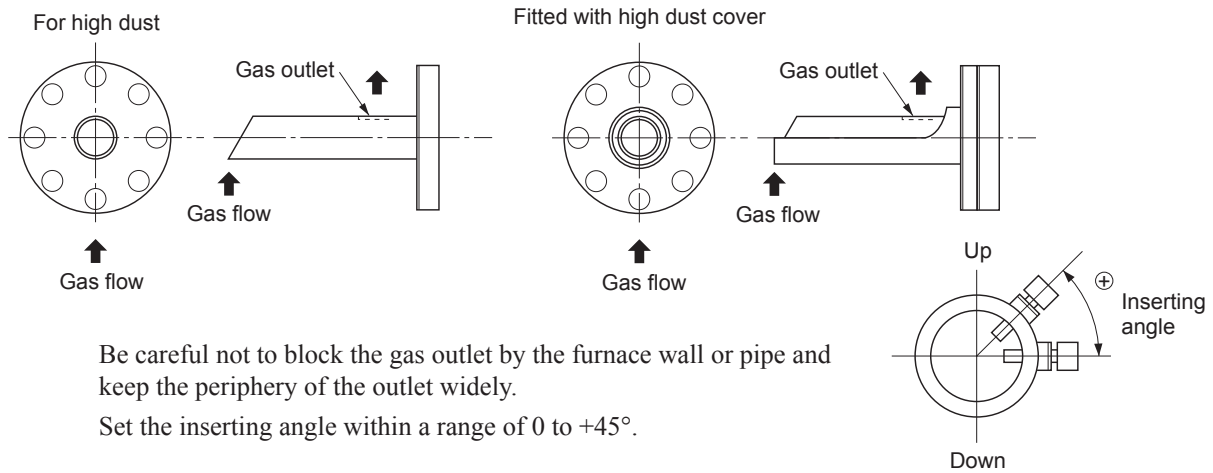
(Designation of type: When 9th to 11th digits are 5B□ and 5C□)

- Inserting angle: within a range of 0 to +45°



2.2.3 Mounting method of high dust-use flow guide tube (Designation of type : When 9th to 11th digits are 6D□ and 6E□)

Mount the tube so that the gas outlet turns downward relative to the gas flow as shown below.



Be careful not to block the gas outlet by the furnace wall or pipe and keep the periphery of the outlet widely.

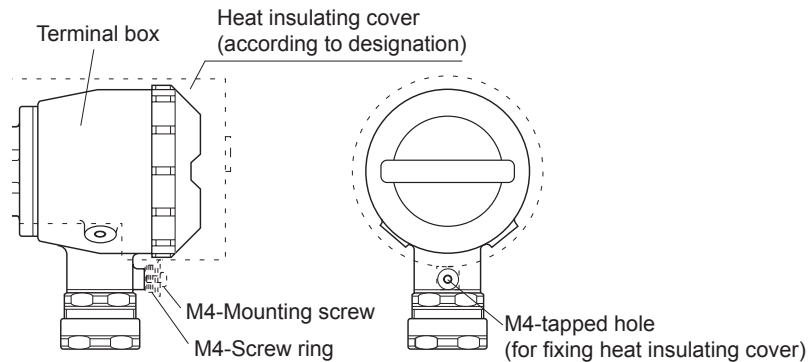
Set the inserting angle within a range of 0 to +45°.

2.3 Mounting of heat insulating cover

For using at a cold district, use a heat insulating cover.

(For the part No. for additional procurement of the heat insulating cover, refer to Item “6.4”).

- Put M4-mounting screw of the heat insulating cover into M4-heat insulating cover fixing tapped hole of the terminal box with M4-screw ring put between the tapped hole and screw.



- Do not use a heat insulating cover in the place where the temperature is high.

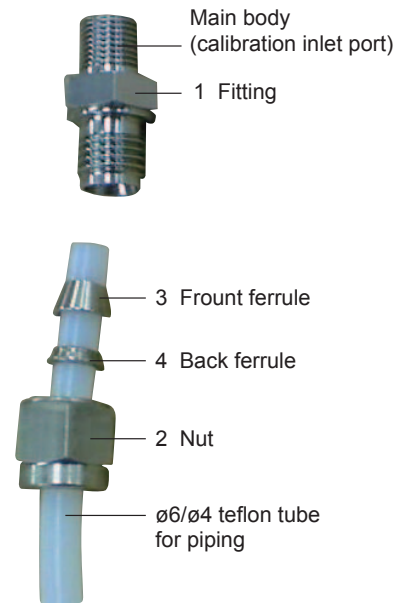
3. PIPING

3.1 Piping of calibration gas

As the piping material, use a teflon-made $\phi 6/\phi 4$ tube.

(1) ZFK2, 5

- From the fitting put up to the detector, 2 nut, 3 front ferrule and 4 back ferrule are removed, it passes through the $\phi 6$ teflon tube for the piping, and it installs it on the fitting.
- For mounting nut 2, tighten by making about 2 turns with a spanner after it cannot be turned any more by hand.



3.2 Piping for blow down air

Connect the blow air inlet (4 locations) of blowdown-fitted flow guide tube by detaching a plug of the upper-side blow port (1 location) so that drain does not accumulate.

For the blow piping, use a copper tube equivalent to larger than 15A SGP (tube having larger inside diameter) or $\phi 10/\phi 8$ teflon tube. And, use L-shape joint or union without bending the pipe wherever possible and keep the piping length as short as possible.

3.3 Piping of reference gas inlet

When installing at a place where the peripheral atmosphere is very dirty or when using at a place where humidity is very high, mount a reference gas inlet by arranging separately. (For the part No. for arrangement, refer to Item “6.5”.) When 13th digit of the type is A and B, the port is mounted before shipping. So, install the pipe referring to Item “3.3.2”.



CAUTIONS

- When used at an ordinary place (oxygen concentration : 20.6vol%), the reference gas is unnecessary. So, don't remove a hexagon set screw of the mounting port of reference gas inlet unnecessarily since a waterproofness becomes poor.

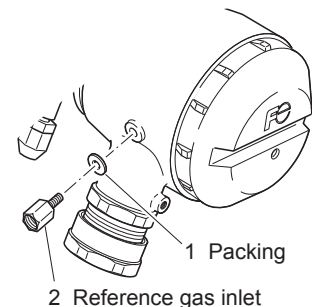
3.3.1 Mounting of reference gas inlet

Removing M5×10 hexagon set screw fitted to the mounting port of reference gas inlet by hexagon wrench (width across flat of 2.5mm), screw reference gas inlet 2 in with the attached packing 1 fitted to the reference gas inlet and tighten it securely with a spanner. (When 13th digit of the type is A and B, the port is mounted before shipping. So, proceed with the piping work in the succeeding Item 3.3.2.)

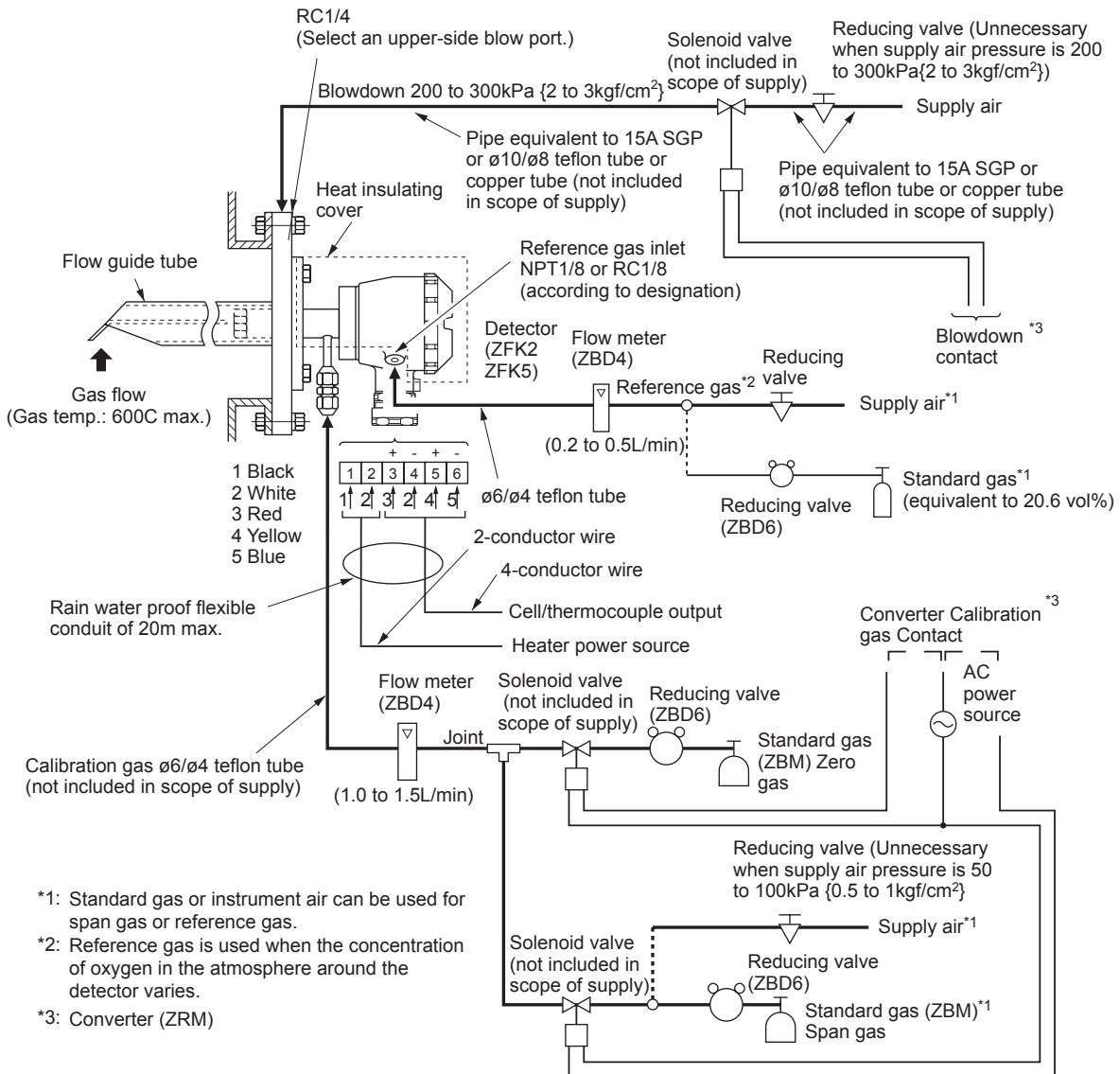
3.3.2 Piping

For the air whose oxygen concentration is 20.6vol%, connect a pipe to the reference gas inlet with NPT1/8 or Rc1/8 joint.

For the piping material, use $\phi 6/\phi 4$ teflon tube.



3.4 Piping drawing



4. WIRING

CAUTIONS

- In the case of the wiring work, be careful not to drop foreign matters including wire chips inside the product. Otherwise, this might cause a fire, failure or incorrect operation.
- Connect a power source compatible with the rating. Connection of a power source not conforming to the rating may cause a fire.
- Before proceeding with the wiring work, be sure to turn off the main power supply. Otherwise, there is a fear of getting an electric shock.
- As the wiring material, use a proper one conforming to the rating of apparatus. The use of a wiring material which is not bearable to the rating could cause a fire.

PROHIBITION

- Under no circumstances be the work done at a place where rain water splashes the product directly. Otherwise, an electric shock or failure may result.

4.1 Before wiring

Put a cable (6 conductors in all) connected between detector and converter into a conduit pipe terminal for protecting the cable. Also, put the cables for R thermocouple and element output away from the power cable to take a noise preventive step.

When an exclusive cable is not used, use the following wire rods:

- For heater (2 pcs.)3A or more in rating
- For R thermocouple Prescribed by JIS C 1610 (Equivalent to RCA2G-0.75mm²-S2)
- Recommended wire rod (at 20 °C)

		For heater	Element output compensation conductor
Composition	Nominal sectional area (mm ²)	0.75	
	Number of composed element wires/ diameter of element wire (mm)	30/0.18	
	Outside dia. (mm)	1.1	1.14
	Thickness of vinyl insulating material (mm)	0.6	
	Thickness of vinyl sheath (mm)	1.0	1.5
Max. conductor resistance per unit length (Ω)		24.4	—
Test voltage (V)		1000	1500
Insulation resistance per unit length (MΩ•km)		5	40
Rating (A)		7	—

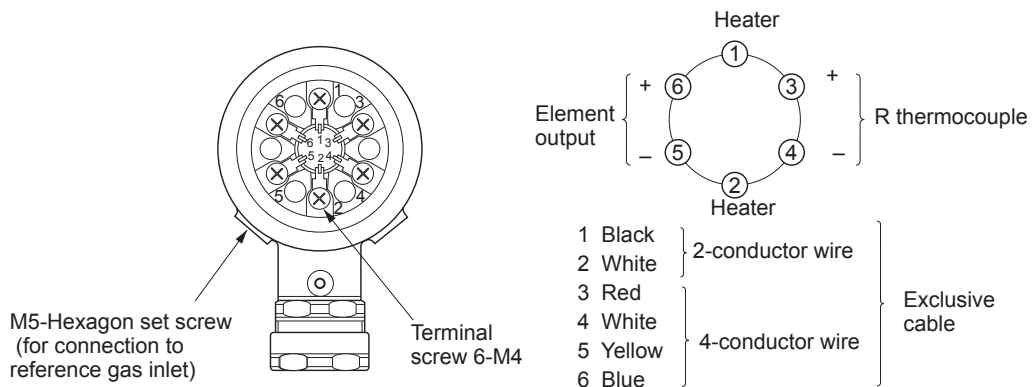
For wiring of the detector, be sure to use a solderless terminal (for M4).

- Recommended solderless terminal Solderless terminal prescribed in JIS C 2805 (Nominal designation: R1.25-4)

4.2 Wiring to each terminal

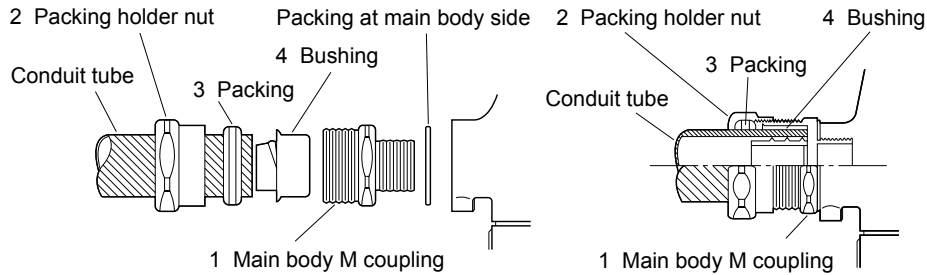
CAUTIONS

- Unless otherwise the reference gas inlet is used, don't loosen M5-hexagon set screw. Otherwise, a waterproofing effect becomes zero.



4.3 Mounting of conduit

- Remove packing holder nut 2, packing 3 and bushing 4 from M coupling of the main body.
- Fit the packing holder nut 2 and packing 4 onto the conduit tube and fit the end face of conduit tube into a groove of the bushing 4.
- Insert the bushing 4 fitted to the conduit tube into M coupling 1 of the main body and tighten with the packing 3 and packing holder nut 2 for fixing.



5. OPERATION AND STOP



- In case where combustible gas is contained in the measured gas, make sure of the gas composition and specifications carefully before using this product. Otherwise, the original performance is not displayed and there is a fear of explosion.

5.1 Start of operation

- Upon turning of the power switch of the converter after completion of the wiring and piping work, the detector starts its operation.
- After warming up at least 15 minutes, start the operation of the furnace.
- After zero calibration and span calibration have finished, get to work on the measurement.
- For the method of calibration, refer to each instruction manual of converters (ZRM and ZRY).
- When the converters (ZRM and ZRY) are not used, run the zero and span calibration gases and calibrate by converting the output in a stabilized state into oxygen concentration according to the standard output table of converter in Item. "6.3". When the reference gas inlet is used, run the reference gas before calibration. (flow rate: 0.2 to 0.5L/min)

5.2 Stop of operation

If the power is turned on in a dewed condition, it leads to the failure of detector. Stop the operation following the procedures described below.

(1) In case of short-term shutdown (about 1 week) of furnace

- Keep the power supply of the detector (converter) turned "ON". This can prevent the detector from getting dewed.

Also, note that if "ON-OFF" is repeated in a condition where the detector has dewed (according to the furnace and ambient conditions), the detector might fail.

- When the ejector (ZTA) is in use, stop the air supply to the ejector.

(2) In case of long-term shutdown of furnace

- Turn off the power of the detector (converter) after the peripheral air of the detector inside the furnace (especially, temperature and humidity) has become an air environment. Or, turn off the power after taking the detector out of the furnace and leaving it as is 15 minutes or more.
- When the ejector (ZTA) is in use, stop the air supply to the ejector.

6. MAINTENANCE AND CHECK



CAUTIONS

- Do the work in a condition where the main power supply has been turned off. If the work is done while current is flowing, there is a fear of getting an electric shock.
- The operation temperature of the detector (tip of the ceramic heater) is about 800°C and the surface temperature is also very high. So, never touch it by bare hand. Otherwise, there is a fear of getting a burn.
- Before proceeding with the cleaning of the flow guide tube, turn off the main power and cool the tube down fully and then, do the work. Otherwise, there is a fear of getting a burn.
- Don't use other renewal parts than those designated by the maker. Otherwise, the original performance is not displayed fully and an accident or failure could come about.
- Dispose of the renewal parts including the maintenance parts as an incombustible article.



PROHIBITION

- Under no circumstances be the work done at a place where rain water splashes the product directly. Otherwise, an electric shock or failure may result.

6.1 Check

Perform the check periodically for using the product always in good condition. Especially, perform the checks shown in table below. Moreover, perform the periodic check at a time of checking the furnace or every 6 months.

	Check items	Details of checking work
Daily check	Execution of zero & span calibration	<ul style="list-style-type: none"> • When the converters (ZRM, ZRY) are in use: With reference to the instruction manuals of the converters (ZRM, ZRY), check once a week as a rough standard. (calibration gas flow rate : 1.0 to 1.5L/min) • When the converters (ZRM, ZRY) are not used: Running the zero and span calibration gases, make calibration once a week as a rough standard by converting the output in a stabilized state into oxygen concentration according to the standard output table of converter in Item "6.3".
	Check for looseness of cable gland.	Retighten the cable gland or if the packing is found deteriorated, replace.
	Check of residue in calibration gas cylinder	Check it by a primary pressure gauge.
	Check of blowdown (when blowdown nozzle is fitted)	Referring to each instruction manual of the converters (ZRM), check at 200 to 300kPa { 2 to 3kgf/cm ² }
Periodic check	Check for leak from packing fitted between flow guide tube and mating flange and O-ring of detector.	If either of the packing and O-ring or both of them are found deteriorated, replace with new O-ring (refer to the part No. for procurement in Item "6.4") and replace the packing (not included in scope of supply).
	Check by disconnecting for clogging or corrosion of flow guide tube.	Check following the procedure in Item "6.2.1".
	Check by removing for clogging or corrosion of sampling probe of ejector (ZTA).	Check following the procedure in Item "6.2.2".
	Check by removing if air outlet port of ejector (ZTA) is left stopped up.	Clean the air outlet port of the thermal insulation part of furnace wall.
	Removing detector, check for loading of ceramic filter of detector.	When it is necessary to replace the ceramic filter, refer to Item "6.2.3".

6.2 Maintenance

The replacing intervals of detector, ceramic filter and O-ring, and the maintenance periods of flow guide tube and sampling probe differ depending on the working conditions including the components of measured gas and the amount of dust.

The replacing intervals in a general conditions are shown below. Determine the replacing intervals in the individual working condition with a period till a first replacement after delivery and operation as a rough standard.

- Detector Yearly
- Ceramic filter..... At 6 month interval
- O-ring Yearly
- Flow guide tube..... At 3 to 4 year interval
- ZTA sampling probe..... At 3 to 4 year interval

6.2.1 Maintenance of flow guide tube

- After removing the flow guide tube from the furnace wall and then, from the detector, cool the tube down fully in the air.
- Remove dust sticking to the outside of the flow guide tube by water-washing with the use of a scrubbing brush.
- Remove dust sticking to the inside of the flow guide tube by using a metallic rod or screwdriver. (Clean so that tube is through at least about 3/4 part of the whole interior.)
- For the flow guide tube for high dust, remove together dust sticking around the gas outlet.

6.2.2 Maintenance of sampling probe

- After removing the ejector (ZTA) from the furnace wall and then, the sampling probe from the ejector, cool the probe down fully in the air.
- Remove dust sticking to the outside of the sampling probe by using a scrubbing brush.

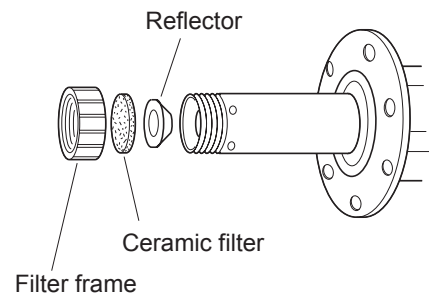


CAUTIONS

- The high temperature-use sampling probe (made of SIC) of the ejector (ZTA) is liable to break. So, be careful not to cool abruptly by water (quenching) or apply undue force to the probe in the dust removing work.
- Remove dust sticking to the inside of the flow guide tube by using a metallic rod or screwdriver. (Clean so that the tube is through at least about 3/4 part of the whole interior.)

6.2.3 Replacement of filter

- Turning the power to the detector “OFF”, lower the surface temperature of the tip (at the ceramic filter side) by cooling down fully with the air.
- After having been cooled down fully, remove the filter frame from the detector, take the ceramic filter and reflector off the filter frame.
- Set a new ceramic filter and reflector in the filter frame and fit the frame to the detector and then, tighten till the ceramic filter does not move any longer. (Be careful then not to fail to set the reflector in place. For the part No. for additional procurement of the reflector, refer to Item. “6.4”).



6.3 Standard output of detector

For the output voltage of the detector, refer to the standard output table below.

Standard output table (Reference)

Oxygen concentration (Vol%)	Detector (ZFK2) output (Unit: mV)	Detector (ZFK5) output (Unit: mV)
0.01	168.15	160.31
0.05	132.68	126.50
0.1	117.41	111.93
0.5	81.94	78.12
1.0	66.67	63.56
1.2	62.65	59.73
1.4	59.25	56.49
1.5	57.73	55.04
1.6	56.31	53.68
1.8	53.71	51.21
2.0	51.39	49.00
2.2	49.29	46.99
2.4	47.37	45.17
2.5	46.47	44.31
2.6	45.61	43.48
2.8	43.98	41.93
3.0	42.46	40.48
3.5	39.06	37.24
4.0	36.12	34.43
4.5	33.52	31.96
5.0	31.20	29.75
5.5	29.10	27.74
6.0	27.18	25.92
6.5	25.42	24.23
7.0	23.79	22.68
7.5	22.27	21.23

Oxygen concentration (Vol%)	Detector (ZFK2) output (Unit: mV)	Detector (ZFK5) output (Unit: mV)
8.0	20.84	19.87
8.5	19.51	18.60
9.0	18.25	17.40
10.0	15.93	15.18
11.0	13.83	13.18
12.0	11.91	11.35
13.0	10.14	9.67
14.0	8.51	8.11
15.0	6.99	6.66
16.0	5.57	5.31
17.0	4.23	4.04
18.0	2.97	2.83
19.0	1.78	1.70
20.0	0.65	0.62
20.6	0.00	0.00
21.0	-0.42	-0.40
22.0	-1.45	-1.38
23.0	-2.43	-2.32
24.0	-3.37	-3.21
25.0	-4.27	-4.07
30.0	-8.28	-7.90
35.0	-11.68	-11.14
40.0	-14.62	-13.94
45.0	-17.22	-16.42
50.0	-19.54	-18.63

6.4 Arrangement

	No.	Description	Part No. for procurement (Procured type)	Remark
Consum-ables	1	Ceramic filter	*ZZPZFK4-TK750201P1	
	2	Detector O-ring (P36)	*ZZPZFK4-8552836	
Spare parts	3	Detector for replacement	According to designation of type in Item. "8.2"	Including ceramic filter (2 pcs.) and detector O-ring (1 pc.)
	4	Flow guide tube	According to part No. for procurement of flow guide shown in table below	
Additionally procedure parts	5	Reference gas inlet (for NPT1/8 joint)	*ZZPZFK4-TK7J0408C1	
		Reference gas inlet (for Rc1/8 joint)	*ZZPZFK4-TK7J0408C2	
	6	Thermo sticker	*ZZPZFK4-TK746983P1	
	7	Joint (fitted with inner)	ZFK2 *ZZPZFK4-TK7K1652P1 ZFK5 *ZZPZFK4-TK7K1652P4	
	8	Reflector	*ZZPZFK4-TK7H6762P1	
	9	Heat insulating cover	*ZZPZFK4-TK4E5339C1	

Part No. for procurement of flow guide

Type designation digits			Procurement DWG. No.	Classification	Inserting length
9	10	11			
5	A	3	*ZZP-TK464430C1	For general use	300mm
5	A	5	*ZZP-TK464430C2	For general use	500mm
5	A	7	*ZZP-TK464430C3	For general use	750mm
5	A	1	*ZZP-TK464430C4	For general use	1000mm
5	B	3	*ZZP-TK4B5999C1	Corrosive gas	300mm
5	B	5	*ZZP-TK4B5999C2	Corrosive gas	500mm
5	B	7	*ZZP-TK4B5999C3	Corrosive gas	750mm
5	B	1	*ZZP-TK4B5999C4	Corrosive gas	1000mm
5	C	3	*ZZP-TK4A3274C1	Fitted with blowdown nozzle	300mm
5	C	5	*ZZP-TK4A3274C2	Fitted with blowdown nozzle	500mm
5	C	7	*ZZP-TK4A3274C3	Fitted with blowdown nozzle	750mm
5	C	1	*ZZP-TK4A3274C4	Fitted with blowdown nozzle	1000mm
6	D	8	*ZZP-TK7H8487C3	High dust flow guide tube	800mm
6	E	8	*ZZP-TK7H8487C3 *ZZP-TK7H8489C2	Fitted with high dust flow guide tube cover	800mm

7. TROUBLE-SHOOTING



CAUTIONS

- If a failure should occur which cannot be judged even if referring to the operation manual, be sure to ask the nearest dealer or Fuji adjustment serviceman for repair. If disassembled without thought for the outcome, there is a fear of bringing an unnecessary trouble or getting an injury.

Troubles	Probable causes	Check procedures (normal values)	Remedies
<ul style="list-style-type: none"> Indication is fixed. Indication response is slow. 	<ul style="list-style-type: none"> Clogging of ceramic filter of detector and flow guide tube interior 	<ul style="list-style-type: none"> Check visually for fouling of ceramic filter of detector and clogging of flow guide tube interior with dust. 	<ul style="list-style-type: none"> Clean or exchange ceramic filter, if need be.
	<ul style="list-style-type: none"> Leak from joint and airtightness of mounted part. 	<ul style="list-style-type: none"> Check for looseness of each joint and airtightness of mounted part. 	<ul style="list-style-type: none"> Retighten and replace joint(s), if need be.
	<ul style="list-style-type: none"> Deterioration of detector 	<ul style="list-style-type: none"> Check by changing zero calibration gas over to span calibration gas and vice versa if it takes more than 5 minutes for 90% response. 	<ul style="list-style-type: none"> Replace detector.
	<ul style="list-style-type: none"> Decrease of exhaust gas flowing velocity 	<ul style="list-style-type: none"> Check exhaust gas responding time after stop of calibration gas supply. 	<ul style="list-style-type: none"> Increase amount of exhaust gas inside flow guide tube to be taken in. Clean flow guide tube.
<ul style="list-style-type: none"> Temperature alarm continues coming on despite 20 minutes having elapsed after turning on power. 	<ul style="list-style-type: none"> Disconnection of cable 	<ul style="list-style-type: none"> Check continuity. 	<ul style="list-style-type: none"> Replace cable.
	<ul style="list-style-type: none"> Error in wiring 	<ul style="list-style-type: none"> Check wiring. 	<ul style="list-style-type: none"> Wire correctly.
	<ul style="list-style-type: none"> Low supply voltage 	<ul style="list-style-type: none"> Check if supply power is as specified. 	<ul style="list-style-type: none"> Supply correct power.
	<ul style="list-style-type: none"> Disconnection of thermocouple 	<ul style="list-style-type: none"> Check continuity. Check if resistance across terminals No. 3 and No. 4 is 2 to 3Ω. 	<ul style="list-style-type: none"> Replace detector.
	<ul style="list-style-type: none"> Blown-off of fuse of converters (ZRM and ZRY) 	<ul style="list-style-type: none"> Check continuity of fuse. 	<ul style="list-style-type: none"> Exchange fuse(s). (Refer to each instruction manual of converters (ZRM and ZRY).
<ul style="list-style-type: none"> Disconnection of detector heater 	<ul style="list-style-type: none"> Check heater resistance as follows (exclusive of wiring resistance): For 100V : 50 to 55Ω For 200V : 200 to 250Ω 	<ul style="list-style-type: none"> Replace detector. 	
<ul style="list-style-type: none"> Indication is too high or too low. 	<ul style="list-style-type: none"> Looseness of flange mounted part or deterioration of O-ring or packing (not included in scope of supply). 	<ul style="list-style-type: none"> Check airtightness of detection unit, flow guide tube and flange mounted part. 	<ul style="list-style-type: none"> Retighten mounting screw. Exchange O-ring. Exchange packing (not included in scope of supply)
		<ul style="list-style-type: none"> Check for leak in from periphery. 	<ul style="list-style-type: none"> Shield
	<ul style="list-style-type: none"> Deterioration of detector 	<ul style="list-style-type: none"> Check airtightness of calibration gas supply port. Check at a time of running zero and span calibration gases if detector output (mV) is higher or lower than others. (Refer to Table in Item "6.3"). 	<ul style="list-style-type: none"> Retighten calibration gas joint. Replace detector.
	<ul style="list-style-type: none"> Abnormality of detector temperature Change of oxygen concentration peripheral air of terminal box or very high humidity 	<ul style="list-style-type: none"> Check indicated temperature of converter. Check oxygen concentration of peripheral air of terminal box is 20.6vol%. 	<ul style="list-style-type: none"> Use reference gas inlet.

8. APPENDIX

8.1 Specification

8.1.1 General

- **Measuring object** : Oxygen contained in incombustible gas
- **Measuring principle**: Direct-insertion zirconia type
- **Measuring range** : 0 to 2...50vol%O₂ freely settable
(in 0.5%O₂ step)
Switch from 0 to 5/10/25 (ZRY)
- **Repeatability** : Within ±0.5% of max. output signal
- **Linearity** : ±2%full scale
- **Response time** : Within 7 sec for 90% response(from calibration gas inlet)
- **Power supply** : 100, 115, 220 or 230VAC, 50/60HZ
- **Power consumption** :
Approx. 15 + 50VA
(in steady state of converter + detector)
Approx. 15 + 200VA
(for start of converter + detector)
- **Warmup time** : Approx. 15 minutes

8.1.2 Oxygen detector (ZFK2 & 5) and ejector (ZTA)

- **Measured object** : For general use ZFK2
For corrosion-proof ZFK5
- **Measured gas temperature** : Flow guide tube type: -20 to +600°C
(for general use and corrosion-proof)
Ejector type: -20 to +1500°C(for high temperature)
-20 to +800°C (for general use)
- **Measured gas pressure** : -3 to +3kPa (-306 to +306mmH₂O)
- **Flow guide tube** : With or without blowdown nozzle
Flange: JIS 5K 65A FF
Insertion length : 0.3, 0.5, 0.75 & 1m
Flow guide tube for high particulate gas
(with blowdown nozzle), not fitted with cover
& fitted with cover
Flange: JIS 5K 80A FF
Insertion length: 0.8m (standard)
- **Ejector** : Probe for guiding measured gas to detector
Flange : JIS 10K 65A RF
Insertion length : 0.5, 0.75, 1 and 1.5m
(according to customer's specification)
- **Ambient temperature** : Cable: -20 to +60°C
Ejector : -5 to 100°C
Detector flange surface :
Less than 125°C in case of current flowing.
- **Structure** : Dust-proof, rain-proof structure
(IEC IP55 equivalent) In cold district, heat insulating cover is necessary.
- **Filter** : Alumina (filtrating accuracy: 50µm) and quartz paper
- **Materials of gas contact part** : Detector for general use
Zirconia & SCS14 (equivalent to SUS316)
Platinum & SUS304
Detector for corrosion proof
Zirconia, Titanium, Platinum, SUS316
Flow guide tube
SUS304 or SUS 316
Ejector (for general use)
SUS316 & SUS 304
Ejector (for high temperature)
SiC, SUS316 & SUS304
Calibration gas inlet
SUS (joint)

- **Detector mounting** : Horizontal plane ±45° ambient surrounding air should be clean.
- **Outside dimension** : (L x Max. dia.) 210 x 100mm (detector)
- **Mass** : Detector—Approx. 1.6kg
Ejector—Approx. 15kg (inserting length: 1m)
Flow guide tube (for general use)—
Approx. 5kg (inserting length: 1m)
- **Painting color** : Silver and SUS metallic color
- **Calibration gas flow rate** : 1.0 to 1.5L/min
- **Ejector air inlet flow rate** : 5 to 10L/min
- **Blowdown air inlet pressure** : 200 to 300kPa (2 to 3kgf/cm²)
- **Ejector exhaust gas processing**: Within furnace, returned to flue
- **Heater temperature drop** : Alarm output when below 100°C
alarm output (ejector) Mechanical thermostat N.O. (1a) contact 200V AC, 2A

8.1.3 Specifications of converter (ZRM)

- **Measuring range** : 0 to 2...50vol%O₂ freely settable
(in 0.5% O₂ step)
- **Repeatability** : ±0.5% FS
- **Linearity** : ±1.0% FS
- **Display** : Oxygen concentration display—3 digits LED
Operation/setting display — 16 digits 2 lines LCD
Mode display—3pcs. LED
- **Oxygen concentration output signal** : 4 to 20mA DC (allowable load resistance:
500Ω or less) or 0 to 1V (output resistance:
100Ω or less)
Isolated output, linear
- **Contact output signal** : (1) Contact spec.: 4 points N.O.(1a) 250V AC, 2A
(2) Contact function: Under maintenance,
under blowdown, span calibration gas &
zero calibration gas
The following functions are selectable freely:
· High limit alarm
· Low limit alarm
· High limit/low limit alarms
· Fault (abnormal)
- **Contact input signal**: Auto. calibration start (auto calibration starts
when contact closes)
Calibration disable(calibration disabled when
contact closes)
Contact spec.: Isolated, ON at 1kΩ or less
- **Calibration method**: (a) Manual calibration by key operation
(b) Auto. calibration (standard function)
Calibration cycle: 00 day 00 hour to 90
days 60 hours
- **Calibration gas** : Range settings
Zero gas: 0.010 to 50.000% O₂
Span gas: 8.000 to 23.000% O₂
Recommended calibration gas concentration
Zero gas: 0.25 to 2.0% O₂
Span gas: 20.6 to 21.00% O₂
(oxygen concentration in the air)
- **Blow down** : A function for blowing out with compressed
air dust that has deposited in the flow guide
tube. Blow down can be performed for a
predetermined time and at predetermined
intervals.
Blow down cycle: 00 hours 00 minutes to 99
hours 60 minutes
Blow down time: 0 minutes 00 sec. to
9 minutes 60 sec.

-
- **Output hold** : Output signal is held during calibration and blow down. The hold function can also be released.
 - **Transmission function (option)** : RS-485
Transmission distance: Max. 500m and Total number of units connected ;Max. 8 units half-duplex bit serial transmission, start-stop synchronization
Remark : When connecting via an RS-232C interface, an RS-232C ↔ RS-485 converter should be used .
 - **Combustion efficiency display (Optional)** : This function calculates and displays combustion efficiency from an oxygen concentration and measured gas temperature. Temperature, (K or R) is required for temperature measurement.
 - **Self-diagnosis function** : Provided for detector temperature fault. Zero calibration fault, span calibration fault, calibration disable and detector output fault.
 - **Ambient temperature**: -10 to +50°C
 - **Ambient humidity** : 90%RH or less
 - **Power supply** : 90 to 220V AC or 230V AC 50/60Hz
 - **Structure** : Dust-proof, rain-proof construction (corresponding to IP53 of IEC)
 - **Material** : Steel sheet
 - **Outer dimension** : 220×193×89mm (H×W×D)
 - **Mass {weight}** : Approx. 3.5kg (excluding cable and detector)
 - **Finish color** : Munsell 2.5Y8.4/1.2
 - **Mounting method** : Mounted flush on panel or on pipe
 - **Outer dimensions (H x W x D)**: 220 X 230 X 95mm
 - **Mass {weight}** : Approx. 4.5kg (excluding cable and detector)
 - **Finish color** : Munsell 6PB 3.5/10.5 (blue): cover, silver; case
 - **Mounting method** : Mounted flush on panel

8.1.4 Converter specification (ZRY)

- **Measuring range** : 0-5, 10, 25 vol% O₂
Changeable by internal set pin.
 - **Repeatability** : ±1.0% of full scale
 - **Lineality** : ±2.0% of full scale
 - **Indication** : Oxygen concentration; 3-digit LED
 - **Oxygen concentration output signal:**
4 to 20mA DC (allowable load resistance: 500Ω or less)
Isolated output, linear
 - **Fault contact output:**
250V AC, 2A rating (close contact or open contact for fault should be specified when you place an order.)
 - **Self-diagnoses** : Fault of sensor temperature, zero calibration error, span calibration error
 - **Calibration method:** Manual calibration with key operation
 - **Calibration gas** : •Recommended calibration gas concentration
Zero gas; 1.0 to 2.0% O₂
Span gas; 20.6 to 21.0% O₂
(oxygen concentration in the air)
 - **Ambient temperature:**
-10 to +50°C
 - **Ambient humidity:** 90% RH or less
 - **Power supply** : 90 to 220 or 230 V AC, 50/60Hz
 - **Construction** : Dust-tight, waterproof construction, NEMA4 (corresponding to IP65 of IEC)
 - **Material** : Aluminum die casting
-

8.2 Designation of type (PILC code table)

8.2.1 Detector

1 2 3 4 5 6 7 8 9 10 11 12 13 14 Digits														
Z	F	K	R	4	-									Description
														Application General use For corrosive gas (refuse incinerator)
														Cal. gas inlet SUS joint for ø6 tube SUS joint for ø1/4 in. tube
														Power supply 100/115V AC 50/60Hz 200/220V AC 50/60Hz 230V AC 50/60Hz (CE-marking approved)
														Flow guide tube Flange material
														Type
														Length
														0 Y 0 None
														5 A 3 SUS304 General use 300mm
														5 A 5 SUS304 General use 500mm
														5 A 7 SUS304 General use 750mm
														5 A 1 SUS304 General use 1000mm
														5 B 3 SUS316 For corrosive gas 300mm
														5 B 5 SUS316 For corrosive gas 500mm
														5 B 7 SUS316 For corrosive gas 750mm
														5 B 1 SUS316 For corrosive gas 1000mm
														5 C 3 SUS316 With blow down nozzle 300mm
														5 C 5 SUS316 With blow down nozzle 500mm
														5 C 7 SUS316 With blow down nozzle 750mm
														5 C 1 SUS316 With blow down nozzle 1000mm
														6 D 8 SUS316 For high particulate 800mm
														6 E 8 SUS316 For high particulate with cover 800mm
														Z Z Z Others
														NOTE) As for the flange dimension, JIS 5K-65A FF is standard. However, for the flange of high dust flow guide tube, JIS 5K-80A FF is standard.
														Heat insulating
														Y Without
														A With
														Reference air inlet
														Y None
														A Rc 1/8
														B NPT 1/8
														None-standard spec.
														Z Other none-standard items

8.2.2 Replacement detector

1 2 3 4 5 6 7 8 9 10 11 12 13 Digits														
Z	F	K	R	4	-	0	Y	0	Y	Y				Description
														Application General use For corrosive gas (refer to incinerator)
														Cal. gas inlet SUS joint for ø6 tube SUS joint for ø1/4 in. tube
														Power supply 100/115V AC 50/60Hz 200/220V AC 50/60Hz 230V AC 50/60Hz (CE-marking approved)

8.2.3 Ejector

1 2 3 4 5 6 7 8 Digits								
Z	T	A	1	1	1			Description
								Measured gas temp. For high temp. (+1500°C max.) General use (+800°C max.)
								Inserting length [mm]
								B 500
								C 750
								D 1000
								E 1500
								Power supply 100/115V AC 50/60Hz 200/220V AC 50/60Hz 230V AC 50/60Hz

8.2.4 Converter

(1) Single-channel type (ZRM)

1 2 3 4 5 6 7 8 9 Digits									Description	
Z	R	M	1				1	1		Output signal 4 to 20mA DC 0 to 1V DC
									B	Optional function None Serial communication (RS-485) Combustion efficiency display Transmission function + Combustion efficiency display
									E	
									Y	
									A	Power supply 90 to 220V AC 50/60Hz 230V AC 50/60Hz (CE-marking approved)
									B	
									C	
								1		Mounting method Panel mounting Pipe mounting
								5		
									1	
									2	

(2) Multi-channel type (ZRY)

1 2 3 4 5 6 7 8 9 10 11 12												Description				
Z	R	Y	1				Y	1	2			1	R	0	Output signal and fault output 4 to 20mA DC, close contact 4 to 20mA DC, open contact	
															B	Power supply 90 to 230V AC 50/60Hz (CE marking approved)
														C		
															1	Mounting method Panel mounting
															Y	Instruction manual NO YES (English)
														E		

(3) Exclusive-special (*1)

1 2 3 4 5 6 7 8 9 Digits									Description					
Z	R	Z						1				Connectable devoces For ZRM For ZRY		
											M	Kinds For R thermocouple		
											P			
												R	Conduit (*2) Cable length None 6m None 10m None 15m None 20m None 30m None 40m None 50m None 60m None 70m None 80m None 90m None 100m AA 6m BB 10m CC 15m DD 20m	
												YA		
												YB		
												YC		
												YD		
												YE		
												YF		
												YG		
												YH		
												YJ		
												YK		
												YL		
												YM		
												AA		
												BB		
												CC		
												DD		
													0	Cable end treatment None Treatment at one side (only for detector) Treatment at both sides
													1	
													2	

NOTE) (1) One cable is used for one detector.
(2) Water proof flexible conduit.

8.3 Device composition

The device to be combined differs according to the conditions of gas to be measured. Select the devices to be combined with reference to the following table.

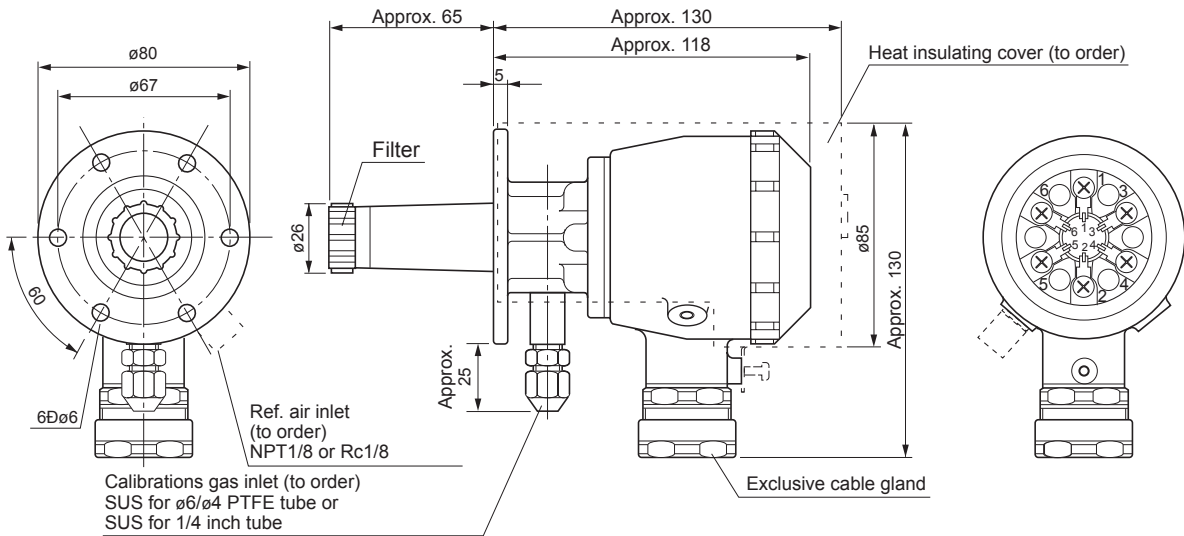
Measured gas						Device configuration		
Application	Temp.	Gas flow	Dust	Protection cover	Note	Detector type	Converter type	Ejector type
General-use (boiler)	600°C or less	5 to 20 m/s	Less than 0.2g/Nm ³	—	Fuel: Gas/oil	ZFK2RA□4-5A□□□	ZRM ZRY	—
			Less than 10g/Nm ³		Fuel : Coal with blow down	ZFK2RA□4-5C□□□	ZRM	—
For corrosive gas (refuse incinerator)	600°C or less	5 to 20 m/s	Less than 1g/Nm ³	—	Included low moisture	ZFK5RA□4-5B□□□	ZRM	—
			Less than 10g/Nm ³	—	Included low moisture with blow down	ZFK5RA□4-5C□□□	ZRM	—
			Less than 25g/Nm ³	No	Included low moisture with blow down	ZFK5RA□4-6D□□□	ZRM	—
				Yes	Included low moisture with blow down	ZFK5RA□4-6E□□□	ZRM	—
General-use (boiler)	800°C or less	Less than 1m/s	Less than 1g/Nm ³	—	SUS316 tube with blow down	ZFK2RA□4-0Y0□□	ZRM	ZTA2
	1590°C or less	Less than 1m/s	Less than 1g/Nm ³	—	SiC tube with blow down	ZFK2RA□4-0Y0□□	ZRM	ZTA1

NOTE 1) Dust volume is approximate value.

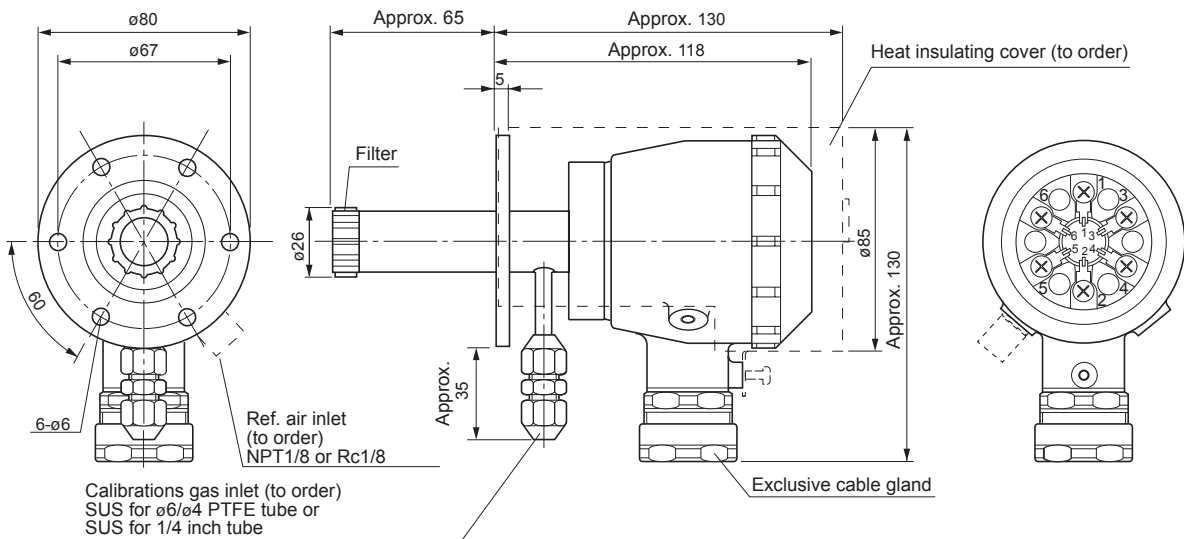
NOTE 2) Instrument quality air or bottled air is available as reference air by selecting detector with reference air inlet.

8.4 Outline diagram (unit: mm)

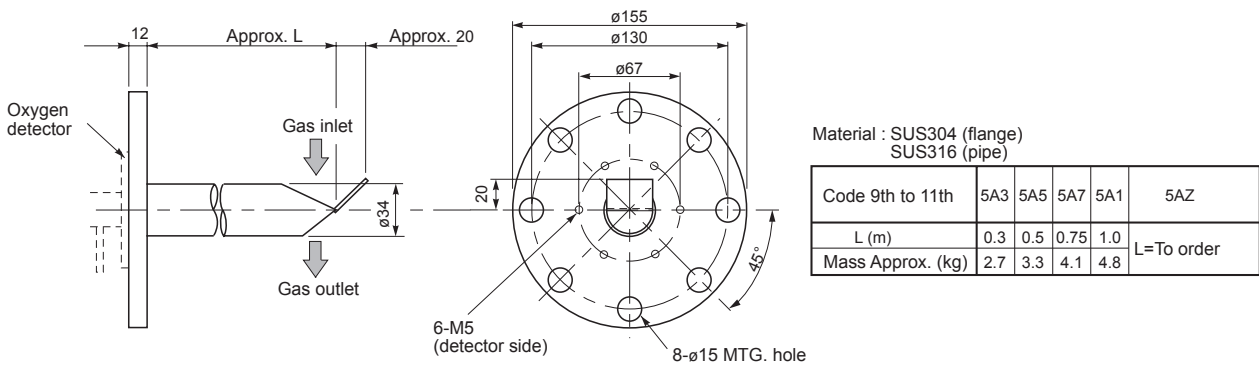
(1) Detector (ZFK2)



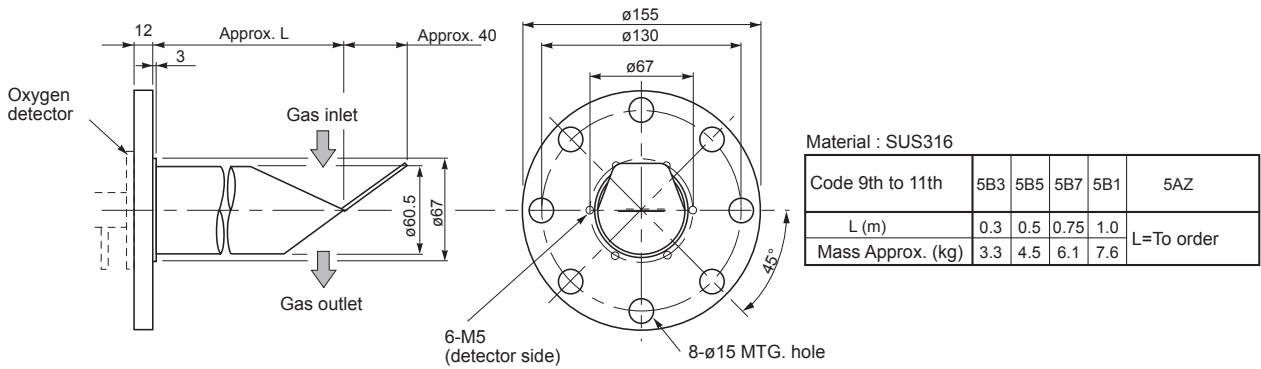
(2) Detector (ZFK5)



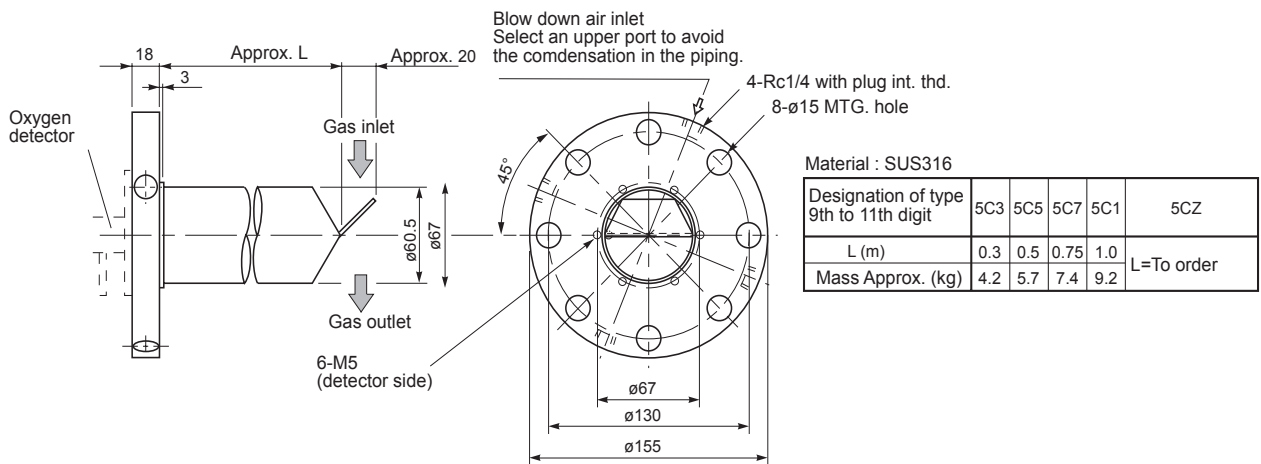
(3) Flow guide tube (for general use. ZFK2)



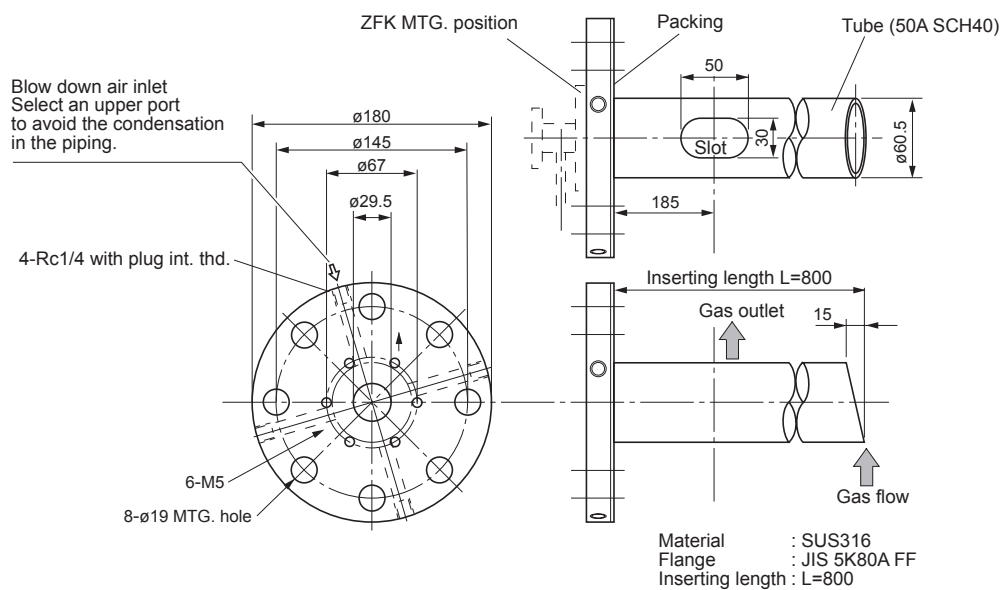
(4) Flow guide tube (ZFK5)



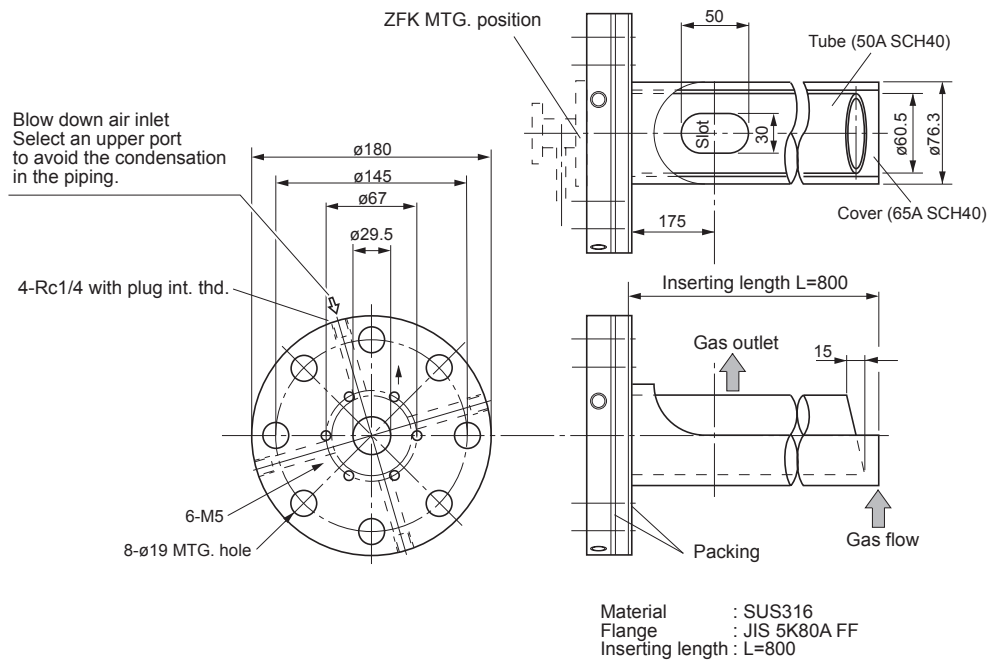
(5) Flow guide tube (with blow down nozzle)
(for general use and corrosive gas, common to ZFK2 & ZFK5)



(6) Flow guide tube (for high particulate)



(7) Flow guide tube (for high particulate with cover)



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