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AD2-I20-A042

1mφ Space Chamber

Users’ Manual

Advanced Engineering Services Co., Ltd.

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Appendix A

1. Introduction

This users' manual is to provide necessary information to the users of 1mφ Space Chamber (referred to as "this facility" hereafter) located in the chamber room on the 1st floor of the 8m ϕ Space Chamber Building.

The major environments in outer space are high vacuum, cryogenic shade, etc. On the geostationary orbit which is about 36,000 km above the surface of the earth, those environments respectively reach the levels of about 1.3×10^{-11}Pa and 3K, the latter being an infinite heat absorber.

However, it is financially unfeasible to simulate such environments on ground as they are, and therefore this facility provides vacuum pressure of 1.3×10^{-3}Pa or less and shroud temperature of 100K or lower (except for the door and the head of the chamber), which enable us to verify the reliability of satellite behaviors in space by extrapolating them from the accuracy assessment on thermal designs under the simulated environments mentioned above.

2. Brief Overview of this Facility

2.1. System Outline

This facility consists of a vacuum vessel system that includes a side-laid cylindrical type vacuum vessel as its main constituent, a vacuum equipment system made up of different kinds of vacuum pumps, a cryogenic system composed of a shroud that is cooled down to 100K or lower by liquid nitrogen, etc., a data acquisition system which monitors temperature and pressure, and utility equipment.

The external view and schematic system diagram of this facility are shown in Figures 2-1 and 2-2, respectively.

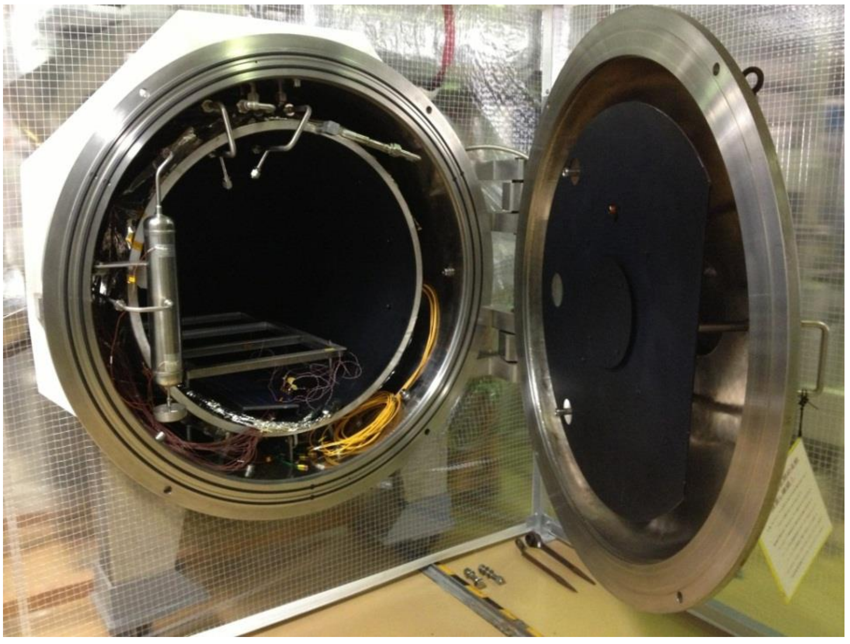


Figure 2-1 External View of 1mφ Space Chamber

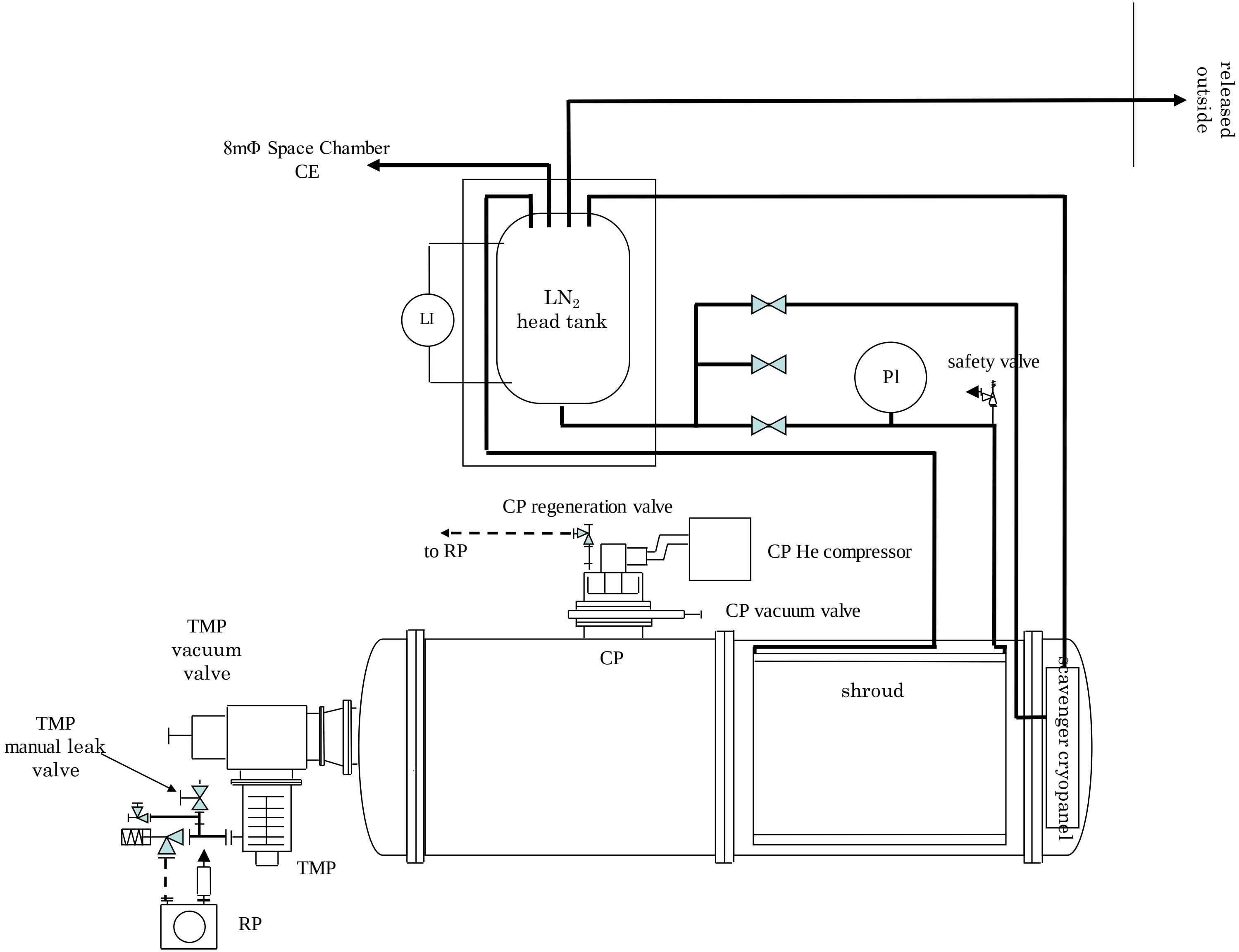


Figure 2-2 System Diagram of 1mφ Space Chamber Facility

2.2. Main Specifications

The main specifications of the whole facility are shown in Table 2-1. The detailed specifications of each equipment are presented below.

Table 2-1 Main Performance and Facility Specifications of 1mφ Space Chamber

system		item	specifications	notes
vacuum vessel system	vacuum vessel	material	SUS304	
		dimensions	outer Φ 1,300 mm × straight cylindrical body part 3,200 mm, thickness 6 mm	
		weight	about 2,600 kg	including shroud; inner bench and vacuum system not included
		inner capacity	about 4.17 m^3	nozzles not included
		inner surface area	about 14.3 m^3	nozzles not included
	inner bench	dimensions	600 mm × 1,000 mm	
cryogenic system	shroud	material	alluminum alloy	
		dimensions	inner Φ 1,000 mm × straight cylindrical body 1,380 mm, thickness 8 mm	
		coating	Aeroglaze Z307	
		# of partitions	3	body part, cover plate on mirror side, cover plate on door side
	scavenger cryopanel (contamination panel)	material	SUS304	
		dimensions	Φ89 mm × 500 mm	
vacuum equipment system	RP (Rotary Pump)	inlet/outlet port	NW40 / NW40	with oil mist trap on outlet side
		vacuum rate	500 ℓ/min (50Hz)	
	TMP (Turbo Molecular Pump)	inlet/outlet port	VG200 / NW40	
		vacuum rate	1,230 ℓ/sec N_2	with wire mesh
	CP (Cryo Pump)	inlet port φ	VG300	1 outlet port NW25
		vacuum rate	3,000 ℓ/sec N_2 9,500 ℓ/sec H_2O 5,000 ℓ/sec H_2 2,500 ℓ/sec Ar	
		cooling fall time	110 mins (50Hz)	
data acquisition system	gauge	pressure measurement range	Pirani gauge： 1.0×10^{5}Pa～1.0×10^{-1}Pa Cold Cathode gauge： 4.9×10^{-1}Pa～1.0×10^{-6}Pa	digital combination gauge (stationary equipment)
	temperature・voltage signals	total # of chs	88 chs	measurement accuracy: ±1℃ sampling cycle: 1 or 2 minutes
		＜composition＞ for thermocouples (T-type)： for gauge signals： for current/voltage signals：	72 chs (including 12chs for facility) 2 chs 14 chs (for IR power supply)	
power supply system for heat sources	IR power supply	capacity, quantity	3 kW × 3 sets 300W × 5 sets	

2.2.1. Vacuum Vessel System

This side-laid cylindrical vacuum vessel made of stainless-steel has a size of 1,300-mm outer diameter × 3,200-mm length across its straight cylindrical body. Its access door through which a test specimen (■abbreviated as TS hereafter) is carried into the vessel has a diameter of 1,288 mm. For more detailed dimensions, refer to the corresponding drawings in Appendix B.

<TS storage space>

when shroud is used: 1,000 mmφ × 1,380 mmL

when shroud is not used (viz. with shroud removed from the chamber, which is possible only for tests in room temperature): 1,280mφ × 3,200 mL

2.2.2. Cryogenic System

This system consists of a shroud which is cooled down to 100K or lower by means of LN_2 to establish cryogenic dark environment, a scavenger cryopanel which prevents contamination on a TS, and an LN_2 supplier for the shroud and the scavenger cryopanel.

LN_2 is supplied from the LN_2 storage tank in the 8mφ Space Chamber into the head tank for this facility, then distributed into the shrouds, scavenger cryopanels, etc.

Meanwhile, the shrouds on the door or head do not get LN_2 supplied, and therefore their temperature does not become as low as the body-part shroud. Refer to Figures 3-5 and 3-6 for more details.

2.2.3. Vacuum Equipment System

This system consists of rotary pumps, turbo molecular pumps, and cryopumps. The specifications for each of them are shown in Table 2-1.

2.2.4. Data Acquisition System

This system is capable of acquiring, processing, recording, and displaying in real time such data as the temperature on parts of a TS, temperature/vacuum levels of the test facility, or power supply voltage/current during a test. Its basic specifications are shown in Table 2-1. Refer to the users' manual of the data acquisition system for further information.

The system diagram of the data acquisition system is shown in Figure 2-3.

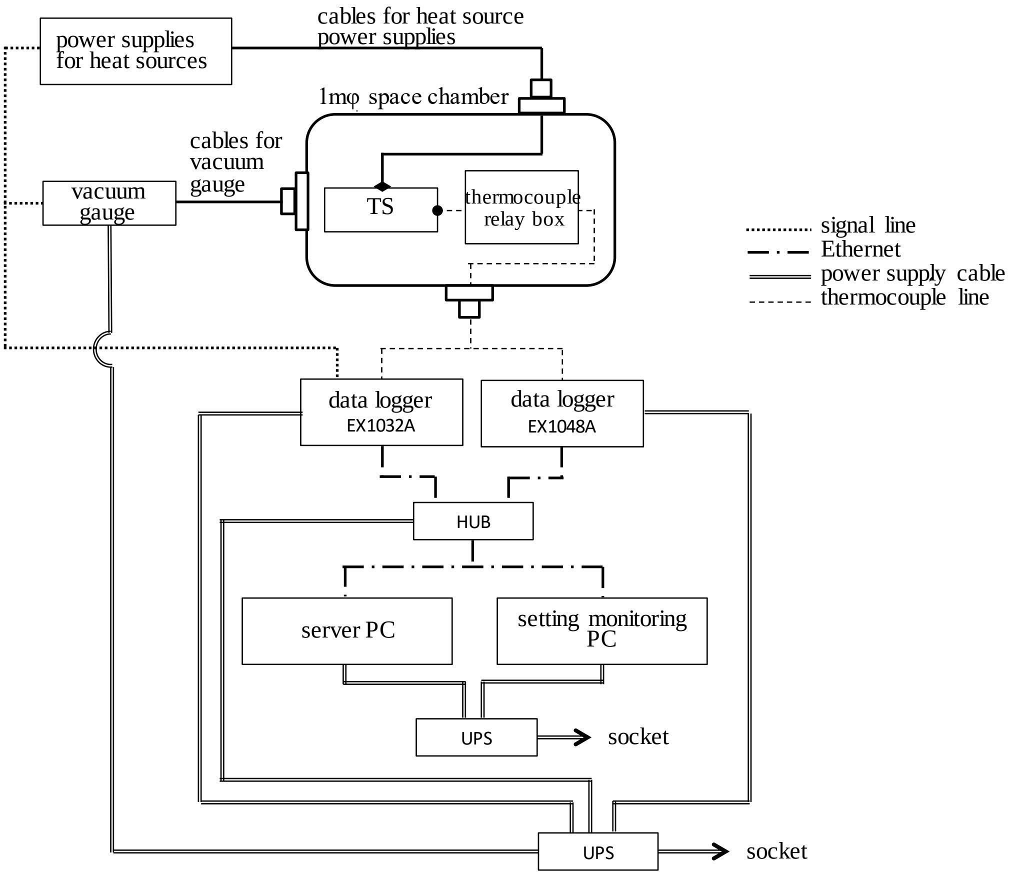


Figure 2-3 Diagram of Data Acquisition System

2.2.5. Power Supplies for Heat Sources

The power supplies for heat sources are composed of three sets of 3 kW power supplies and five sets of 300W power supplies. Two of the former sets and all the latter sets can be monitored via the data acquisition system for current/voltage. The external view is shown in Figure 2-4.

Figure 2-4 External View of Power Supplies for Heat Sources

2.2.6. Utility Equipment

(1) TS bench

The TS supporter works as a jig for setting a TS inside the chamber. Its external view and details are shown in Figure 2-5 below and Figure A-11 SKC-002NC in Appendix B. With its 28 holes of 9 mmφ, the bench allows a TS to be fixed on it.

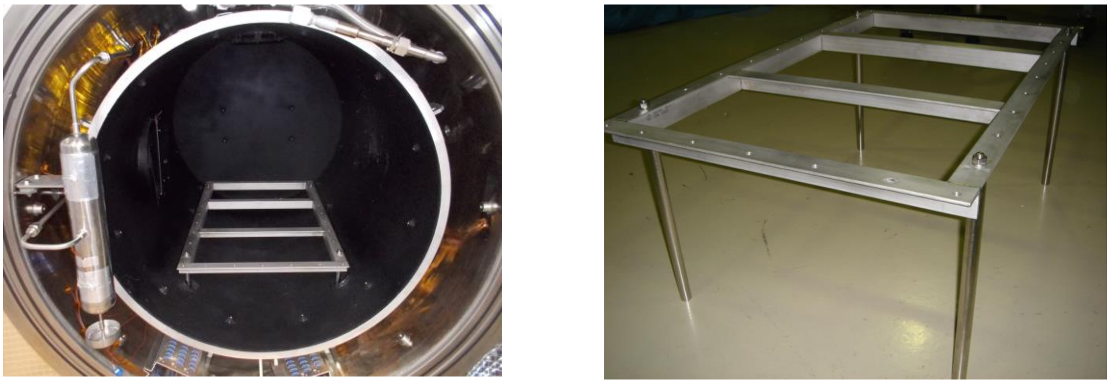


Figure 2-5 External View of TS Bench

(2) Thermocouple relay box

A thermocouple relay box refers to a terminal box that relays the thermocouple lines on the users' side and those on the facility side. There are 36 mini omega connectors on each of the two thermocouple relay boxes.

The external views of a thermocouple relay box and a mini omega connector are shown in Figures 2-6 and 2-7, respectively.

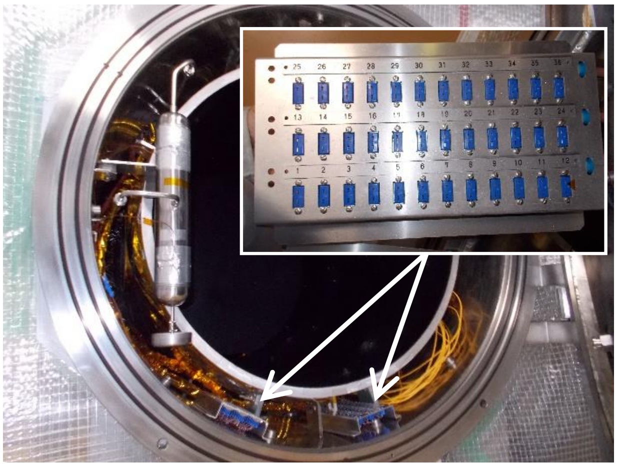


Figure 2-6 External View of Thermocouple Relay Box (Left)

Figure 2-7 External View of Mini Omega Connector (Right)

(3) Clean booth

This facility owns a clean booth which helps handling a TS and performing a test in the environment of controlled temperature, humidity, and cleanliness. Its external view and basic specifications are shown in Figure 2-9 and Table 2-2, respectively. After opening/closing the entrance curtain, the cleanliness inside the clean booth may degrade or the humidity may vary, and therefore works that require certain cleanliness or humidity are to be waited for one hour or so before conducted, and to be started on confirmation of their levels by the dust counter and the thermohydrometer.

Figure 2-9 External View of Clean Booth

Table 2-2 Basic Specifications of Clean Booth

item	specifications
dimensions	2.7m × 2.7m × H2.5m
temperature	23 ± 3℃
relative humidity	45 ± 15%
air pressure	atmospheric pressure
cleanliness	ISO14664-1 class 8 (Max) (equivalent of FED-STD-209D class 100,000)
others	・with lights ・with curtains

(4) TS handling equipment

This facility owns a TS handling equipment which can handle heavy items (especially TSs.) The external view, movable range, and basic specifications, of the equipment are shown in Figures 2-10, 2-11, and in Table 2-3, respectively.

TS Handling Equipment:

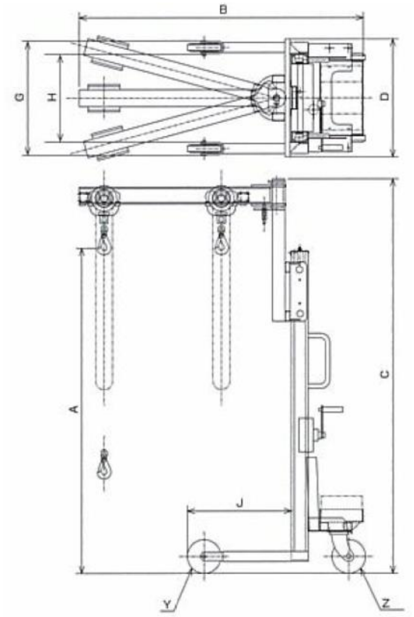


Figure 2-10 External View (Left)

Figure 2-11 Movable Range (Right)

Table 2-3 Basic Specifications of TS Handling Equipment

model #	load	lifting height (A)	full length (B)	total height (C)	total width (D)	forelegs outer width (G)	forelegs inner width (H)	forelegs length (J)	fore wheels (Y)	rear wheels (Z)	lifting height per rotation	empty weight	lifting
HGL150	150 ～ 350kg	600 ～ 1930	1685	1890	690	690	510	620	ϕ200 (Jane rubber)	ϕ200 (w/ a brake)	about 14	about 250kg	hand rolling

3. User I/F

3.1. External I/F on Chamber

A schematic configuration of this facility is shown in Figure 3-1.

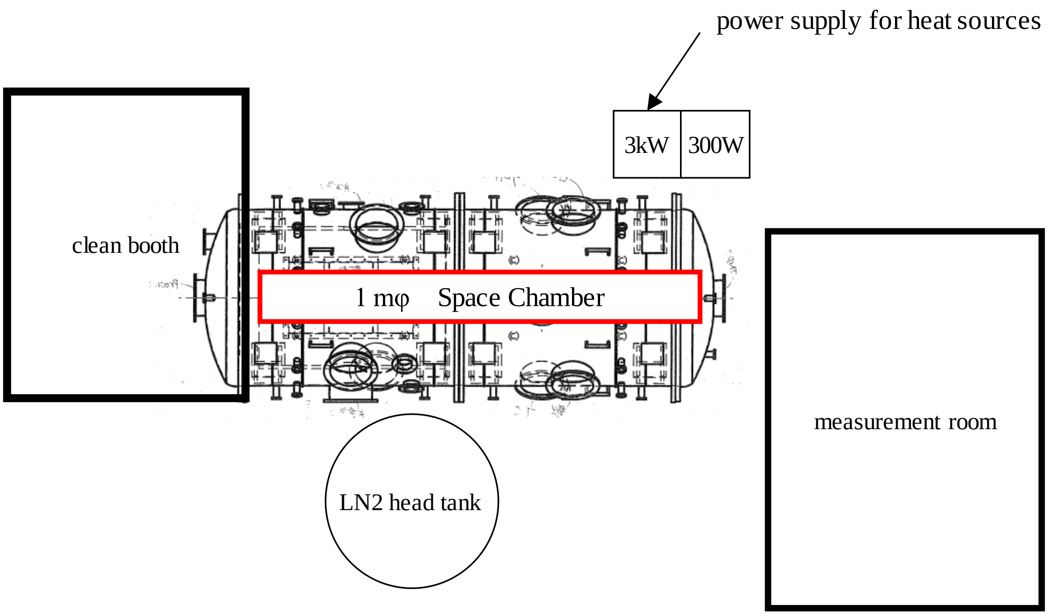


Figure 3-1 Schematic Configuration of 1mφ Space Chamber

3.2. Device I/Fs

3.2.1. Vacuum Vessel

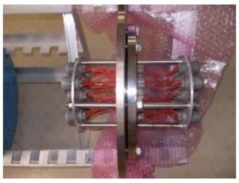
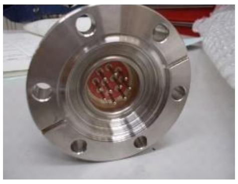
(1) Nozzle configuration in vacuum vessel (including view port)

There are nozzles with flanges all over the vacuum vessel as the I/Fs to connect the inside and outside of the vessel. A list of those nozzles is shown in Table 3-1, and their locations are shown in Figure A-2 SKCK-001A and Figure A-3 SKCK-002A of Appendix B. The nozzles not being used by the facility are available to users. The flanges shown in Table 3-2 are owned by the facility side and are available to users. In case flanges other than the ones owned by the facility are necessary, users are to prepare them.

Table 3-1 List of Nozzles

No.	port #	model #	replacement of flange	usage purpose	notes
1	N19	ICF70	not possible	for TS support	
2	N20	ICF70	not possible	for TS support	
3	N21	ICF70	not possible	for TS support	
4	N22	ICF70	not possible	for TS support	
5	N23	-	not possible	for facility LN_2/GN_2	
6	N24	-	not possible	for facility LN_2/GN_2	
7	N25	50A	possible		
8	N26	50A	possible		
9	N27	300A	possible		
10	N28	100A	possible		
11	N29	ICF203	possible		
12	N30	300A	not possible	for temperature measurement	
13	N31	300A	possible		
14	N32	300A	possible		
15	N33	300A	possible		
16	N34	100A	possible		stationary viewport
17	N35	100A	possible		stationary viewport
18	N36	100A	possible		
19	N37	100A	possible		
20	N38	100A	possible		
21	N39	100A	possible		
22	ICF-1	ICF70	possible		
23	ICF-2	ICF70	possible		
24	ICF-3	ICF70	possible		
25	ICF-4	ICF70	possible		
26	ICF-5	ICF70	possible		
27	ICF-6	ICF70	possible		
28	ICF-7	ICF70	possible		
29	ICF-8	ICF70	possible		
30	ICF-9	ICF70	possible		
31	ICF-10	ICF70	possible		
32	ICF-11	ICF70	possible		
33	ICF-12	ICF70	possible		
34	ICF-13	ICF70	possible		
35	t2-1	250A	possible		
36	t2-2	100A	possible		
37	t2-3	ICF70	possible		

Table 3-2 List of Flanges owned by this Facility

No.	size	usage purpose	quant.	specifications	external view		preparation by users / notes
1	300A	for signals	1	・10 pins × 10 sets ・current tolerance: 1A/1 cable ・both-end connection via connector MS3106A18-1S			・connector: [MS3106A18-1S] *Teflon insulator is to be used for the vacuum side. *Check the pin assignment before using.
2	300A	for thermocouple (for CC)	2	・24 pins (12 pairs) × 12 sets ・both-end connection via connector MS3106B24-28S			・connector:[MS3106B24-28S] *Teflon insulator is to be used for the vacuum side. ・stationary equipment at N30
3	ICF70	for current and signals	2	・10 pins × 1 set ・current tolerance: 13A/1 cable ・both-end connection via connector MS3106A18-1S			・connector: [MS3106A18-1S] *Teflon insulator is to be used for the vacuum side.
4	ICF70	for current and signals	2	・10 pins × 1 set ・current tolerance: 13A/1 cable ・one-end connector MS3106A18-1S			・connector: [MS3106A18-1S] *Teflon insulator is to be used for the vacuum side.
5	ICF70	For applying current	4	・6PIN ・current tolerance: 5A/1 cable ・ANELVA 954-7290			Insert socket contact into the pins on the vacuum side when used. ・vacuum-side socket contact : #16 socket contact [954-7326] ・atmosphere-side connector : 6P plug [951-7291] crimp tool main body: [M22520/1-01] crimp tool positioner: [M22520/1-02]

*1: The vessel has multiple types of nozzles, e. g., 300A, 200A, ICF70, etc., which can therefore be used as additional I/Fsif users prepare compatible flanges to them.

3.2.2. Electric Power, Signals

(1) Temperature measurement lines

Out of the temperature measurement lines owned by the facility, 72 channels are available for TSs. T-type thermocouples are to be used as sensors, and the thermocouples and mini omega connectors (SMP-T-M) for the usage inside the vacuum vessel are to be prepared by users.

60 channels out of 72 can be monitored via the data acquisition system. The rest can be measured by measurement instruments, etc., brought in by users.

The schematic view of the temperature measurement lines and the table of connections for them are respectively shown in Figure 3-2 and Table 3-3.

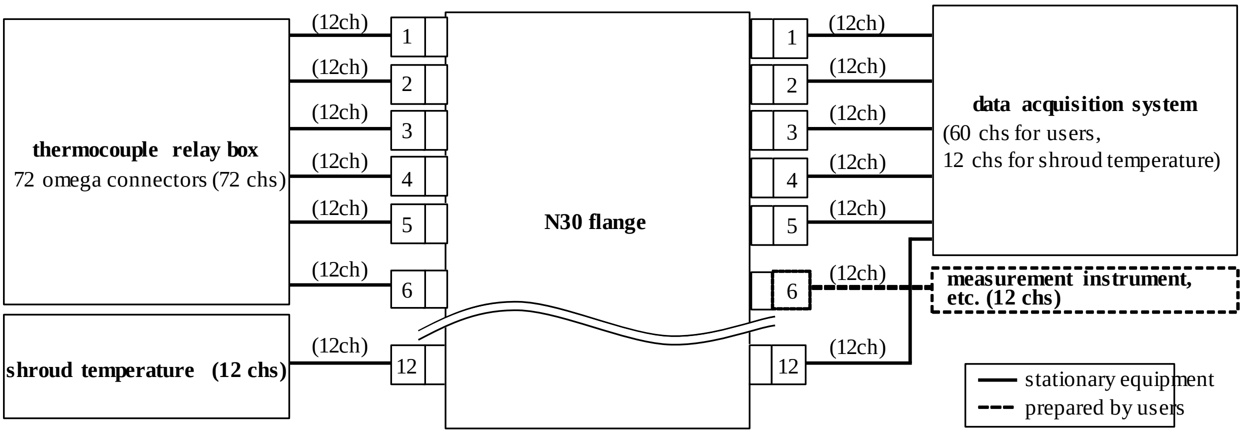


Figure 3-2 System Diagram of Temperature Measurement Lines

(2) Measurement lines other than those for thermocouples

Flanges with feed-through terminals and cables (both inside and outside the vacuum vessel) are to be prepared by users. The former can be leased out from the facility side, provided that they are shown in Table 3-2.

(3) Electric power lines

Flanges with feed-through terminals and cables (for both inside and outside the vacuum vessel) are to be prepared by users. The former can be leased out from the facility side, provided that they are shown in Table 3-2.

Table 3-3 Table of Connections for Temperature Measurement Lines (1/3)

channel #	data logger channel #	material of conductor	atmosphere-side connector pin #	feed-through pin #	feed-through connector #	feed-through flange #	vacuum-side connector pin #	thermocouple relay box
1	0	copper	A	A	1	N30	D	1
		constantan	B	B			C	
2	1	constantan	C	C			B	2
		copper	D	D			A	
3	2	constantan	E	E			J	3
		copper	F	F			H	
4	3	constantan	G	G			G	4
		copper	H	H			F	
5	4	constantan	J	J			E	5
		copper	Q	Q			K	
6	5	copper	K	K			Q	6
		constantan	R	R			V	
7	6	constantan	L	L			P	7
		copper	M	M			N	
8	7	copper	N	N			M	8
		constantan	P	P			L	
9	8	copper	S	S			U	9
		constantan	T	T			T	
10	9	copper	U	U			S	10
		constantan	V	V			R	
11	10	copper	W	W			Z	11
		constantan	X	X			Y	
12	11	constantan	Y	Y			X	12
		copper	Z	Z			W	
13	12	copper	A	A	2	N30	D	13
		constantan	B	B			C	
14	13	constantan	C	C			B	14
		copper	D	D			A	
15	14	constantan	E	E			J	15
		copper	F	F			H	
16	15	constantan	G	G			G	16
		copper	H	H			F	
17	16	constantan	J	J			E	17
		copper	Q	Q			K	
18	17	copper	K	K			Q	18
		constantan	R	R			V	
19	18	constantan	L	L			P	19
		copper	M	M			N	
20	19	copper	N	N			M	20
		constantan	P	P			L	
21	20	copper	S	S			U	21
		constantan	T	T			T	
22	21	copper	U	U			S	22
		constantan	V	V			R	
23	22	copper	W	W			Z	23
		constantan	X	X			Y	
24	23	constantan	Y	Y			X	24
		copper	Z	Z			W	
25	24	copper	A	A	3	N30	D	25
		constantan	B	B			C	
26	25	constantan	C	C			B	26
		copper	D	D			A	
27	26	constantan	E	E			J	27
		copper	F	F			H	
28	27	constantan	G	G			G	28
		copper	H	H			F	
29	28	constantan	J	J			E	29
		copper	Q	Q			K	
30	29	copper	K	K			Q	30
		constantan	R	R			V	
31	30	constantan	L	L			P	31
		copper	M	M			N	
32	31	copper	N	N			M	32
		constantan	P	P			L	
33	32	copper	S	S			U	33
		constantan	T	T			T	
34	33	copper	U	U			S	34
		constantan	V	V			R	
35	34	copper	W	W			Z	35
		constantan	X	X			Y	
36	35	constantan	Y	Y			X	36
		copper	Z	Z			W	

Table 3-3 Table of Connections for Temperature Measurement Lines (2/3)

channel #	data logger channel #	material of conductor	atmosphere-side connector pin #	feed-through pin #	feed-through connector #	feed-through flange #	vacuum-side connector pin #	thermocouple relay box
37	36	copper	A	A	4	N30	D	37
		constantan	B	B			C	
38	37	constantan	C	C			B	38
		copper	D	D			A	
39	38	constantan	E	E			J	39
		copper	F	F			H	
40	39	constantan	G	G			G	40
		copper	H	H			F	
41	40	constantan	J	J			E	41
		copper	Q	Q			K	
42	41	copper	K	K			Q	42
		constantan	R	R			V	
43	42	constantan	L	L			P	43
		copper	M	M			N	
44	43	copper	N	N			M	44
		constantan	P	P			L	
45	44	copper	S	S			U	45
		constantan	T	T			T	
46	45	copper	U	U			S	46
		constantan	V	V			R	
47	46	copper	W	W			Z	47
		constantan	X	X			Y	
48	47	constantan	Y	Y			X	48
		copper	Z	Z			W	
49	16	copper	A	A	5	N30	D	49
		constantan	B	B			C	
50	17	constantan	C	C			B	50
		copper	D	D			A	
51	18	constantan	E	E			J	51
		copper	F	F			H	
52	19	constantan	G	G			G	52
		copper	H	H			F	
53	20	constantan	J	J			E	53
		copper	Q	Q			K	
54	21	copper	K	K			Q	54
		constantan	R	R			V	
55	22	constantan	L	L			P	55
		copper	M	M			N	
56	23	copper	N	N			M	56
		constantan	P	P			L	
57	24	copper	S	S			U	57
		constantan	T	T			T	
58	25	copper	U	U			S	58
		constantan	V	V			R	
59	26	copper	W	W			Z	59
		constantan	X	X			Y	
60	27	constantan	Y	Y			X	60
		copper	Z	Z			W	
—	—	copper	A	A	6	N30	D	61
		constantan	B	B			C	
—	—	constantan	C	C			B	62
		copper	D	D			A	
—	—	constantan	E	E			J	63
		copper	F	F			H	
—	—	constantan	G	G			G	64
		copper	H	H			F	
—	—	constantan	J	J			E	65
		copper	Q	Q			K	
—	—	copper	K	K			Q	66
		constantan	R	R			V	
—	—	constantan	L	L			P	67
		copper	M	M			N	
—	—	copper	N	N			M	68
		constantan	P	P			L	
—	—	copper	S	S			U	69
		constantan	T	T			T	
—	—	copper	U	U			S	70
		constantan	V	V			R	
—	—	copper	W	W			Z	71
		constantan	X	X			Y	
—	—	constantan	Y	Y			X	72
		copper	Z	Z			W	

Table 3-3 Table of Connections for Temperature Measurement Lines (3/3)

channel #	data logger	material of conductor	atmosphere-side connector	feed-through			vacuum-side connector	thermocouple relay box
	channel #		pin #	pin #	connector #	flange #	pin #	
61	28	copper	A	A	12	N30	D	right front of chamber
		constantan	B	B			C	
62	29	constantan	C	C			B	right back of chamber
		copper	D	D			A	
63	30	constantan	E	E			J	left front of chamber
		copper	F	F			H	
64	31	constantan	G	G			G	left back of chamber
		copper	H	H			F	
65	32	constantan	J	J			E	upper front of chamber
		copper	Q	Q			K	
66	33	copper	K	K			Q	upper back of chamber
		constantan	R	R			V	
67	34	constantan	L	L			P	lower front of chamber
		copper	M	M			N	
68	35	copper	N	N			M	lower back of chamber
		constantan	P	P			L	
69	36	copper	S	S			U	upper part of scavenger cryopanel
		constantan	T	T			T	
70	37	copper	U	U			S	lower part of scavenger cryopanel
		constantan	V	V			R	
71	38	copper	W	W			Z	center of the door
		constantan	X	X			Y	
72	39	constantan	Y	Y			X	center of the head
		copper	Z	Z			W	
	*40 ~ 47 are unavailable, with shorting connectors inserted.							

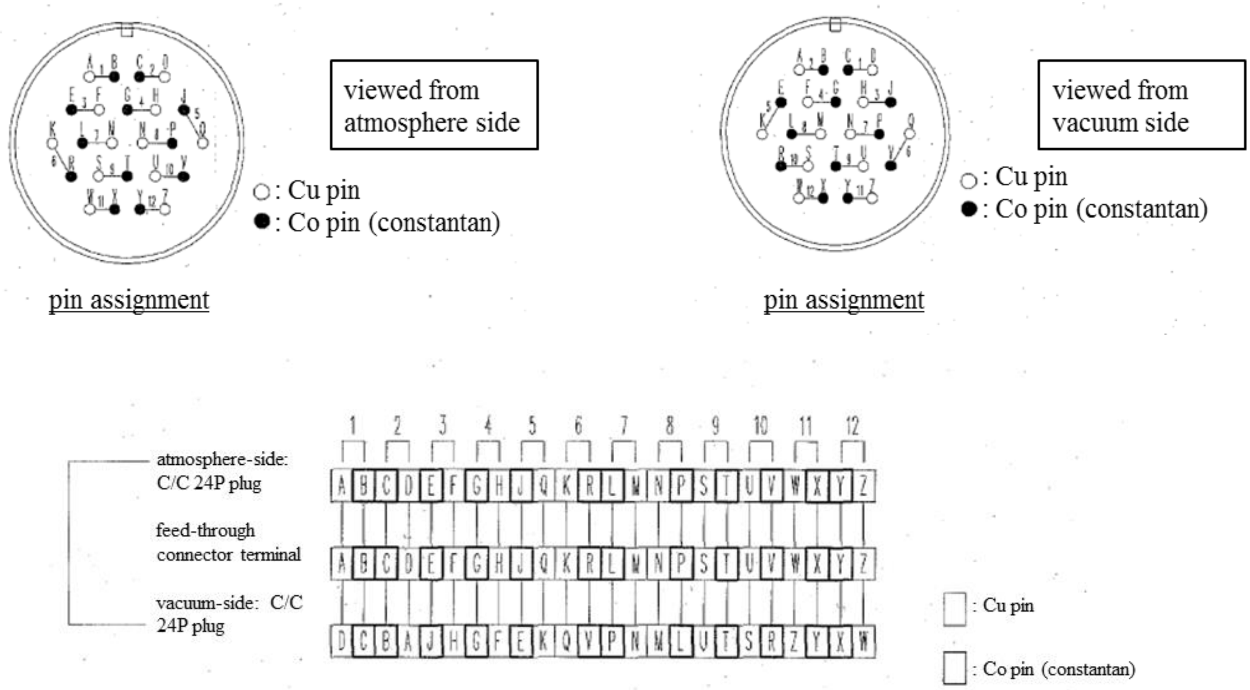


Figure 3-3 Pin Assignment of Temperature Measurement Plugs

3.2.3. Power Supplies for Heat Sources

The cables (w/ connectors) from the power supplies to the I/F flanges are stationary equipment of the facility. Refer to Table 3-4 for the connection assignment of the connectors.

When users' own cables are used instead of the forementioned stationary cables, the latter can be pulled out of the terminal boards or output terminals where users' cables can then be connected. On completion of tests, etc., the stationary cables are to be connected as they were.

Table 3-4 Assignment of Connectors from Power Supplies for Heat Sources

300W power supplies			cables for 300W power supplies		I/F flange to vacuum vessel	inside vacuum vessel	notes
name of power supply	terminal board	polarity	pin #	model # of connector			
power supply 21	5P1	+	A	MS3106B18-1S	to be prepared by users (Flanges in Table 3-2 can be leased.)	to be prepared by users	power supply specification output voltage: DC0 ~ 100V output current: 0 ~ 3A *Pay attention to power supply capacity and the rated current of flange *Facility cables on terminal board can be replaced by users' own cables. (Original cables are to be resumed on completion of test.)
	5N1	-	B				
power supply22	5P2	+	C				
	5N2	-	D				
power supply23	5P3	+	E				
	5N3	-	F				
power supply24	5P4	+	G				
	5N4	-	H				
power supply25	5P5	+	I				
	5N5	-	J				

3kWpower supplies		cables for 300W power supplies		I/F flange to vacuum vessel	inside vacuum vessel	notes
name of power supply	output terminal					
	polarity	pin #	model # of connector			
power supply1	+	A	MS3106B18-1S	to be prepared by users (Flanges in Table 3-2 can be leased.)	to be prepared by users	rated current per 1 pin: 13A provided 63A or less per 1 connector power supply specification output voltage: DC0 ~ 100V output current: 0 ~ 30A *Pay attention to power supply capacity and the rated current of flange. *Facility cables on terminal board can be replaced by users' own cables. (Original cables are to be resumed after completion of test. *Facility cables on output terminal can be replaced by users' own cables. (Original cables are to be resumed on completion of test.)
	-	B				
power supply2	+	C				
	-	D				
power supply3	+	E				
	-	F				

3.2.4. Data Acquisition System

The measured data is collected by the server computer (data acquisition PC) in accordance with the preset program. The display program puts up measured data both in real time and of the past for reference.

(1) Content of data acquired by data acquisition system

The following data is obtainable by the data acquisition system.

(a) Thermocouple temperature

(b) Output current/voltage from power supplies for heat sources

(c) Vacuum pressure

(2) Preset data

The following items are to be preset for using the data acquisition system. The preset is to be completed prior to the start of a test.

(a) Measurement conditions: sampling interval, with or without checking on breaking of wires, etc.

(b) Measurement ID: channel No., measurement ID, names of data, etc.

(c) Modes: names of test modes, registered channels, etc.

(d) Groups: names of groups, registered channels, etc.

For further details, refer to Appendix A “Users’ Manual for Database.”

(3) Distribution of data

On completion of a test, the recorded measurement data will be handed to users after converted into a comma-delimited text file (viz. CSV format.)

The data includes TS names, test names, output periods, group names, channel numbers, measurement ID, data names, units, data acquisition times, mode names, and measured data.

3.2.5. Building

(1) Chamber

A part of 8mφ space chamber can be shared by users as a working area for using 1mφ space chamber. TSs and equipment can be carried in/out via the loading dock shutter of 8mφ space chamber building.

Equipment, systems, etc., brought in by users can be set using the desks and chairs in the room. A schematic view of the chamber is provided in Figure 3-4.

(2) Clean booth

The temperature, humidity, and cleanliness in the clean booth can be put up on the portable monitor.

To prevent the degradation of the cleanliness, the opening/closing of the curtain at the entrance is to be kept to the minimum and shortest time possible.

The temperature of the air conditioner can be adjusted as needed.

(3) Measurement room

The data obtained by the data acquisition system can be monitored via the setting monitoring PC installed in this room. Equipment, systems, etc., brought in by users can be set using the desks and chairs in the room.

(4) Distribution boards for users, sockets

The power supplies necessary for conducting a test are connected to the distribution boards for users or sockets for usage.

The configuration of distribution boards and sockets is shown in Figure 3-5. Please be sure of the total EP load applied by users not to exceed the capacities of the EP supply or breakers.

Since the distribution boards and the sockets are not connected to any emergency power supply system, an UPS, power generator, etc., may need to be prepared by users to be on the safe side.

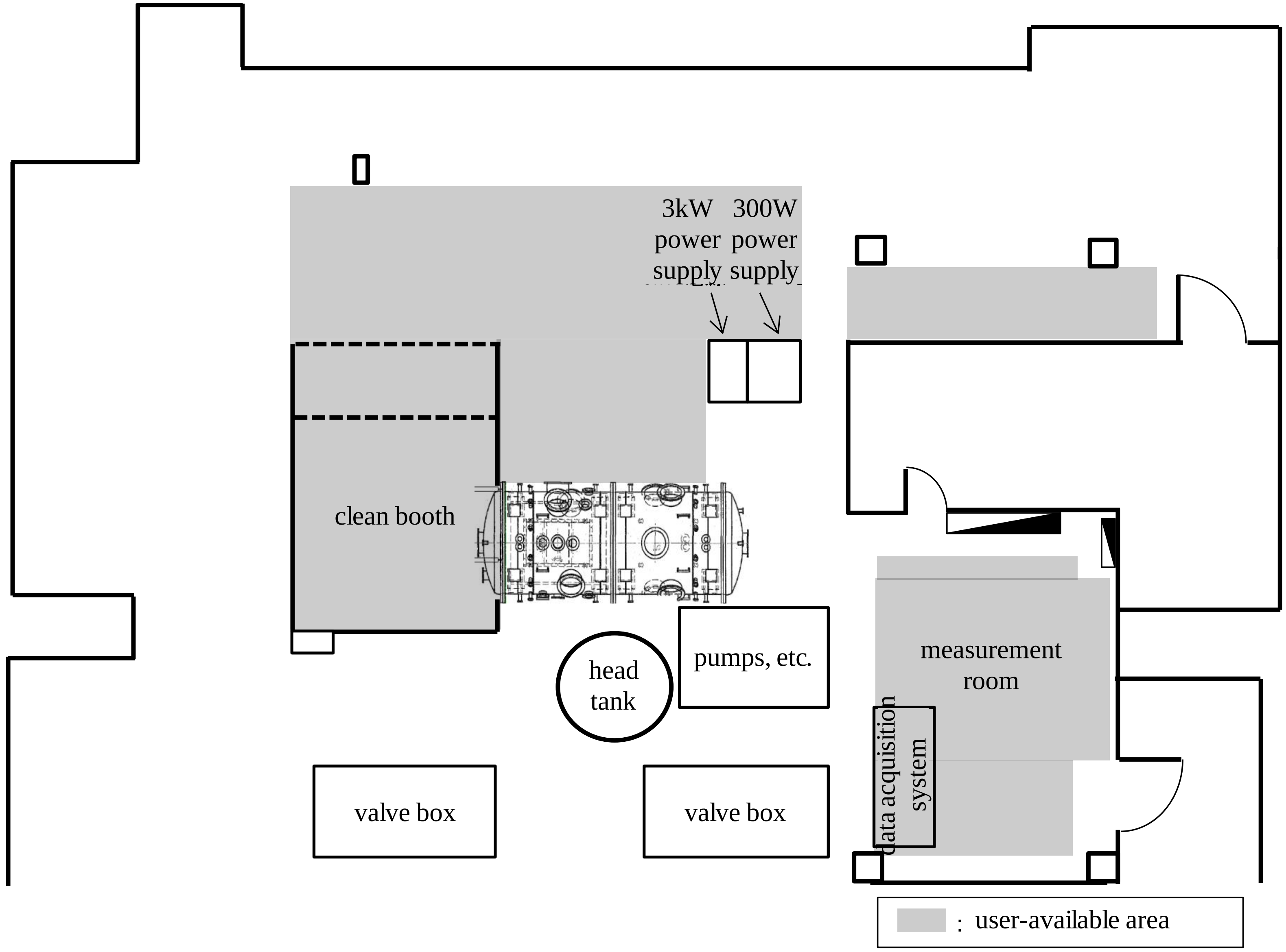


Figure 3-4 Schematic View of Chamber Room

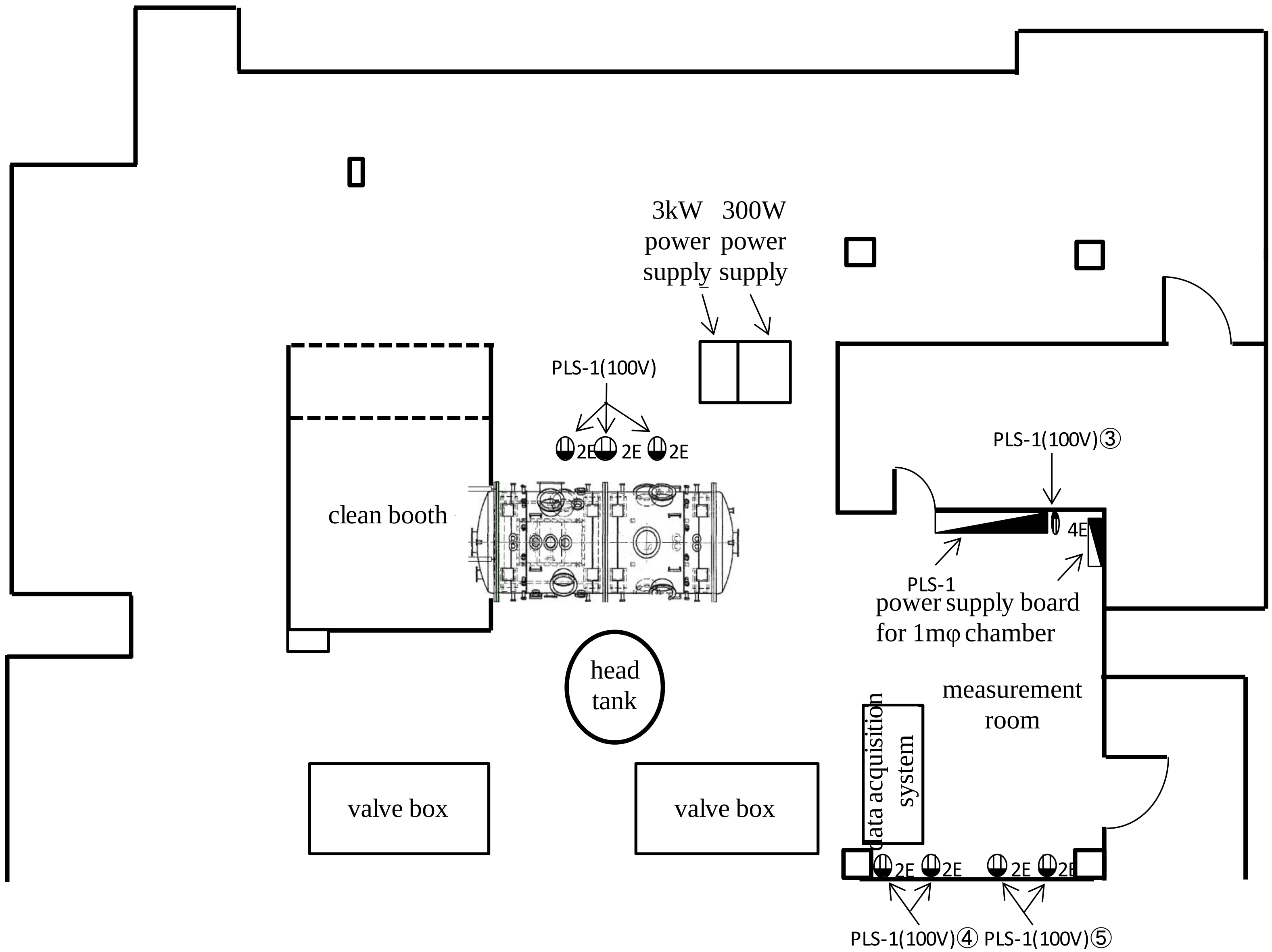


Figure 3-5 Configuration of Distribution Boards and Sockets

4. Execution of Tests

4.1. Test-related Work Procedure

Each work in the course of a test is executed based on the test implementation plan sheet presented by the TS side. The following Figure 4-1 shows a general flow of test-related work.

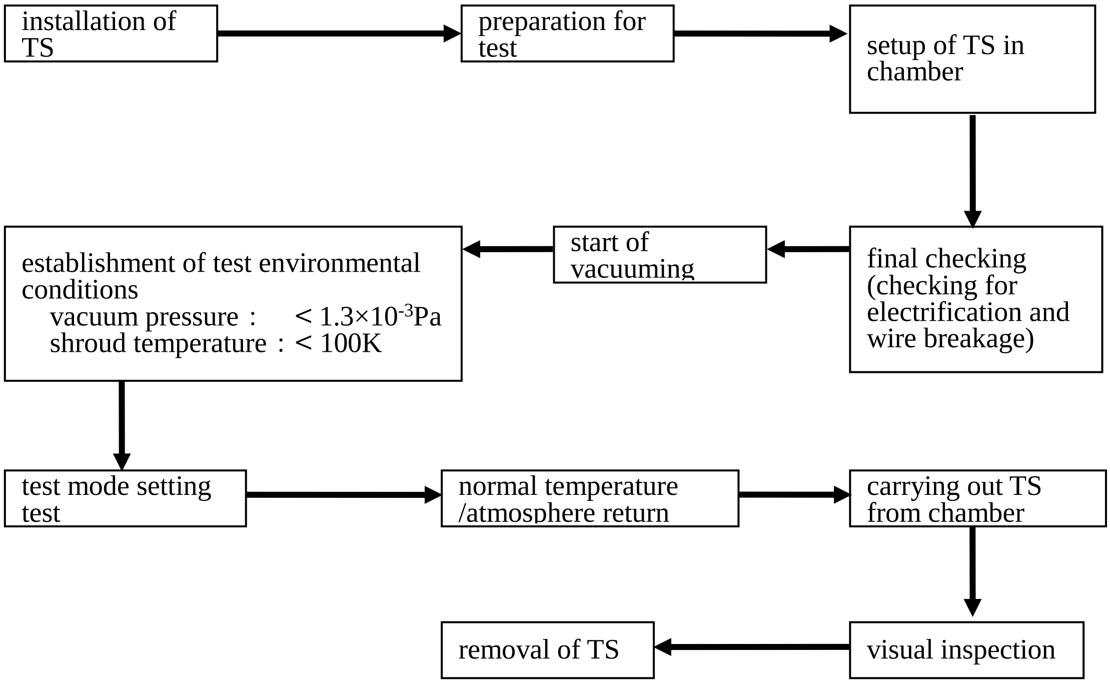


Figure 4-1 Test-related Work Flow

4.2. Test Procedure

4.2.1. Chamber Operation Pattern

The standard vacuum curve and shroud temperature during a thermal vacuum test in this facility are shown in Figure 4-2, while the shroud temperature measurement points are shown in Figure 4-3.

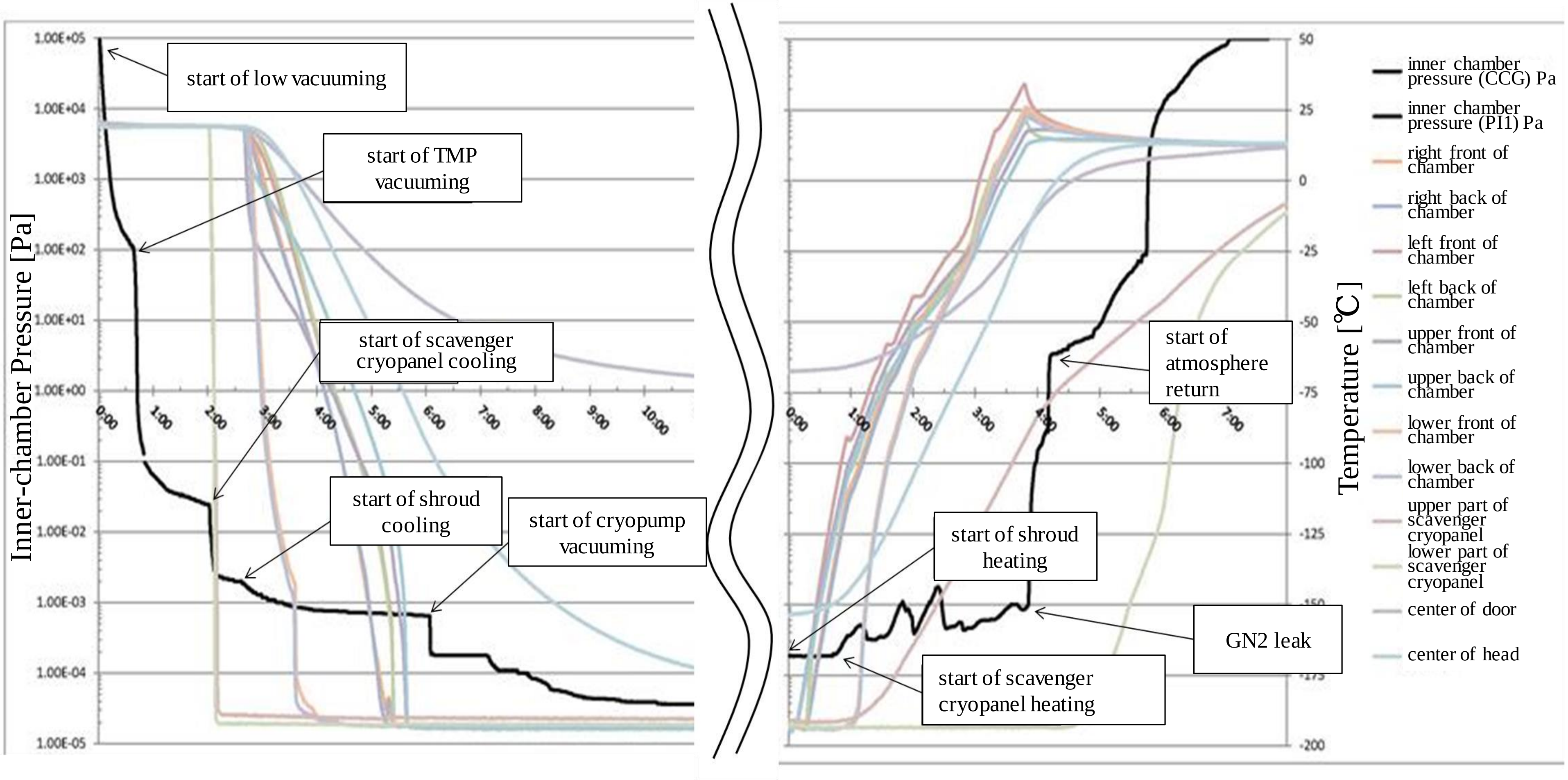


Figure 4-2 Standard Vacuum Curve, Shroud Temperature

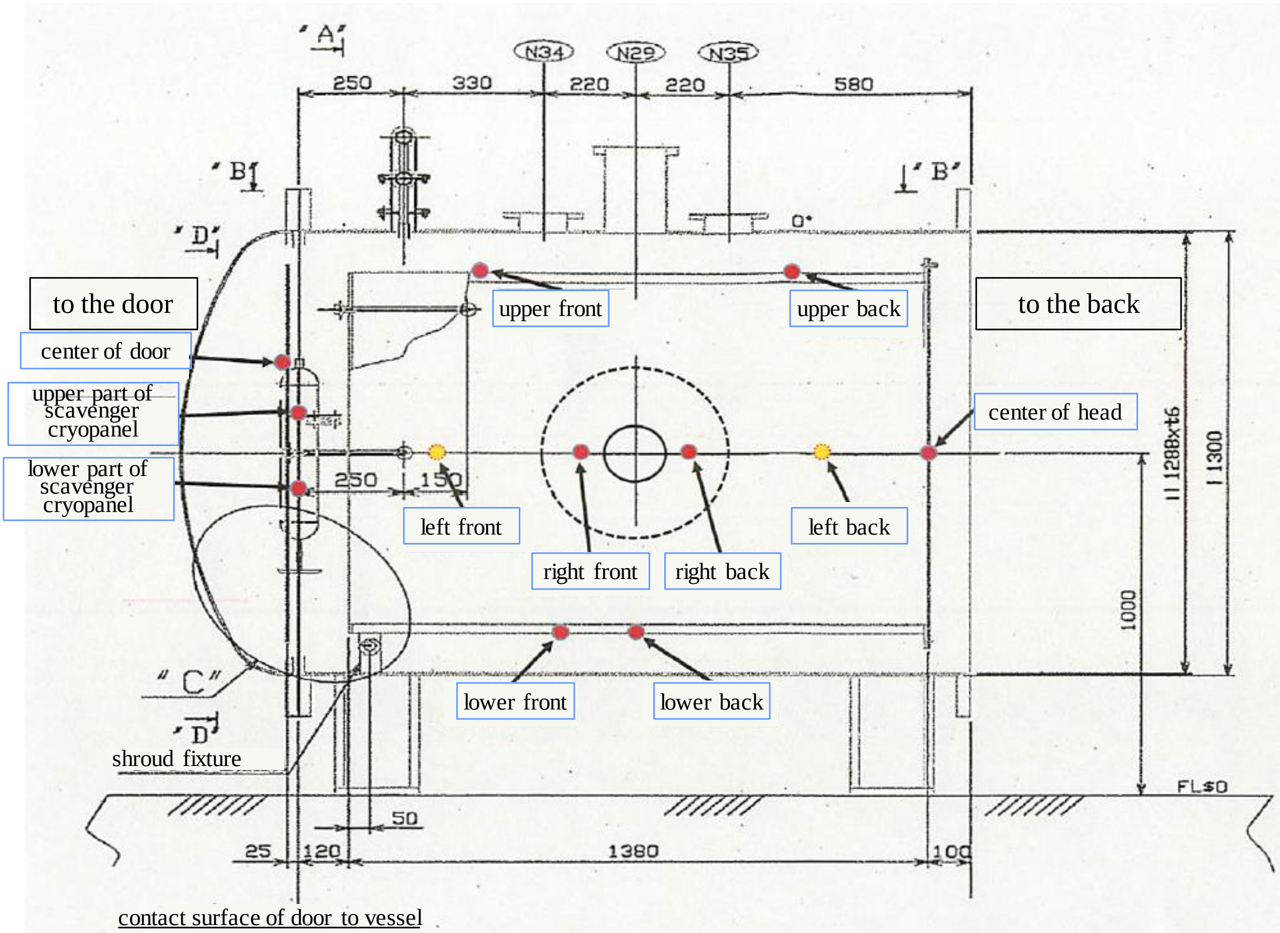


Figure 4-3 Shroud Temperature Measurement Points

4.3. Other Remarks

(1) Matters to be confirmed for test

The environment in the space chamber is the same as outer space in that it cannot be accessed promptly even when abnormalities are found on a TS. Bearing that in mind, the following matters are to be checked.

What is suggested in this section are general matters to be attended to for using this chamber. For further information on each equipment, refer to their respective users' manual.

(a) With its equipment all manually operated, this facility has no interlock system to protect equipment or TSs. Therefore, users are to be cautious of the pressure and temperature inside the vessel, the state of a TS, etc., when using this facility.
[ex] If the TMP valve is opened in the middle of its operation when the vessel is in the atmospheric state, back pressure can be exerted on the TMP, possibly damaging its rotor.

(b) Stay alert to the lack of oxygen when dealing with LN_2.

(c) When performing work using LN_2, be cautious of the parts that take on cryogenic temperature. Pay special attention to the shroud and scavenger cryopanels right after the achievement of atmosphere return, because they can be extremely cold.

(d) Before closing the door, users are to make sure that there is no dust or dirt on the O rings and flange surfaces. If there is, it is to be wiped off with a piece of clean rug, using a little amount of IPA applied to the rug when it doesn't come off easily.

(e) Do not apply vacuum grease to the O rings to the extent possible, because that will end up collecting dust or accumulating gas.

(f) When fastening the tightening bolts for the door, do so on the four of them little by little in turn. Avoid retightening them when the vessel is in the vacuum state, because that will make the bolts fastened too tight to be turned when the atmosphere return is achieved.

(g) Do not reuse the gaskets of ICF70 and VCR, because they are made of copper.

(h) Do not open/close the atmosphere return valve too fast when operating it. Otherwise, a TS, gauge, etc., can be damaged by the abrupt inflow of air.

(i) When supplying LN_2 to the shroud and scavenger cryopanels, open/close the valve slowly to avoid the sudden change of temperature.

(j) When raising the temperature of the shroud, be careful not to let it exceed 60℃, because that may cause the detachment of the black paint inside the shroud.

(k) Make sure to mount the Pirani gauge (PSG-1) manufactured by DIAVAC horizontally. If mounted vertically, errors take place at the pressure of 4×10^4Pa or more. The Penning gauge (C-4), on the other hand, has no usage restrictions, but may as well avoid such places where magnetic field can have problematic effect on it, due to the magnet used for the gauge.

(l) Even though the Nude gauge is supposed to be capable of measurement at the pressure of 10^{-1}Pa or lower according to its catalogue, it is better used in higher vacuum pressure (around 10^{-3}Pa or less) to the extent possible, because its lighting in high pressure can shorten its longevity.

(m) When opening the vacuum valve of the cryopump, make sure in advance that the vessel is in the vacuum state and the cryopump is 20K or lower. If the vacuum valve is opened when the vessel is in the atmospheric state, it takes long before the cryopump returns to the original state, due to its absorption of a large amount of water.

(2) Documents to be submitted at K/O meeting

The following documents are to be submitted to the personnel in charge of the facility at the K/O meeting.

- Test implementation plan
- Requirements for the facility

Table 4-1 Requirements for Facility

>>>These requirements are to be submitted at K/O meeting to the personnel in charge of operating the facility.<<<

1mφ Space Chamber

name of test			documentation date： Year Month Day
facility users' name			note
test conditions, etc.	inner-chamber pressure	Pa or less	generally 1.33×10^{-3}Pa or less
	discharge-hazardous range	Pa ~ Pa	
	shroud temperature	K or lower	generally 100K or lower
	environment of clean booth	temperature：	23 ± 3℃
		humidity：	30 ~ 60％
		cleanliness：	cleanliness: ISO class 8 (class 100,000)
test method, used equipment, etc.	power supplies for heat sources	300W power supply: (qty)	up to 5
		300 kW power supply: (qty)	up to 3
	test specimen mass	kg	
	test specimen dimensions	(incl. jig)	within 1,000 mmφ × 1,380 mm
	TQCM	not use ／ use: (qty)	

Appendix A Attached Drawings

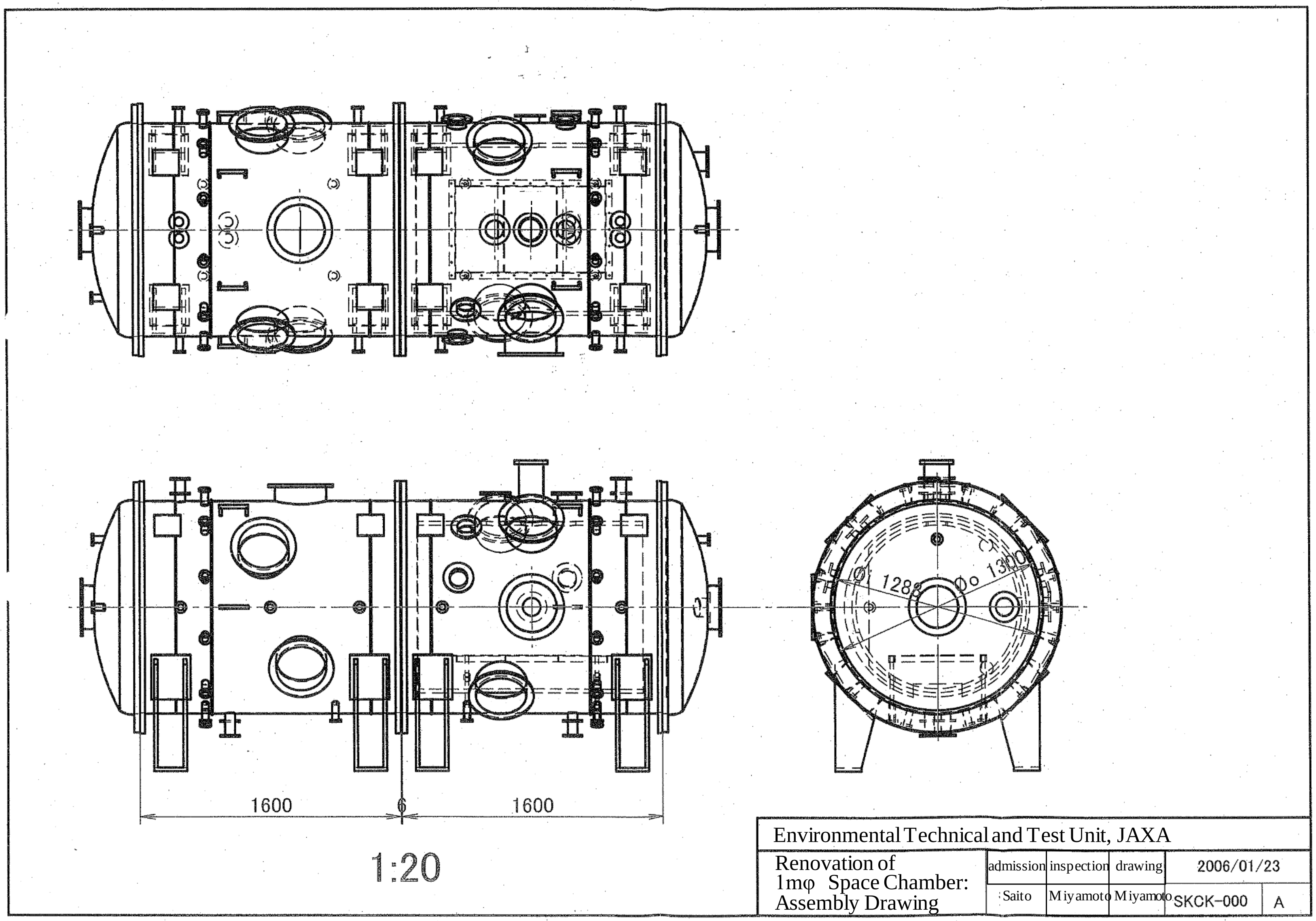


Figure A-1 SKCK-000A Renovation of 1mφ Space Chamber: Assembly Drawing

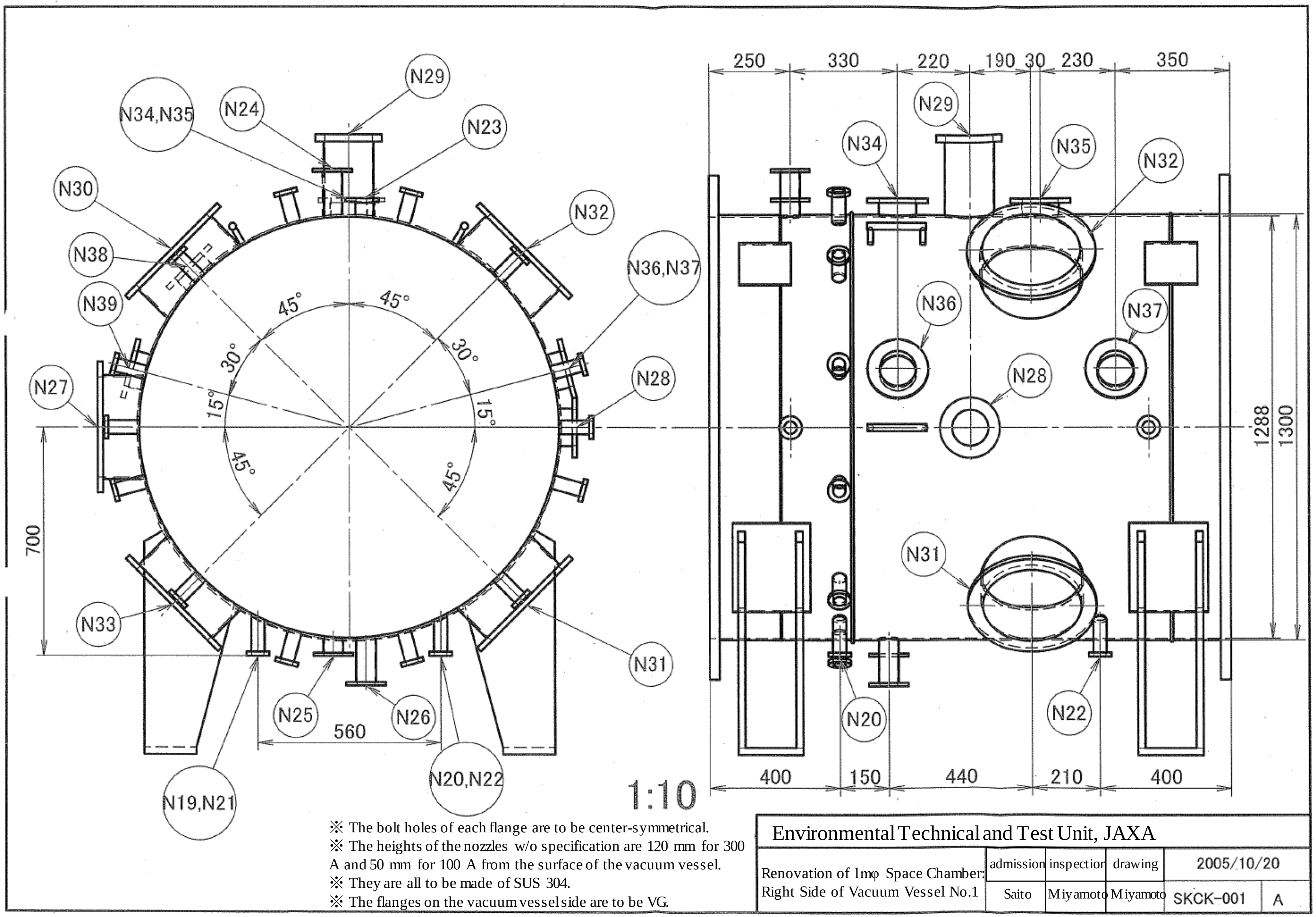
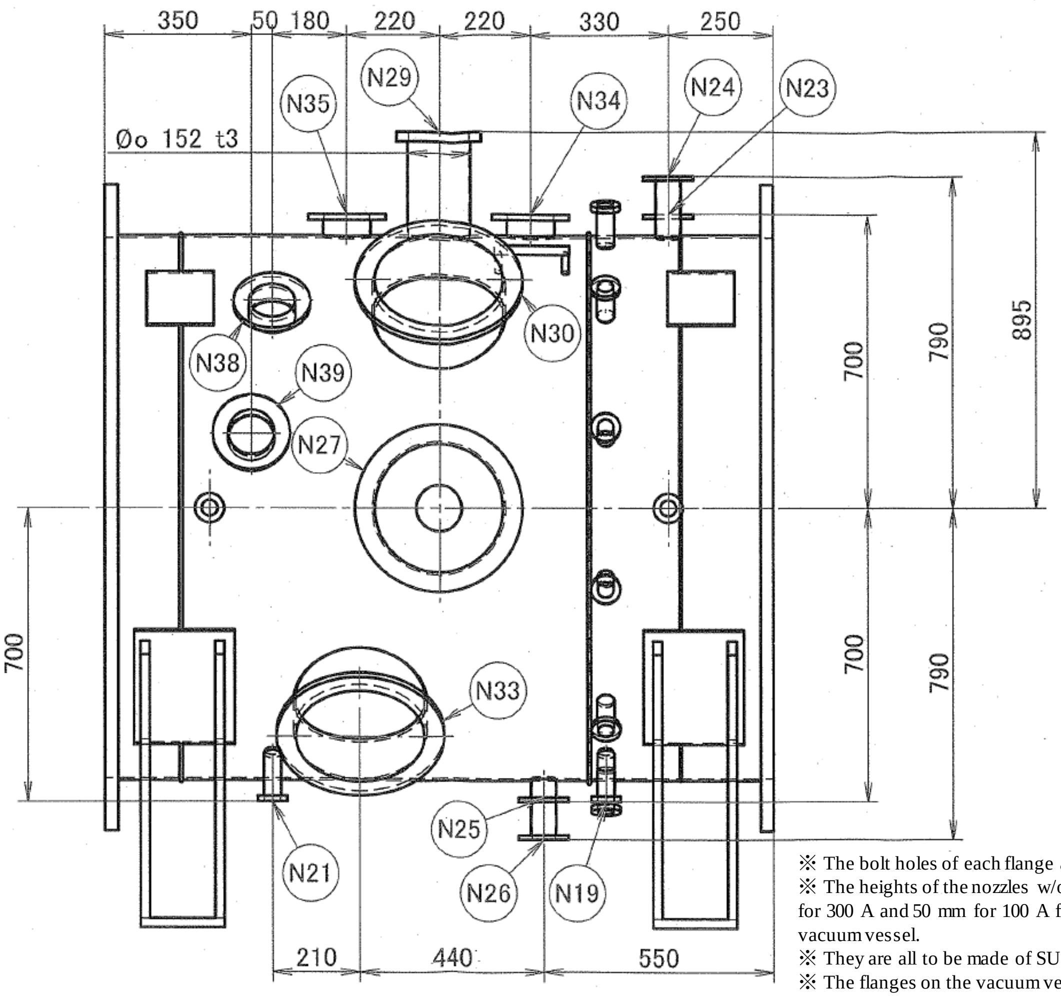


Figure A-2 SKCK-001A Renovation of 1mφ Space Chamber: Right Side of Vacuum Vessel No.1



※ The bolt holes of each flange are to be center-symmetrical.
※ The heights of the nozzles w/o specification are 120 mm for 300 A and 50 mm for 100 A from the surface of the vacuum vessel.
※ They are all to be made of SUS 304.
※ The flanges on the vacuum vessel side are to be VG.

1:10

Environmental Technical and Test Unit, JAXA					
Renovation of 1mφ Space Chamber: Left Side of Vacuum Vessel No.1	admission	inspection	drawing	2005/10/18	
	Saito	Miyamoto	Miyamoto	SKCK-002	A

Figure A-3 SKCK-002A Renovation of 1mφ Space Chamber: Left Side of Vacuum Vessel No.1

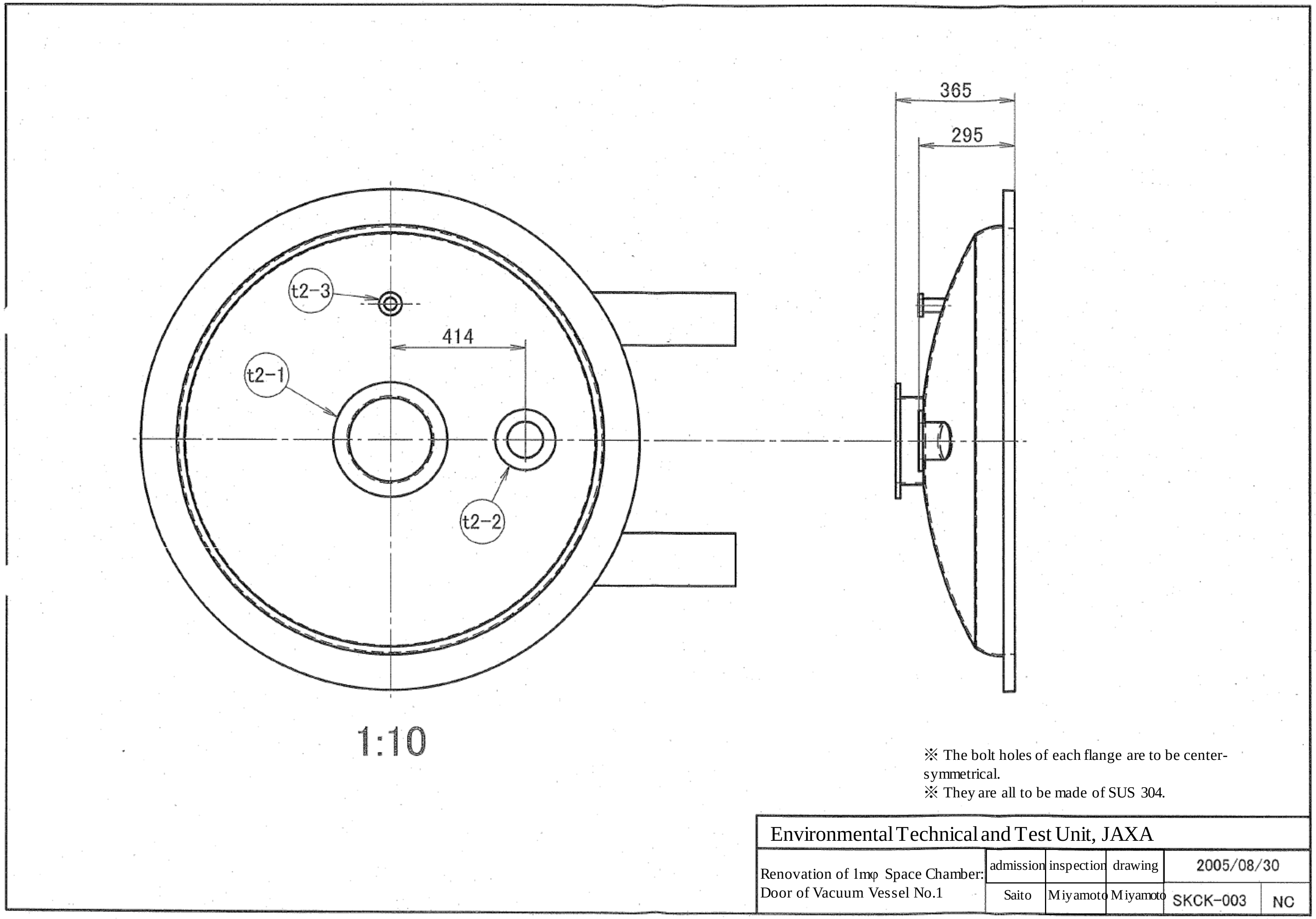


Figure A-4 SKCK-003NC Renovation of 1mφ Space Chamber: Door of Vacuum Vessel No.1

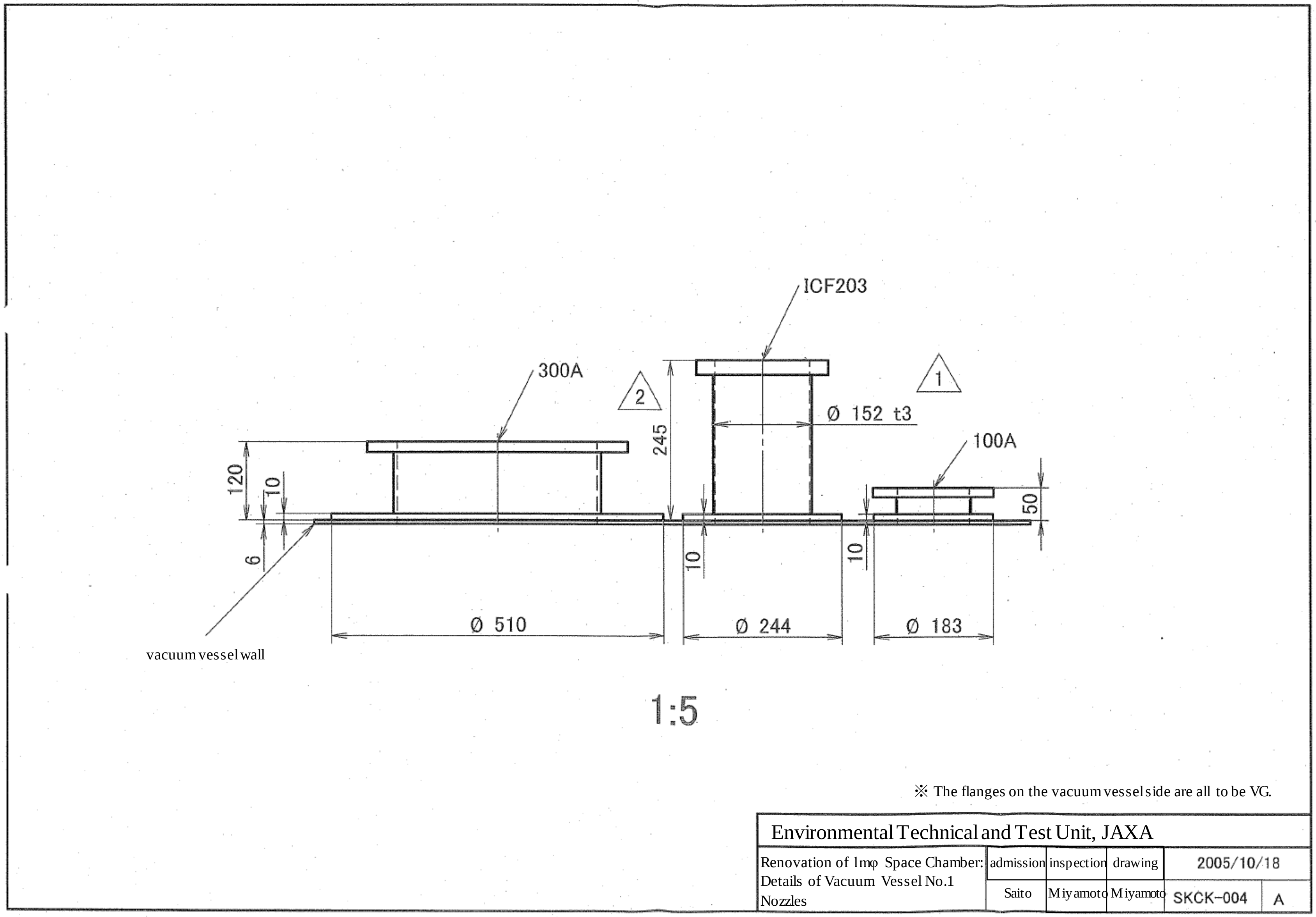


Figure A-5 SKCK-004A Renovation of 1mφ Space Chamber: Details of Vacuum Vessel No.1 Nozzles

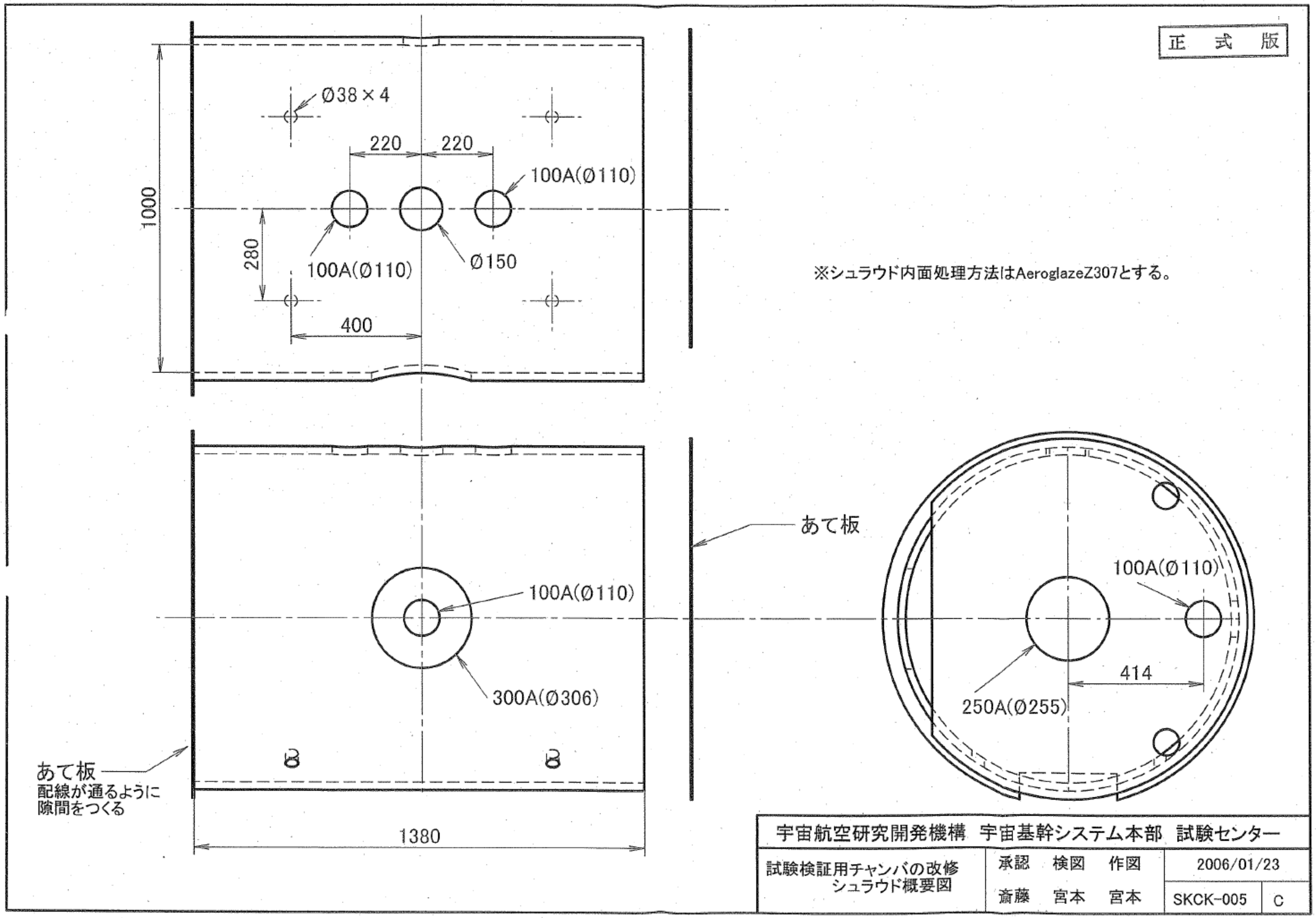


Figure A-6 SKCK-005C Renovation of 1mφ Space Chamber Schematic View of Shroud

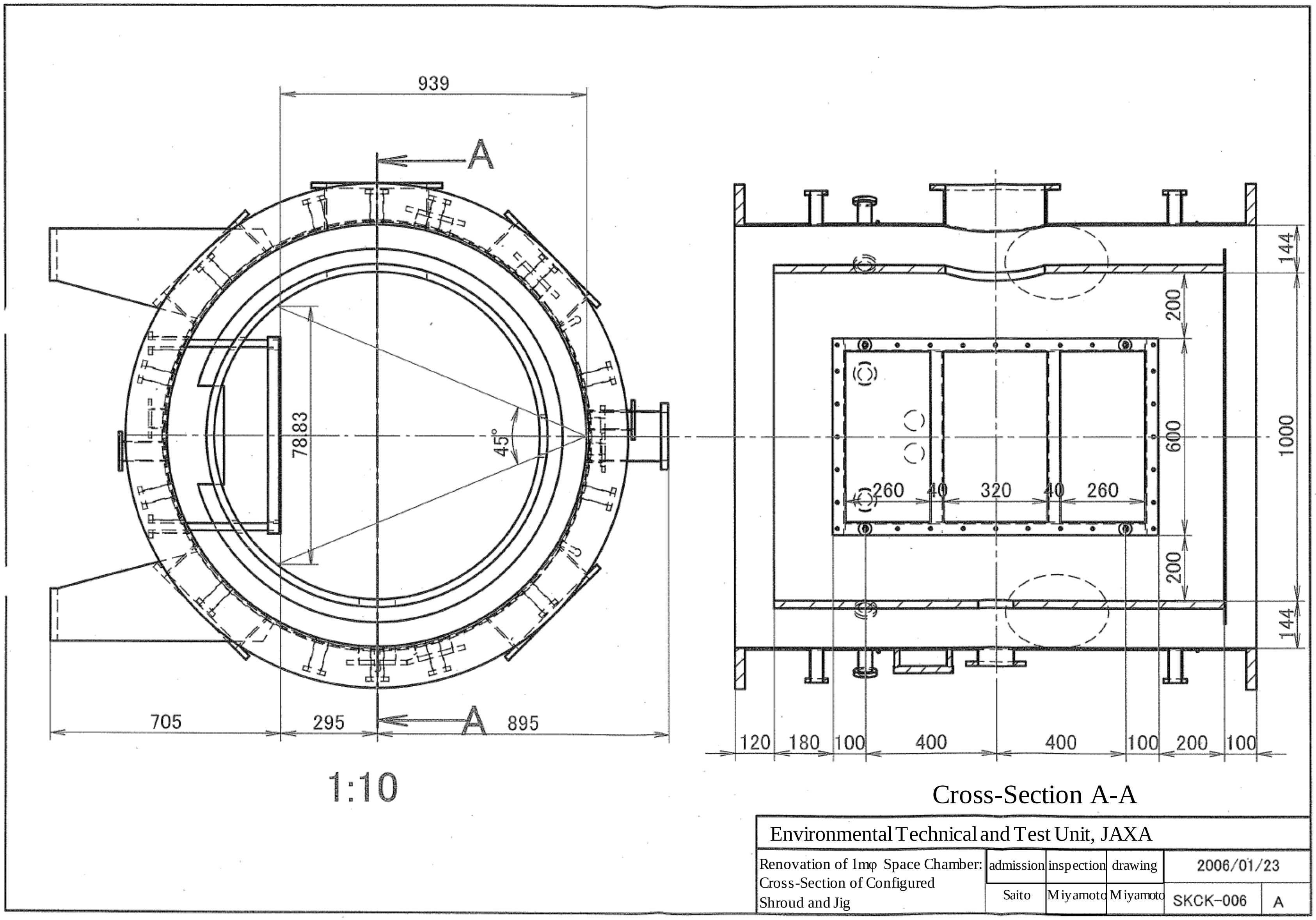


Figure A-7 SKCK-006A Renovation of 1mφ Space Chamber: Cross-Section of Configured Shroud and Jig

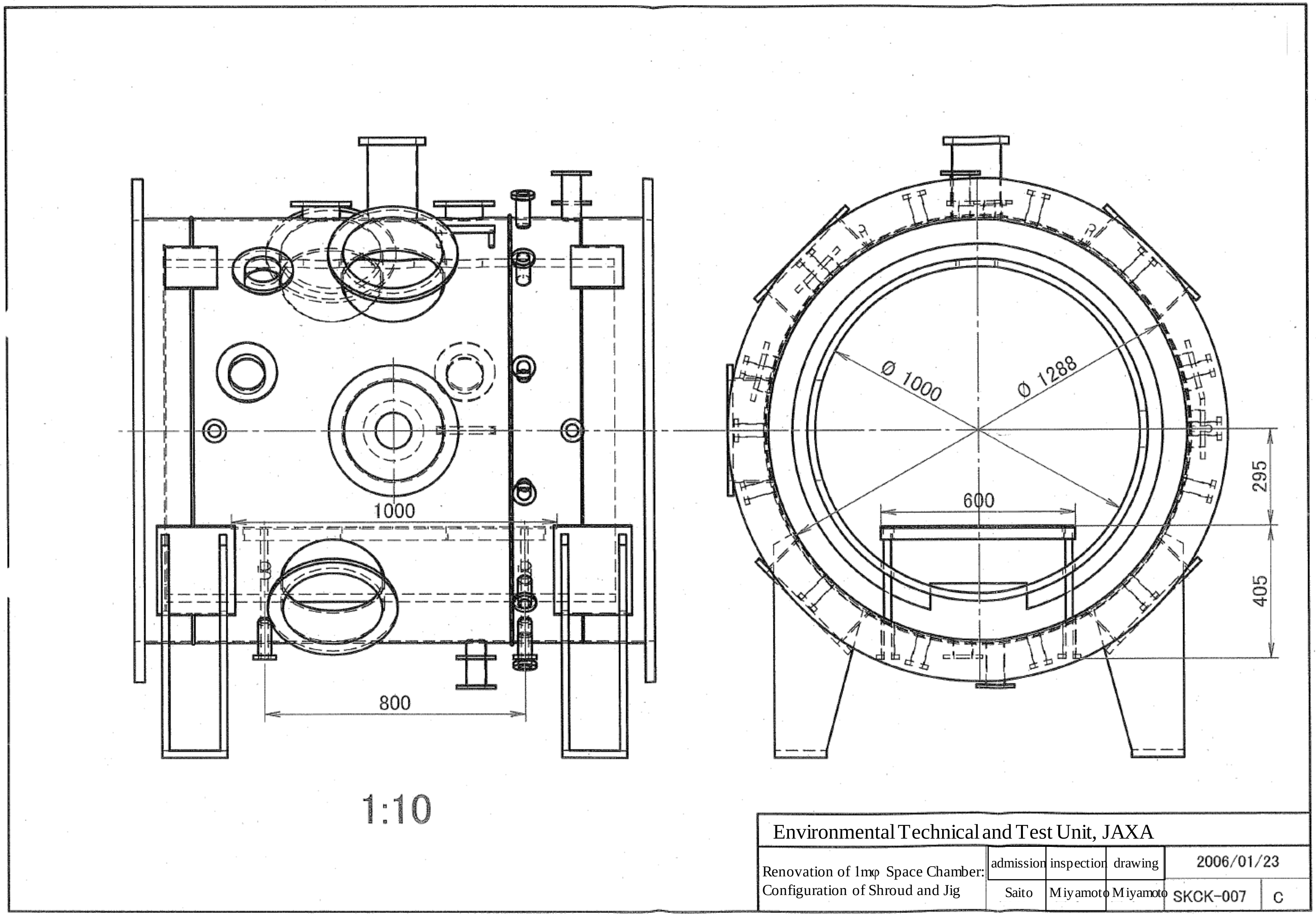


Figure A-8 **SKCK-007C Renovation of 1mφ Space Chamber: Configuration of Shroud and Jig**

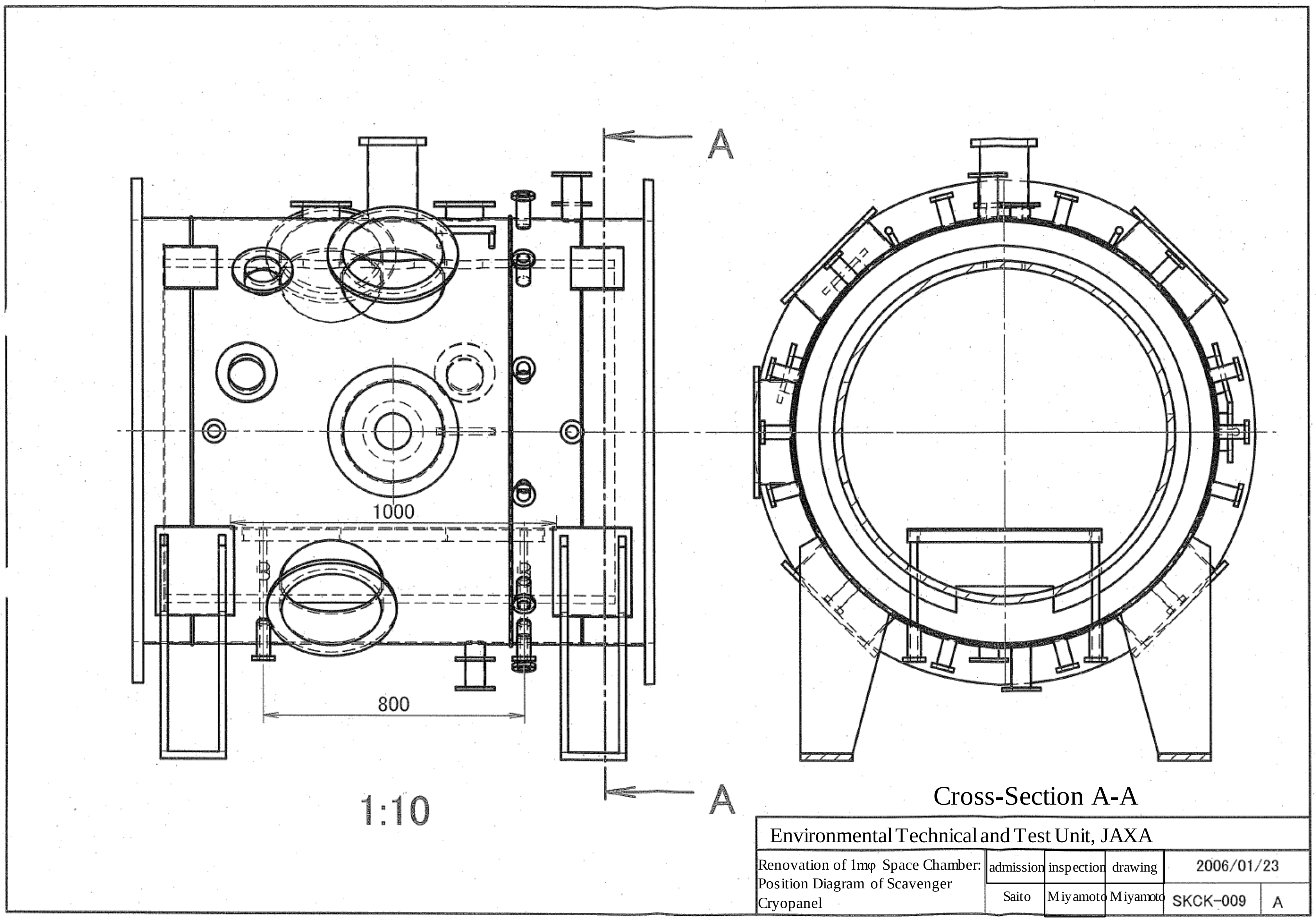


Figure A-9 SKCK-009A Renovation of 1mφ Space Chamber: Position Diagram of Scavenger Cryopanel

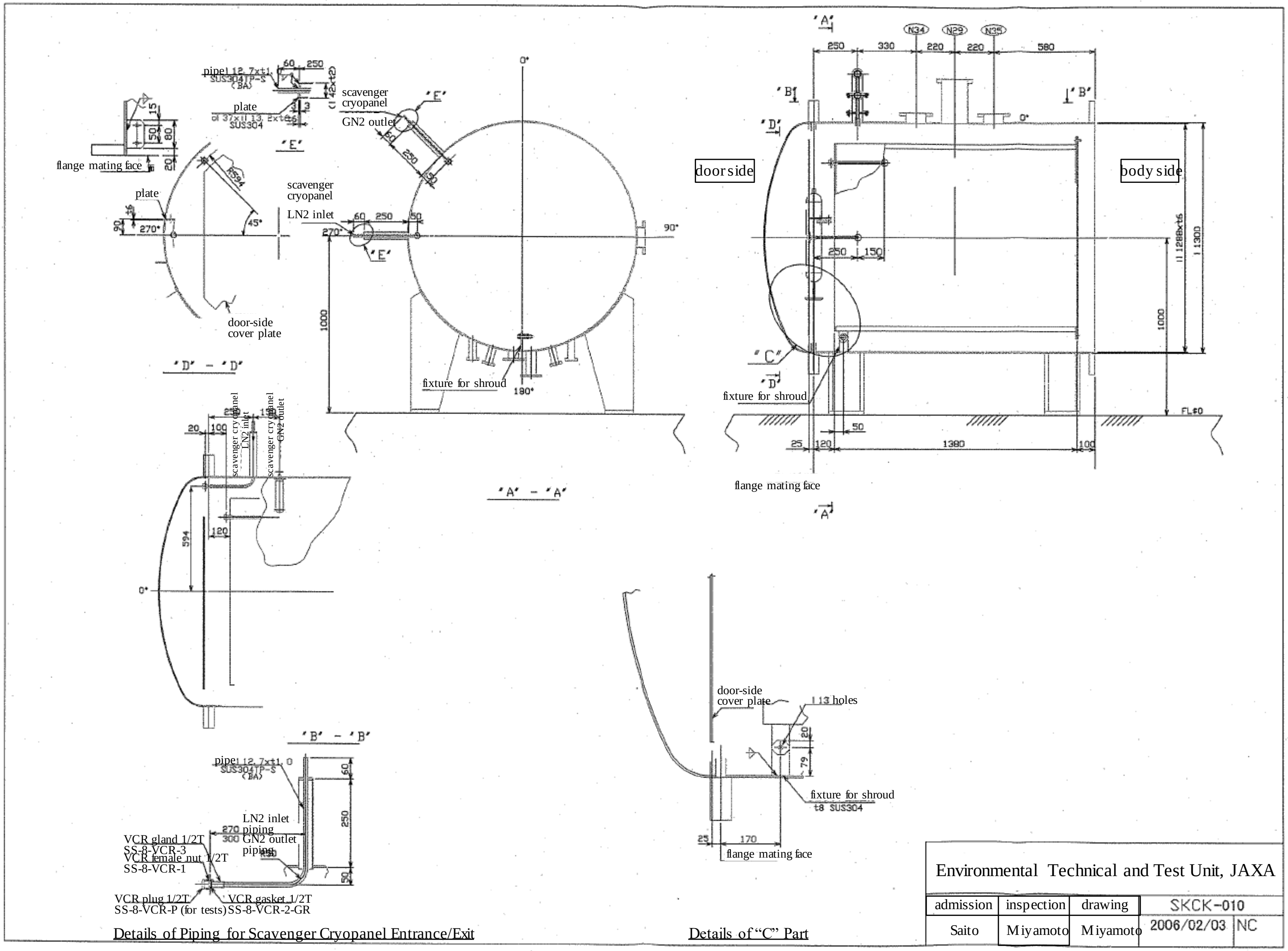


Figure A-10 SKCK-010NC Details of Piping for Scavenger Cryopanel Entrance/Exit

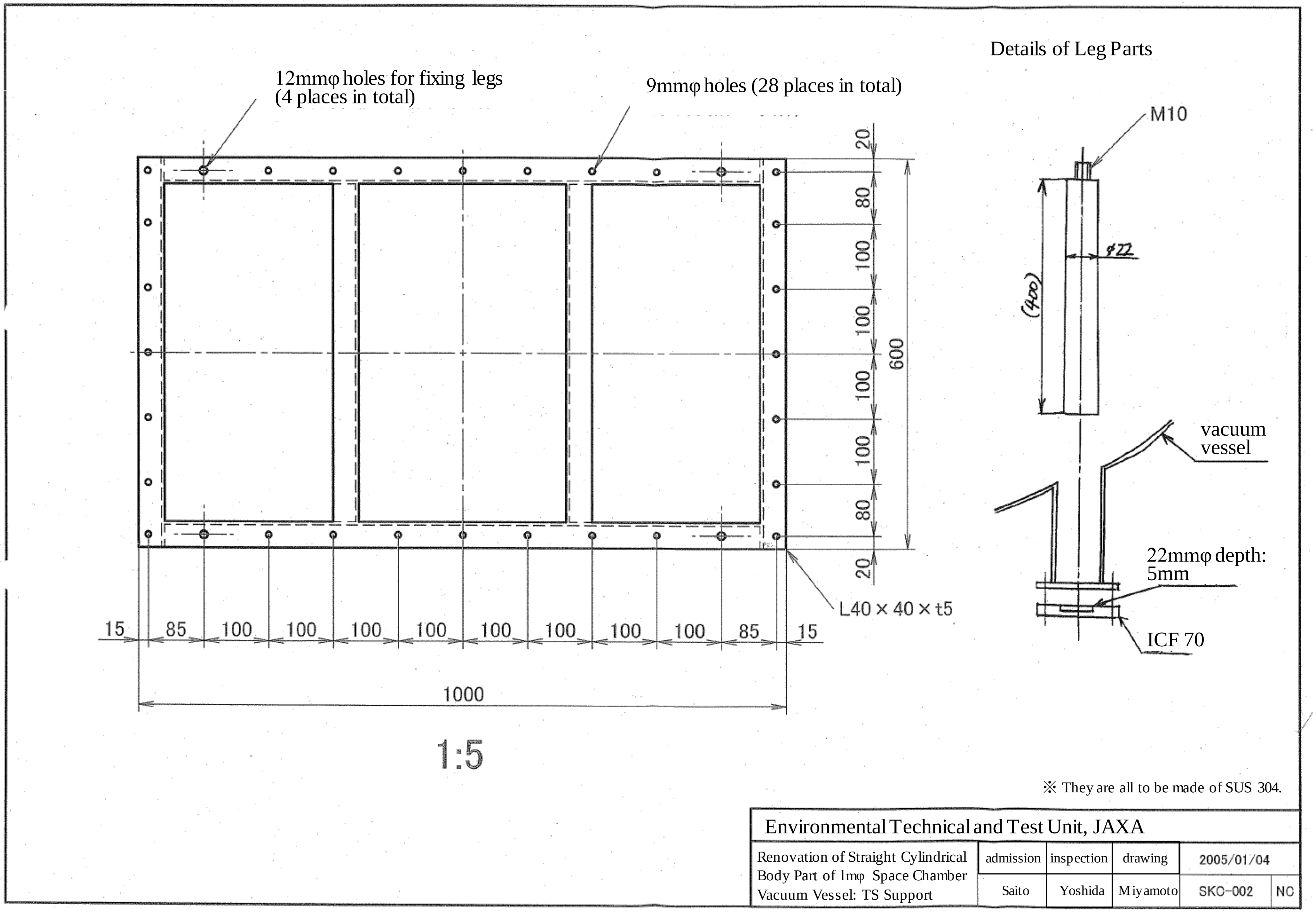


Figure A-11 SKC-002NC Renovation of Straight Cylindrical Body Part of 1mφ Space Chamber Vacuum Vessel: TS Support