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**SPECIFICATIONS
 FOR
 VERTICAL LP-CVD FURNACE SYSTEM**

CUSTOMER	:	Cronos Integrated Microsystems Inc.
MODEL	:	DJ-853V-6BL
PROCESS	:	Silicon Rich Nitride
SPEC. No.	:	C-0585
SUBMISSION No.	:	TIDC3 - 00675, 00677
DATE	:	October , 2000

**SEMICONDUCTOR EQUIPMENT DIVISION
 HITACHI KOKUSAI ELECTRIC INC.
 TOKYO, JAPAN**

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Table of Contents

1.	GENERAL	
2.	FEATURES	
3.	COMPOSITION	
4.	SPECIFICATION	
5.	SCOPE OF SUPPLY (WORK)	
6.	WARRANTY	
7.	ACCEPTANCE CONDITIONS	
8.	SPARE PARTS	
9.	COMPONENTS SUPPLIED BY BUYER	
10.	ACCESSORIES	
11.	ALARM / ALERT MESSAGE TABLE	
12.	CVD HEATER CORE BAKING CONDITIONS	
13.	GAS UNIT PARTS LIST	D4VX29650
14.	GAS UNIT FLOW PATTERN	D3VM94745
15.	EXHAUST UNIT PARTS LIST	D4CM99118
16.	GAS FLOW PATTERN	D2CM94746
17.	LAYOUT (INCHES)	D1CM96796
	LAYOUT (mm)	D1CM92743
18.	OUTWARD VIEWING	D2CM21688
19.	UTILITY JOINT OF DETAIL(Si3N4)	D3CM97467

VERTICAL LP-CVD SYSTEM SPECIFICATION
MODEL DJ-853V-6BL (Silicon Rich Nitride)
SPECIFICATION NO.: C-0585

1. GENERAL

This equipment is vertical low pressure CVD system for processing 150mm diameter wafers.

2. FEATURES

- 2-1 Since vertical heat resist method and unique wafer transfer system, the floor space for the system can be minimized.
- 2-2 The furnace port, which opens downwards, helps to reduce the intake of external air which takes place when the reactor tube is opened, thereby decreasing the oxygen concentration within the reactor tube to minimum.
This reduces the formation of naturally oxidized film on the base layer of wafer which could take place before the deposition of the objective film
- 2-3 The quartz boat carrying wafers is loaded into the reactor tube without touching the process tube.
This reduces the generation of particulate contamination greatly.
- 2-4 This system is equipped with a unique variable number of wafers transfer mechanism and therefore a fast and flexible wafer transportation can be made.
- 2-5 The two cassette simultaneous transport system reduces the cassette transport time remarkably.
- 2-6 Safety and easy maintenance can be made by using Boat elevator system.
- 2-7 The use of the cassette buffer unit in the system allows the storage of cassettes with wafers to cover sequential 3 batches of process.
- 2-8 The superior CX series controllers made by KE are adopted in the system.
- 2-9 The main operation control panel uses collar LCD touch control panel, and is superior in operativity.
- 2-10 The feed forward control method in addition to the Cascade direct control using DDC improves the temperature control and temperature recovery time.
- 2-11 The configuration of the system was designed based on the concept of easy maintenance and easy operation.
- 2-12 The system is configured with maximum 150 dia. wafers.
- 2-13 The cassette port of the front part of the system is equipped with an automatic shutter for the stability of the air flow inside furnace and its safety.
- 2-14 The unique wafer detection system improves wafer detection time greatly.
- 2-15 The wafer alignment mechanism can be equipped optionally. It allows the system to be compatible with various factory automation needs.

3. COMPOSITION

3-1 Furnace Unit

No.	Description	P/N	Q'ty	Remark
1.	Cartridge Heater	D4EX08455	1	
2.	T/C for Heater Control	NM150SR5	4	
3.	T/C for Over temperature Protection	D4EX06097	4	
4.	4-p T/C for Cascade Control	D4EX18187	1 ※1	
5.	4-p T/C for Profile	D4EX18188	1 ※1	
6.	Thyristor Unit for Control	MSG55L4Z1AF	1 ※1	Air radiation
7.	Heat Exchanger	D4CX24784	1	
8.	Transformer for Heater	D4EX08563	1 ※1	(41.4kVA)

Note : 「※1」 is special specification.

3-2 Clean Unit

No.	Description	P/N	Q'ty	Remark
1.	Clean Module Unit	D4CX22388	2	Wafer transfer area
2.	Clean Module Unit	D4CX22387	1	Buffer cassette shelf upper area
3.	Clean Module Unit	D4CX22386	1	Buffer cassette shelf lower area
4.	Clean Module Unit	D4EX09067	1	Cassette stage

3-3 Controllers

No.	Description	P/N	Q'ty	Remark
1.	Main / Main Operation Controller	CX3002B	1 ※1	RAID DISK
2.	DDC Temperature Controller	CQ1600	1	Include over temperature protect
3.	Gate Drive Unit	DN-150A-S4	1	
4.	MFC / Pressure Controller	CX3202	1	
5.	Wafer Handling Controller	CX1223	1	
6.	Valve / Interlock Control Unit	CX1312	1	
7.	Signal Tower	LES-302A-RYG	1 ※1	
8.	Uninterruptible power supply	GE3115-420J	1	CX3002B,CQ1600
9.	Transformer for Controller-1	D4EX12701	1 ※1	(3kVA)
10.	Transformer for Controller-2	D4EX19611	1 ※1	(5kVA)
11.	Relay Unit	D4EX19542	1 ※1	

Note : 「※1」 is special specification.

3-4 Drive Mechanisms

No.	Description	P/N	Q'ty	Remark
1.	Front Shutter		1	
2.	Cassette Stage		1	
3.	Wafer Detection		1	25 wafers simultaneous detection
4.	Cassette Loader		1	
5.	Cassette Rack		1	
6.	Wafer Transfer		1	Lift Transfer Type
7.	Variable Wafer Pitch Converter		1	
8.	Boat Elevator		1	
9.	Furnace Port Shutter		1	

3-5 Quartz ware

No.	Description	P/N	Q'ty	Remark
1.	Outer Tube	D3DK79140	1	※1 GE214 or equivalent
2.	Inner Tube	D3CL26239	1	※1 GE214 or equivalent
3.	Boat	D1CM97776	1	※1 GE214 or equivalent
4.	Adiabatic Plate	D3KN31308	6	※1 GE214 or equivalent
5.	Nozzle	D4CK75771	1	※1 GE214 or equivalent
6.	Nozzle	D4CK73746	1	※1 GE214 or equivalent
7.	Furnace Port Shutter Plate	D3CK35680	1	※1 GE214 or equivalent
8.	Tweezer	----	5	

Note : 「※1」 is special specification.

3-6 Gas System

No.	Description	P/N	Q'ty	Remark
1.	Gas Unit	----	1	※1 N ₂ , SiH ₂ Cl ₂ , NH ₃
2.	Gas Line Heating Unit	----	1	SiH ₂ Cl ₂ , NH ₃ (Inside Furnace only)

Note : Gas supply system, gas purifier, gas exhaust scrubber are not included.

Refer to the gas unit flow pattern and Gas unit parts list.

「※1」 is special specification.

3-7 Exhaust System

No.	Description	P/N	Q'ty	Remark
①.	Dry Pump	AAS200WN	1	Made by EBARA (Dry Pump parts)
②.	Mechanical Booster Pump	-----	1	
3.	Diaphragm sensor	TYPE621C	1	1.3kPa F.S., For Pressure control
4.	Pirani Sensor (Controller)	TM22	1	Made by LEYBOLD
5.	Pirani Sensor (Sensor)	TR211	1	Made by LEYBOLD
6.	Pirani Sensor (Sensor)	TR216	1	Made by LEYBOLD
7.	Exhaust Piping	-----	1	
8.	Piezo Valve for Pressure Control	PV-1502MC	1	5ℓ/min
9.	Exhaust Dilution Line	-----	1	
10.	Reactor Tube Pressure Leak Line	-----	1	
11.	Main Valve (3 stage)	-----	1	Made by MKS ※1
12.	Exhaust Line Heating Unit	-----	1	※1

Note : Please refer to attached gas pattern drawing and exhaust system parts list.

The parts which "○" is added to in a number is supplies by buyer.

〔※1〕 is special specification.

3-8 Special specification

3-8-1 The other

No.	Description	P/N	Q'ty	Remark
1.	Multipoint temperature Controller	SR-mini Series	1	Made by RIKA

4. SPECIFICATIONS

4-1 Resistance Heating Cartridge Heater

- | | |
|--|----------------------------|
| 1) Number of control zone | : 4 zones |
| 2) Effective heater inner dia. | : 335 mm |
| 3) Heater element dia. | : 1.8~2.6mm approx. |
| 4) Heater length | : 1350 mm |
| 5) Normal working temperature range | : 450 ~ 850°C (in furnace) |
| 6) Maximum Power Consumption | : ≤40.2kVA |
| 7) Power consumption in stable condition | : ≤8.0kW (at 800°C) |

Note: Heater must be used after heater baking.

4-2 Clean Unit

- | | |
|--------------------------|---|
| 1) Dust collection ratio | : ≥99.999999% (0.05μm)
≥99.9999% (> 0.1μm) |
|--------------------------|---|

4-3 Controllers

4-3-1 Main / Main Operation Controller (CX3002B)

(1) Main Control

Hardware

- | | |
|----------|---|
| - CPU | : Pentium (133 MHz) |
| - Memory | : 64Mbyte DRAM,
128kbyte ROM BIOS×2 (RAID DISK) ※1 |
| - HDD | : 2.1G byte (2.5inch) |
| - FDD | : 3.5inch (1.44Mbyte / 720Kbyte) |

※1 When RAID disk recognized its break down with hardware, it indicates alarm and changes another hard disk at the same time.

- Recipe can not be started during the alarm occurs.
- Recipe is continued to "END" in case of the alarm occurs during "RUN".

Software

(i) Recipe

- | | |
|---------------------|------------------------------------|
| - Number of step | : Max. 100 step / recipe |
| - Number of recipe | : 100 file (in HDD) |
| - sub recipe | : 20 kind of recipe/sub recipe |
| - process parameter | : 20 kind of recipe/process recipe |

(ii) Interlock

- | | |
|------------------|--|
| - Alert function | : temperature, pressure, gas flow, setting can be Hi / Low
(Buzzer Processing) |
| - Alarm function | : temperature, pressure, gas flow, setting can be Hi / Low
(Alarm Table Processing) |

(iii) Error Information

- | | |
|---------------------------|--------------------------|
| - Product information | : 200 File / HDD |
| - Alarm information | : 200 File / HDD |
| - Maintenance information | : 10 kind of information |

(2) Main operation

- Display : 10.4 TFT color LCD
- Resolution : 640×480 dot
- Operation key : Touch panel
- Back light control : Auto back light off

Note : The life time for TFT color LCD (Back Light) is approx. 20,000 (10,000) hours.

4-3-2 Temperature Controller (CQ-1600)

(1) Temperature Control

- Temperature setting range : 200 ~ 1200°C
- Temperature detection : R type thermocouples
- Setting resolution : 0.1°C
- Control accuracy : $\leq \pm 0.5^\circ\text{C}$ (at 400 ~ 1200°C)
- AD Converter : AD7710 (24 bit)
- Output : Pulse output for Thyristor gate control
- Output control : Power proportional phase control
- Input control : 12 points
- Control period : 2.0 sec
- Control mode : Programmable P.I.D.
 - P (proportional) : 0.1 ~ 200%
 - I (Integral) : 0.01 ~ 100.00 min
 - D (Differential) : 0.00 ~ 10.00 min
- Zero point Competition : IC Temperature Sensor

(2) Over Temperature Protect

- Temperature Setting Range : 400 ~ 1200°C
- Temperature detection : R Type thermocouples
- Input Control : 6 point
- Control Period : 2 sec

Note : High limit of temperature setting sets up in operating temperature range in main control part.

4-3-3 MFC / Pressure Controller (CX3202)

(1) MFC Control

- Object of control : Mass Flow Controller
- Control Mode : Direct control, Ramping control, Soft start control
- No. of channel : Max. 16ch
- Input range for full scale : 0~99.999slm
- Input range : 0~F.S.
- Resolution : 1/32768 F.S.R.
- Control accuracy : $\pm 2\%$ of full scale
- Ramping rate : 0.001~99.999slm
- Soft start setting : Max. 16 pattern
- Soft start time : 0~99 sec.
- Error detectable deviation flow : 0~99 % F.S.R. (1 point per channel)
- Error detectable time : 0~255 sec.

(2) Pressure Control

- Object of control : Piezo valve for pressure control, Conductance Valve (Diaphragm sensor input)
- Control accuracy : $\leq 5\%$ of set point (at 50Pa)

4-3-4 Valve / Interlock Control (CX1312)

(1) Valve Control

- Object of control : Solenoid valve
- Output voltage : DC 24V
- No. of channel : Max. 64Ch.

(2) Interlock Control

- No. of channel : Max. 48Ch.

Note : Normally open/Normally close Interlocks can be select at buyer's option.

4-3-5 The other.

When power failure time is more than 10msec or voltage drop is less than 80 %, controller becomes reset condition.

4-4 Drive Mechanisms

Details are as per "Vertical Diffusion/LP-CVD Automation Mechanism Specification".

4-5 Paint Color

1) Standard Color

- Main furnace : MANSEL 5GY 8/0.5
- Operation panel : MANSEL N3

2) Designation color

- Front panel : MANSEL N5.5

4-6 External Dimensions

	Width	Depth	Footprint	Height	Weight
Furnace Unit	900mm	1,980mm	1.78m ²	3,100mm	1,800kg
Power Box	500mm	1050mm	0.53m ²	1,300mm	800kg
Valve Box	400mm	1050mm	0.42m ²	2,600mm	
Controller Box	500mm	450mm	---	2,600mm	
Gas Box	900mm	600mm	---	2,600mm	

Note : The above sizes does not include ducts, connection pipings.

5. SCOPE OF SUPPLY (WORK)

5-1 Supplied by Buyer

1) Power supply and ground connection work and materials from factory facility to system

Connection	Power	Voltage	Manifold	Use	System Breaker
Power Box Rear Bottom	1-phase, AC480V	60kVA	M10 Terminal	Heater, Clean Unit, Gas Piping Heater, Exhaust Piping Heater	125A
	1-phase, AC120V	3kVA	---	Controller	30A
Pump Box Front Bottom	3-phase, AC208V	---	---	Pump	---

Note: Ground: Class 3 ground (A ground resistance of 100 ohm or smaller is required.)

- Permission rate of power supply fluctuation : Less than 10%
- Frequency of Power supply : 60Hz

Note: Supply a power of controller from UPS

Note: Because a incorrect movement, avoid a common use of power supply with high frequency unit.

2) Cooling water connection work and materials from factory facility to system

Connection	Pressure		Flow Rate	Manifold	Use
Furnace Unit Rear Upper	IN	0.35MPa (50.76psi)	15 ℓ/min	6.35 SWEGELOK	Heater, Furnace port flange
	OUT	0.05MPa (7.25psi)	---	6.35 SWEGELOK	

Note: Cooling water requirements;

- Temperature : $23 \pm 3^{\circ}\text{C}$
- PH : 7~8
- M Alkali : $\leq 40\text{ppm}$ (Converted into CaCO_3)
- Ca, Mg : $\leq 40\text{ppm}$ (Converted into CaCO_3)
- Fe ions : $\leq 0.1\text{ppm}$
- Cl ions : $\leq 10\text{ppm}$
- Resistivity : $\geq 10\text{k}\Omega\text{-cm}$
- Filter size : $\geq 70\mu\text{m}$

3) Exhaust ducts connection work and materials from factory facility to system

Connection	Description	Capacity	Manifold	Use
Furnace Unit Rear upper	Heater Exhaust	5m ³ /min	OD : ϕ 152.4 pipe	Heat Exhaust
	Scavenger Exhaust	2m ³ /min	OD : ϕ 101.6 pipe	General Exhaust
Gas Box Ceiling	Gas Box Exhaust	3m ³ /min	OD : ϕ 101.6 pipe	Acid Exhaust
Valve Box Ceiling	Valve Box Exhaust	2m ³ /min	OD : ϕ 101.6 pipe	General Exhaust

4) Scrubber exhaust ducts connection work and materials from factory facility to system

Connection	Description	Manifold	Use
(Pump Box Ceiling)	(EXHAUST-1)	(NW40 Quick Coupling)	(Acid Exhaust)
Valve Box Rear Bottom	EXHAUST-2	9.52 UJR	Acid Exhaust
Valve Box Back Bottom	VENT	6.35 UJR	Acid Exhaust

5) The 1F←→2F piping materials preparation and execution shall be supplied by customer.
(VALVE BOX ~ PUMP UNIT)

6) Gas connection work and materials from factory facility to system

Connection	Description	Pressure	Max. Flow	Manifold	Use
Gas Box Ceiling	Air/N ₂	0.6MPa (87.0psi)	-----	6.35 SWAGELOK	Air valve drive
	N ₂ -1 (PURE N ₂)	0.2MPa (29.0psi)	22 ℓ/min	6.35 VCR	Process
	N ₂ -2	0.2MPa (29.0psi)	75 ℓ/min	9.52 VCR	VENT
Valve Box Back Bottom	SiH ₂ Cl ₂	0.05MPa (7.25psi)	0.5 ℓ/min	6.35 VCR	Process
	NH ₃	0.1MPa (14.5psi)	0.3 ℓ/min	6.35 VCR	Process
	Loader Vacuum	35 ~ 21kPa (5.1 ~ 3.1psi) (GAUGE)	40Nℓ/min	6.35 SWAGELOK	Partial Exhaust

7) Partition work and materials required shall be supplied by Buyer.

8) Wafers, gas etc. required shall be supplied by Buyer.

5-2 Place of Supply

- 1) Place of delivery : F.O.B. Japan
- 2) Installation Work at Buyer's site

6. WARRANTY

- 6-1 Seller warrants to Buyer that the items provided by Seller shall conform to specifications provided by Seller and shall be free from defects in design, materials and workmanship for the period of one (1) year from the date of acceptance

Seller's responsibility for any warranty claim during the warranty period shall be limited to the repair or replacement of the defective parts, or labor to make repairs and modifications which are required for equipment and conform to the said specifications. If items provided thereunder does not meet the above warranty, Buyer shall promptly advise Seller and after notice to Seller, Buyer ships the defective parts to Seller.

- 6-2 This warranty shall not apply to any items supplied by Seller;

- 1) which is specified as consumable
(Quartz parts, T/C, Pump, MFC, Vacuum sensor, Teflon parts, Check valve, O-ring),
- 2) which has been repaired or altered outside of Seller's works without Seller's approval,
- 3) which has been subjected to improper use, negligence or accident
- 4) which has been subjected to the damages/defects caused for the reasons that can not ascribed to the responsibility of Seller
- 5) which is supplied by Buyer

- 6-3 Warranty for the accuracy of customer supplied Quartz parts (Tube, Boat, Cap etc.)
Accident which is caused by accuracy of customer supplied quartz parts is exempted.

- 6-4 Warranty lost its effectiveness in case the equipment is modified without agreement with our Design Division.

- 6-5 This equipment include inflammables, explosive, strong poisonous gas, please care those handling perfectly for the exhaust transaction.. KE is not responsible for these transaction.

- 6-6 This warranty is limited to KE equipment only, any products other than this equipment, such as production wafers, etc., shall be excluded from the scope of this warranty.

7. ACCEPTANCE PERFORMANCE TEST

7-1 Source Inspection performed at Seller's site with Buyer representative's witness

Test Item	Test Method	Criteria
1. Water Leak Test	Run water for 30min. at 0.35MPa.	No leak
2. Vacuum Test	Evacuate the reactor tube in the MANUAL mode for 5 min. and measure the in-reactor pressure with room temp. and check pressure drop.	0.67 Pa (9.72×10^{-5} psi) 0.133Pa·ℓ/s (1.93×10^{-5} psi·ℓ/s)
3. Gas system Leak Test	Apply and confine N ₂ gas of 0.3MPa in the gas system and leave it for 12 hours After 12 hours, check the pressure drop.	≤0.003MPa (0.44psi)
4. Flat Zone Length Test	With furnace temp. maintained at 800 °C measure the temp. flat zone length.	≥800mm at 800±2.0°C
5. Wafer Transfer Test	Run 5 cycle of following sequence; Cassette Change, Wafer Charge, Boat Load, Boat Unload, Wafer Discharge, Cassette Discharge.	No failure
6. Drive Mech. Test	Run the basic sequence.	No failure
7. Interlock Test	Check all interlocks.	No failure

Note: Test #2,#3,#4 shall be confirmed by data.

7-2 Acceptance Test performed at Buyer's site with Buyer representative's witness

Test Item	Test Method	Criteria
1. Water Leak Test	Run water for 30min. at 0.35MPa.	No leak
2. Vacuum Test	Evacuate the reactor tube in the MANUAL mode for 5 min. and measure the in-reactor pressure with room temp. and check pressure drop.	0.67 Pa (9.72×10^{-5} psi) 0.133Pa·ℓ/s (1.93×10^{-5} psi·ℓ/s)
3. Gas system Leak Test	Apply and confine N ₂ gas of 0.3MPa in the gas system and leave it for 12 hours After 12 hours, check the pressure drop.	≤0.003MPa (0.44psi)
4. Film Deposition Test	-----	
5. Drive Mech. Test	Run the basic sequence.	No failure
6. Wafer Transfer Test	Run 10 cycle of following sequence; Cassette Charge, Wafer Charge, Boat Load, Boat Unload, Wafer Discharge Cassette Discharge	No failure
7. Interlock Test	Check all interlocks.	No failure
8. If any problems occur through above test, they must be discussed and be solved between KE and customer.		

Test Item	Test Method	Criteria
10. Drive Mech. Test	Run the basic sequence.	No failure
11. Wafer Transfer Test	Run 10 cycle of following sequence; Cassette Charge, Wafer Charge, Boat Load, Boat Unload, Wafer Discharge Cassette Discharge	No failure
12. Interlock Test	Check all interlocks.	No failure

8. SPARE PARTS

Spare parts shall be procured under separate contract.

9. COMPONENTS AND MATERIALS SUPPLIED BY BUYER

9-1	Silicon wafers (150mm dia.) for Source Inspection	: 100pcs.
9-2	Wafer Cassettes	: 10pcs.
9-3	The other components materials which should be supplied by Buyer	: Refer to Section "3. COMPOSITION"

10. ACCESSARIES

10-1	Test Result Document	: 2 copies
10-2	Operation Manual (in lint-free paper)	: 2 copies
10-3	Jig for Quartz Exchange	: TBD
10-4	NW100 FLANGE for Foreline	: 2 pcs.

11. ALARM / ALERT MESSAGE TABLE

11-1 Interlocks

ID	Message	Description	Outbreak Point	Alarm Setting Point	Breaker OFF	Processing time delay	Reset Processing
001	AIR ILK	Too low Air Pressure	Gas Box PS11	$\leq 0.35\text{MPa}$ ($\leq 51\text{psi}$)			○
002	N2-1 ILK	Too low Gas system N2	Gas Box PG/PS1	$\leq 0.18\text{MPa}$ ($\leq 27\text{psi}$)			
003	N2-2 ILK	Too low Exhaust system N2 Flow	Gas Box PG/PS12	$\leq 0.18\text{MPa}$ ($\leq 27\text{psi}$)			
004	DCS ILK	Too low SiH ₂ Cl ₂ Pressure	Gas Box PG/PS2	$\leq 0.08\text{MPa}$ ($\leq 11\text{psi}$)			
005	NH ₃ ILK	Too low NH ₃ Pressure	Gas Box PG/PS3	$\leq 0.08\text{MPa}$ ($\leq 11\text{psi}$)			
008	HTPWR ILK	Heater system input power down	Cont. Box	---			
009	C.UT ILK	Clean Unit Blower Stop	Furnace unit MS302,MS303,MS311 MS312,MS321	$\leq 30\text{Pa}$			
		Abnormal temperature in wafer transfer area	Furnace unit TS201	$\geq 100^\circ\text{C}$			
010	O.HT1 ILK	Abnormal heater temperature	Power Box CQ1600	$\geq 900^\circ\text{C}$	Heater		○
011	WAT1 ILK	Too low cooling water Flow	Utility FS101	$\leq 12\ell/\text{min}$	Heater	3sec	○
012	WAT2 ILK	Too low cooling water Flow for furnace port flange	Furnace unit FS102	$\leq 0.5\ell/\text{min}$	Heater	3sec	○
		Too low cooling water Flow for Cap	Furnace unit FS103	$\leq 0.2\ell/\text{min}$			
		Too low cooling water for shutter	Furnace unit FS104	$\leq 0.5\ell/\text{min}$			
013	TEMP1 ILK	Abnormal temp in heater box	Furnace unit TS306	$\geq 130^\circ\text{C}$	Heater		○
		Abnormal temp in radiator	Furnace unit TS307	$\geq 100^\circ\text{C}$			
014	TEMP2 ILK	Abnormal temp in SCR	Power Box TS101	$\geq 80^\circ\text{C}$	Heater		○
		Abnormal temp in Transfermer	Power Box TS102, TS103, TS104, TS201	$\geq 150^\circ\text{C}$			
015	TEMP3 ILK	Abnormal temp in Transfermer	Power Box TS301	$\geq 150^\circ\text{C}$	Cont Main Heater		○
016	G.DOR ILK	Abnormal Gas Box Door	Gas Box S401	at Door Open	All Breaker		○
017	H.DOR ILK	Abnormal Heater room Door	Furnace Unit S1, S2	at Door Open	Heater		○
018	G.EXH ILK	Too low Gas System Exhaust Pressure	Cont. Box MS308	$\leq 30\text{Pa}$ ($\leq 0.004\text{psi}$)	All Breaker		○
019	H.EXH ILK	Too low Heater Exhaust Pressure	Cont. Box MS304	$\leq 60\text{Pa}$ ($\leq 0.008\text{psi}$)			
020	S.EXH ILK	Too low Scavenger Exhaust Pressure	Cont. Box MS305	$\leq 30\text{Pa}$ ($\leq 0.004\text{psi}$)	All Breaker		○

PG/PS : Pressure Gage SW, FL : N2 Flow Meter, MS : Manostar SW, TS : Thermal SW, FS : Water Flow Meter

ID	Message	Description	Outbreak Point	Alarm Setting Point	Breaker OFF	Processing time delay	Reset Processing
021	V.EXH ILK	Too low Valve Box Exhaust Pressure	Cont. Box MS309	$\leq 30\text{Pa}$ ($\leq 0.004\text{psi}$)			
022	T.FAN ILK	Transfer's fan abnormality	Transfer	---			
023	TEMP5 ILK	Too low Temperature Exhaust line (Vacuum Pipe)	Tape heater controller in Exhaust line.	$\geq 130^{\circ}\text{C}$ or $\leq 110^{\circ}\text{C}$			
024	TEMP6 ILK	Abnormal temperature in Gas line (SiH ₂ Cl ₂ ,NH ₃)	Tape heater controller in SiH ₂ Cl ₂ line	$\geq 50^{\circ}\text{C}$ or $\leq 30^{\circ}\text{C}$			
			Temp controller in NH ₃ line	$\geq 110^{\circ}\text{C}$ or $\leq 90^{\circ}\text{C}$			
025	P.DWN ILK	Pump Down	Pump Box	---			○
026	PUMP1 ILK	Pump Alarm	Pump Box	---			
027	PUMP2 ILK	Pump Trip	Pump Box	---			○
028	W.LEK ILK	Water Leak in Radiator	Water Leak Detector	----	All Breaker		○
029	CT.AL ILK	Heater current abnormality	Power Box CT1 (U)	≥ 0.88 (22A)	Heater		○
			Power Box CT2 (CU)	≥ 0.57 (144A)			
			Power Box CT3 (CL)	≥ 0.61 (61A)			
			Power Box CT4 (L)	≥ 0.52 (52A)			
031	O.HT2 ILK	Abnormal Heater Temperature	Power Box SDC10T6DTA0200	$\geq 900^{\circ}\text{C}$			○
035	EXT1 ILK	External EMO Signal	Power Box TB001-1,2	----	All Breaker		
036	EXT2 ILK	External Gas detector input 1	Power Box TB001-3,4	----			
037	EXT3 ILK	External Gas detector input 2	Power Box TB001-5,6	----			
038	EXT4 ILK	External Gas detector input 3	Power Box TB001-7,8	----			
039	EXT5 ILK	External Gas detector input 4	Power Box TB001-9,10	----			

CT : Current Trans., TB : Terminal Block, MS : Manostar SW

11-2 Gas Error

ID	Message	Description	Outbreak Point	Alarm Setting Point	Breaker OFF	Processing time delay	Reset Processing
081	MFC1 ALM	N2 gas Flow allowable deviation alarm.	Gas Box MFC1	High limit / lower limit Optional setup is possible. (%)			○
082	MFC2 ALM	N2 gas Flow allowable deviation alarm.	Gas Box MFC2	High limit / lower limit Optional setup is possible. (%)			○
083	MFC3 ALM	SiH2Cl2 gas Flow allowable deviation alarm.	Gas Box MFC3	High limit / lower limit Optional setup is possible. (%)			○
084	MFC4 ALM	NH3 gas Flow allowable deviation alarm.	Gas Box MFC4	High limit / lower limit Optional setup is possible. (%)			○
513	MFC1 ALT	N2 gas Flow allowable deviation alert.	Gas Box MFC1	High limit / lower limit Optional setup is possible. (%)			
514	MFC2 ALT	N2 gas Flow allowable deviation alert.	Gas Box MFC2	High limit / lower limit Optional setup is possible. (%)			
515	MFC3 ALT	SiH2Cl2 gas Flow allowable deviation alert.	Gas Box MFC3	High limit / lower limit Optional setup is possible. (%)			
516	MFC4 ALT	NH3 gas Flow allowable deviation alert.	Gas Box MFC4	High limit / lower limit Optional setup is possible. (%)			

11-3 Temperature / Pressure

ID	Message	Description	Outbreak Point	Alarm Setting Point	Breaker OFF	Processing time delay	Reset Processing
105	TEMP. ALM	Temperature allowable deviation alarm.	Cont. Box CQ1600	High limit / lower limit Optional setup is possible. (%)			○
106	PRES. ALM	Pressure allowable deviation alarm.	Power Box CX3202	High limit / lower limit Optional setup is possible. (%)			○
539	TEMP. ALT	Temperature allowable deviation alert.	Cont. Box CQ1600	High limit / lower limit Optional setup is possible. (%)			
538	PRES. ALT	Pressure allowable deviation alert.	Power Box CX3202	High limit / lower limit Optional setup is possible. (%)			

11-4 MISC

ID	Message	Description	Outbreak Point	Alarm Setting Point	Breaker OFF	Processing time delay	Reset Processing
113	ATC DWN	Temperature controller Interface line Down.	CX3002B ↔ CQ1600	—			○
114	TC.OP ERR	T/C Breakage.	TC1 ~ TC8	—			○
115	GAS DWN	MFC/Pressure controller Interface line Down.	CX3002B ↔ CX3202	—			○
116	LOAD DWN	Mechanical controller Interface line Down.	CX3002B ↔ CX1223	—			
117	SCOM DWN	Valve/Interface controller Interface line Down.	CX3002B ↔ CX1312	—			○
118	LON DWN	LON line Down	CX3002B ↔ CX2403	—			○
119	LOAD ERR	Loader command abnormal stop.	CX1223	—			
122	VALVE ILK	Valve Open/Close condition error.	CX1311 / CX1312	Refer to valve operating conditions.			

Note 1: As for various alarm(XXXXX ILK, XXXXX ALM, XXXXX DWN, XXXXX ERR), the following processing invocation is possible.

NOP(Disregard), BUZZER(Buzzer), HOLD(Hold), JUMP STEP(ID : 001 ~ 127), SYSTEM RECIPE(ID:01 ~ 20), END, RESET

But the item which “○” is filled in the column of reset processing shall be made for “RESET” mode.

Note 2: Various alert (XXXXX ALT) is fixed in buzzer ”BUZZER”.

Note 3: Refer to operation manual about other alarm / alert message.

Note 4: Heater breaker does OFF when heater room door opened and when detected more than 900℃ in temperature controller (E5CX-RTC) for over temperature detection of heater.

All breaker does OFF when gas box Manostar SW did detection of abnormality.

12. VALVE OPERATION TABLE

12-1 Manual Open / Close Valve

LED No.	Name	Description	Soft Start Setting
1	AV1(NO)	Unconditional Open/Close allowed.	MFC1
2	AV2(NO)	Unconditional Open/Close allowed.	
3	AV3(NO)	Unconditional Open/Close allowed.	MFC2
4	AV4(NO)	Unconditional Open/Close allowed.	
5	AV5	Opening allowed when AV6 is closed.	
6	AV6	Opening allowed when AV5 is closed and, AV7 is closed.	MFC3
7	AV7	Opening allowed when AV6 is closed.	
8	AV8	Opening allowed when AV9 is closed and, pump is on.	
9	AV9	Opening allowed when AV8 is closed and, Furnace port cap is closed and, Pump is on and, AV71 is opened and, VG11 is $\leq 1.3\text{kPa}$ ($\leq 0.19\text{psi}$).	
10	AV10(NO)	Opening allowed when AV11 is closed.	
11	AV11	Opening allowed when AV10 is closed and, AV12 is closed.	MFC4
12	AV12	Opening allowed when AV11 is closed.	
13	AV13(NO)	Opening allowed when AV14 is closed.	
14	AV14	Opening allowed when AV13 is closed and, Furnace port cap is closed and, Pump is on and, AV71 is opened and, VG11 is $\leq 1.3\text{kPa}$ ($\leq 0.19\text{psi}$).	
33	AV71	Opening allowed when Furnace port cap is closed and, VG11 is $\leq 1.3\text{kPa}$ and, Pump is on.	
34	AV72	Opening allowed when Pump is on.	
35	AV77	Opening allowed when Pump is on.	
37	AV75	Opening allowed when VG11 is $\leq 1.3\text{kPa}$ ($\leq 0.19\text{psi}$).	
38	AV76	Opening allowed when Pump is on. (For N2 Ballast control)	
45	VG12	Unconditional allowed to be selected. (Selection of exhaust pirani sensor for exhaust system)	
46	DP	Unconditional On/Off allowed.	
47	WAT (CAP)	Opening allowed when Furnace temp is $\leq 850^\circ\text{C}$. (*1)	

12-2 Auto Open / Close Valve

LED No.	Name	Description	Soft Start Setting
89	VG11	Rump is on when pirani sensor for furnace is selected. (when VG12 is not selected.).	
90	MBP	Automatically on when vacuum switch in pump system is on.	
91	AV60(NO)	Automatically open when AV6 and AV11 is closed.	
92	AV73(NO)	Automatically open when Pump is off.	
93	AV74(NO)	Automatically open when PS13 is on and, AV60 is opened.	
94	AV78	Automatically open when AV6 and AV11 is closed.	

*1 Furnace temp is $\leq 850^\circ\text{C}$: Possible to WAT1,2 is ON. (Water don't flow when valve is opened (EV is ON))

13. CVD HEATER CORE BAKING CONDITIONS

Step	Description
<p>1st STEP</p> <p>HEATER</p>	<p>Ramp up rate 10°C/min</p> <p>400°C</p> <p>Ramp up rate 10°C/min</p> <p>850°C</p> <p>Non forced cooling</p> <p>Room Temp.</p> <p>6hrs</p> <p>6hrs</p>
<p>2nd STEP</p> <p>HEATER</p> <p>+</p> <p>OUTER TUBE</p> <p>+</p> <p>INNER TUBE</p> <p>+</p> <p>BOAT</p> <p>+</p> <p>CAP</p>	<p>Ramp up rate 5°C/min</p> <p>Specified Temp for each film</p> <p>Si₃N₄ 780°C</p> <p>Ramp up rate 3°C/min</p> <p>200°C</p> <p>Room Temp.</p> <p>6hrs</p>

GAS SYSTEM PARTS LIST

SYMBOL	DESCRIPTION	MODEL OR RATING	SPEC	Q'TY	VENDOR	REMARK
PG/PS 1~3	PRESS. GAUGE W/SWITCH	SPT204-100CG/CA/AL420SS	CAT	3	SPAN	VCR, EP-TREATED
		※DIGITAL PRESSURE METER				
		WITH OUTPUT 0~100PSI				
MP 1~3	REGULATOR	SQ140E-50-2P-FS-FF-PM (FEMALE)	CAT	3	VERIFLO	VCR, CP-TREATED
F 1	FILTER	WG3NS2RR2 (MALE)	CAT	1	JPN MILLIPORE	VCR, UP-TREATED
F 2,3	FILTER	WG3NS1RR2 (MALE)	CAT	2	JPN MILLIPORE	VCR, UP-TREATED
HV 1~3	HAND VALVE	6LV-DAFR4-P-GR (FEMALE)	CAT	3	NUPRO	VCR, CP-TREATED
CV 1	CHECK VALVE	6L-CW4VR4-P (MALE)	CAT	1	NUPRO	VCR, CP-TREATED
CV 2	CHECK VALVE	6L-CW4VR4-EP-P (MALE)	CAT	1	NUPRO	VCR, CP-TREATED
NV 1,2	NEEDLE VALVE	SS-4BMG-V51-P (FEMALE)	CAT	2	NUPRO	VCR, CP-TREATED
AV 1~4 10,13	AIR VALVE	6LV-DAFR4-P-0 (NO)	CAT	6	NUPRO	VCR, CP-TREATED
AV 5~9,11 12,14	AIR VALVE	6LV-DAFR4-P-C (NC)	CAT	8	NUPRO	VCR, CP-TREATED
EV 1~14	SOL. VALVE MANIFOLD	10-VV4Z1-16-X236	CAT	1	SMC	2 BLIND
MFC 1	MASSFLOW CNT	UFC-1661-203-4CR-N2-SS-V-NO-D	CAT	1	UNIT	
MFC 2	MASSFLOW CNT	UFC-1661-102-4CR-N2-SS-V-NO-D	CAT	1	UNIT	
MFC 3	MASSFLOW CNT	UFC-1661-501-4CR-SiHCL2-S-V-NO-D	CAT	1	UNIT	
MFC 4	MASSFLOW CNT	UFC-1661-301-4CR-NH3-S-V-NO-D	CAT	1	UNIT	
	TUBINGS	SUS 316L, ϕ 6.35 EP-TREATED TUBE				1SET (EXCLUDING AIR SUPPLY TUBINGS)
	GASKETS	UNPLATED Ni				
	JOINTS	SUS 316L, VCR OR EQUIVALENT T-JOINT : AUTOMATIC WELDED				
	FLOW PATTERN	D3VM94745	S3			

REVISIONS :

MODEL/TYPE : DJ-853V/VERTRON-III(J)

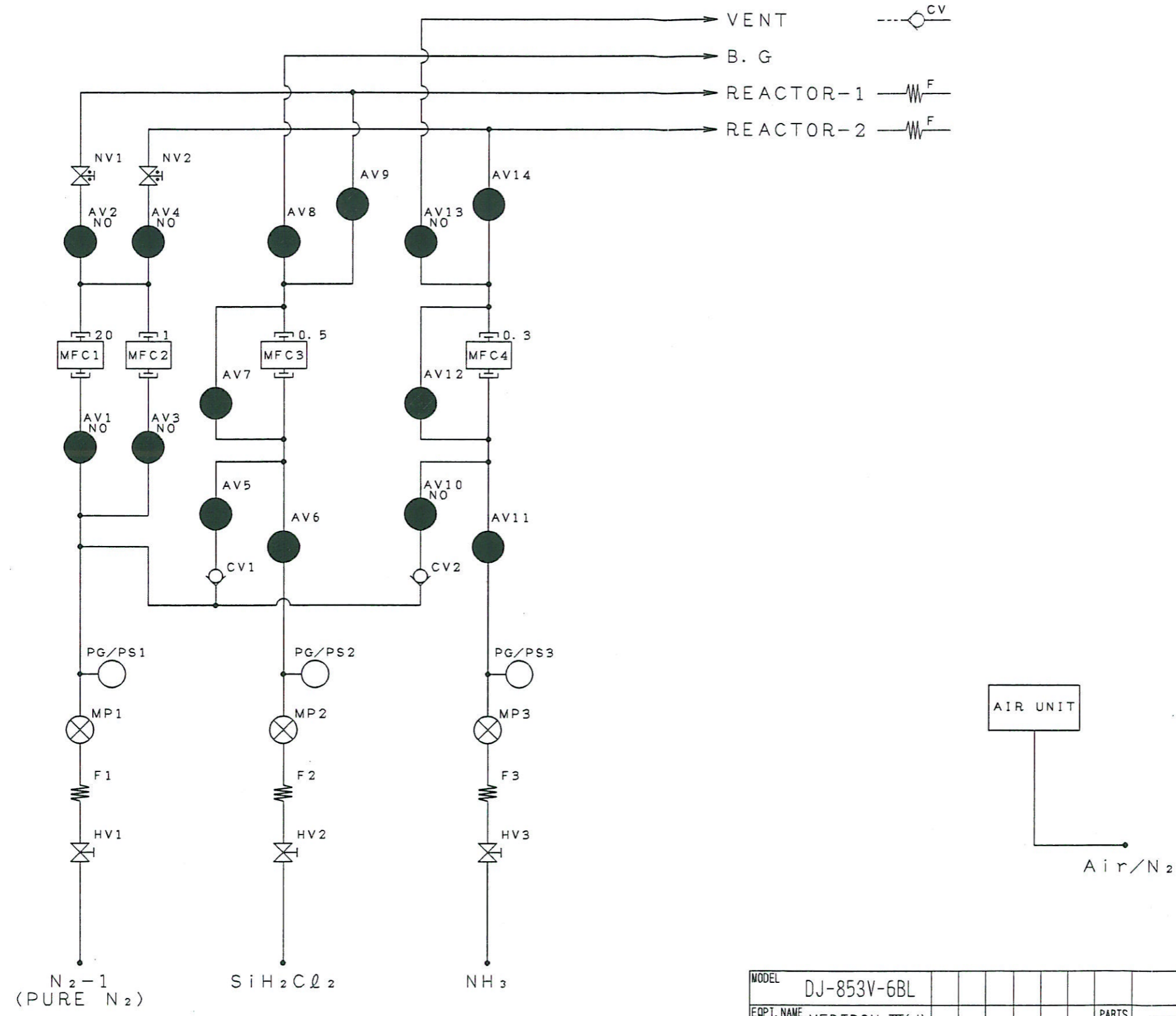
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APPR	JUDG'D	DESIGN	TRACED	CHECKED	ISSUED
N. Kasashima	Y. Hada	S. Sano	M. Yanai	M. Tsuru	

DWG NO : D4VX29650

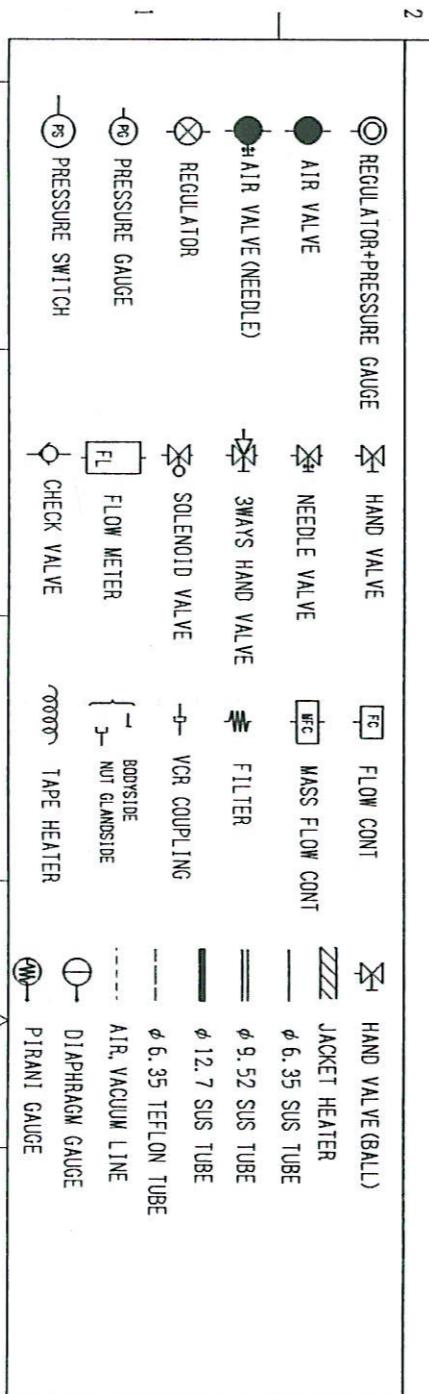
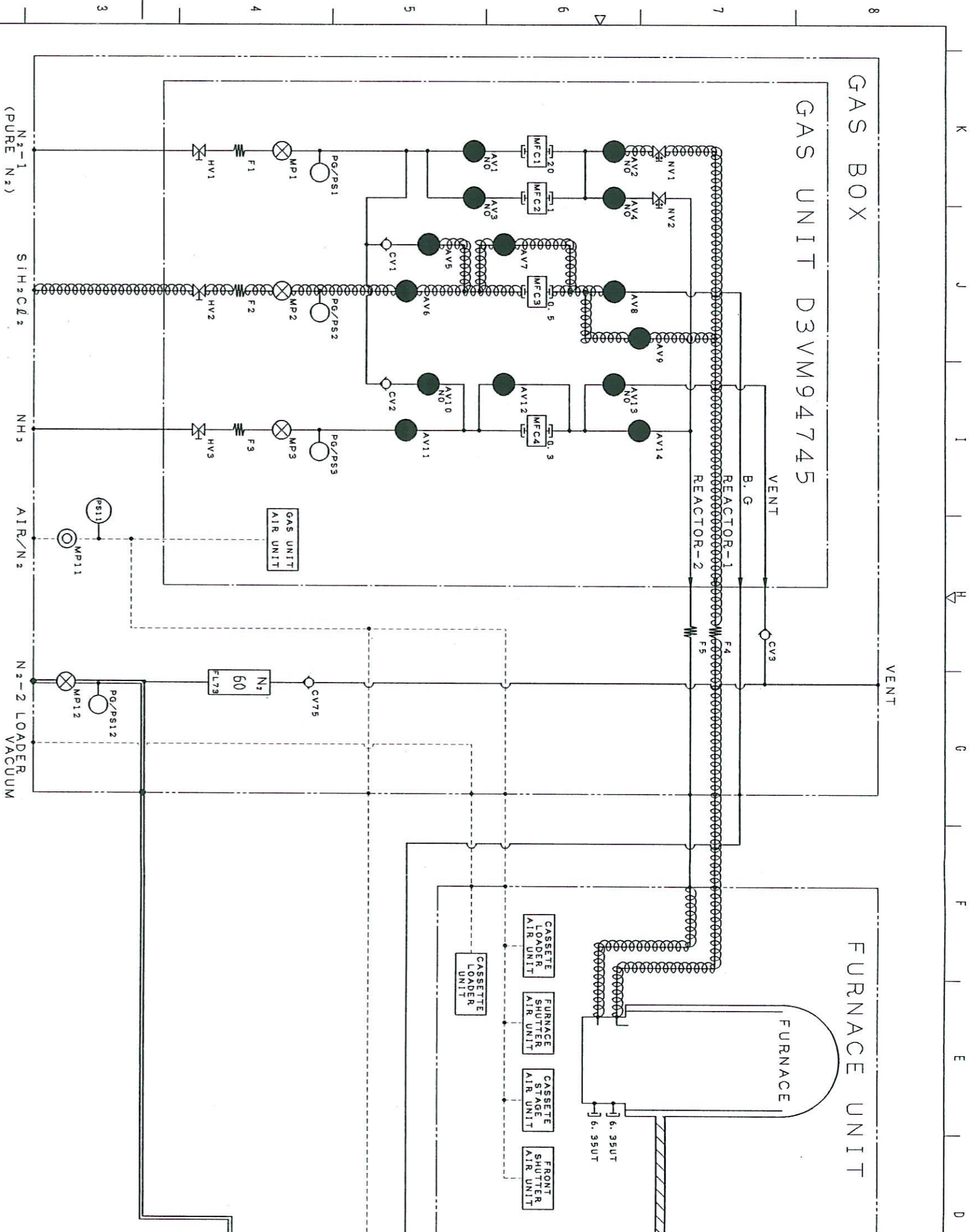
REV.

REVISER		REVISIONS		
DRAW	CHECKED	SYM	DATE	REVISED

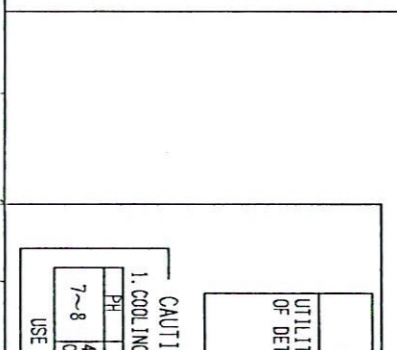
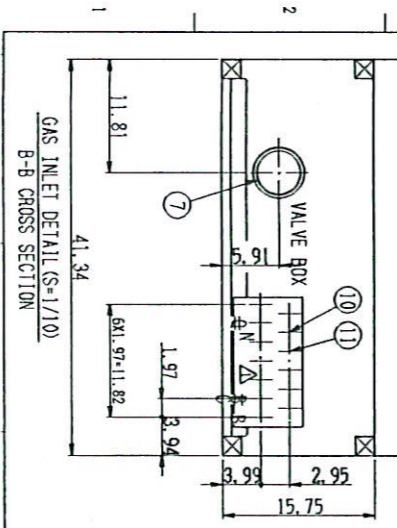
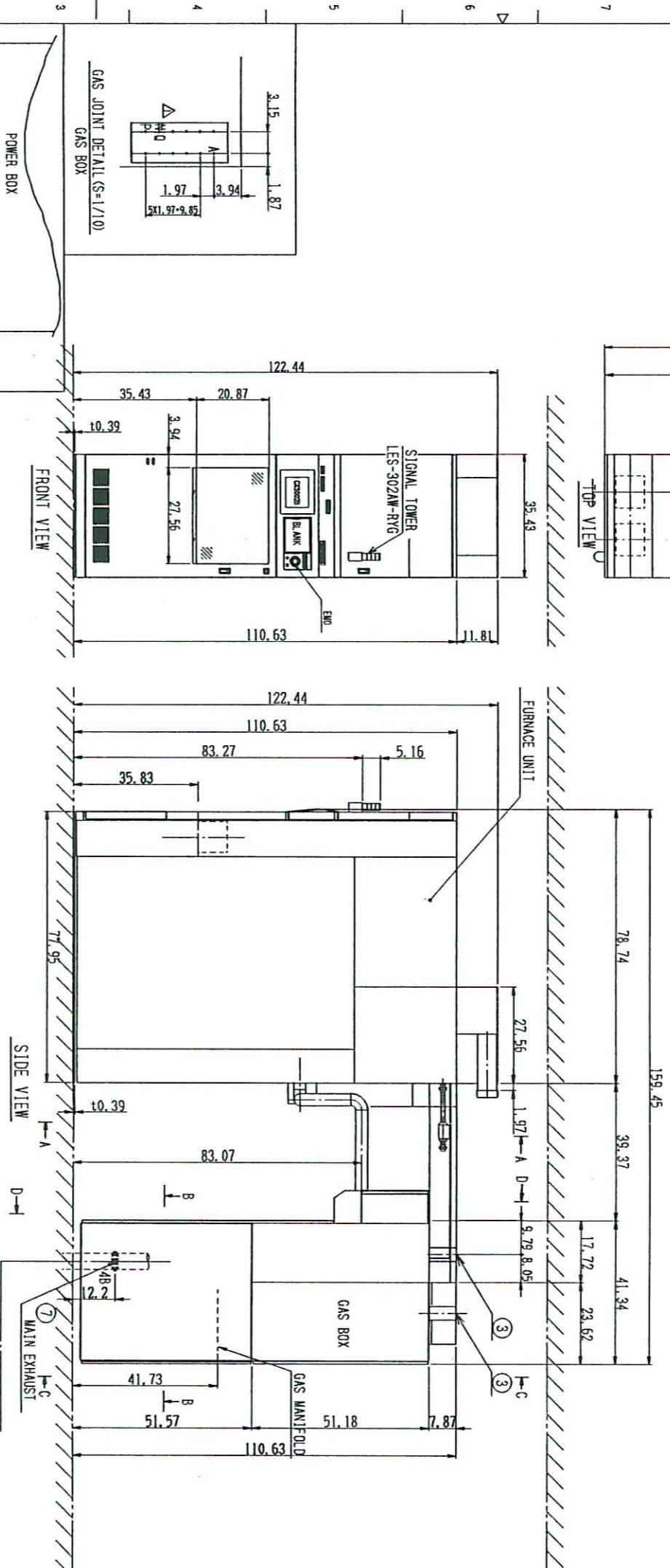
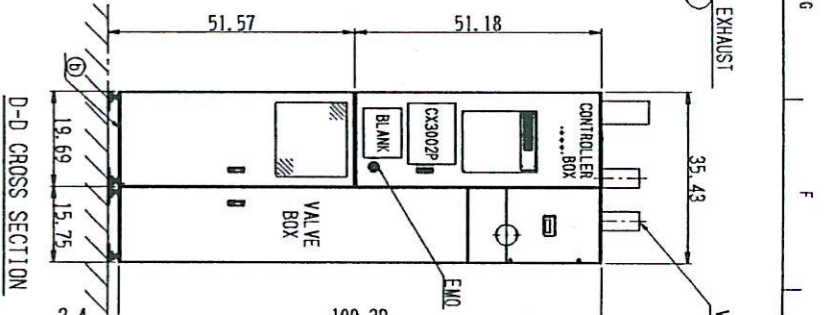
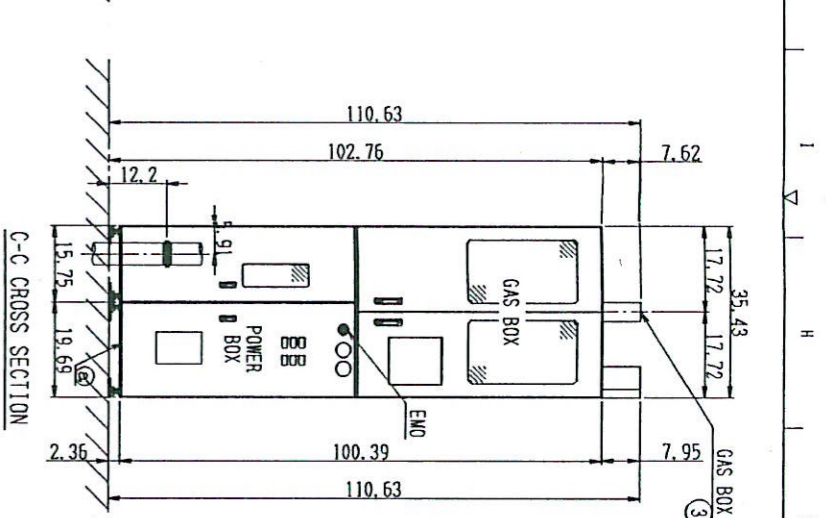
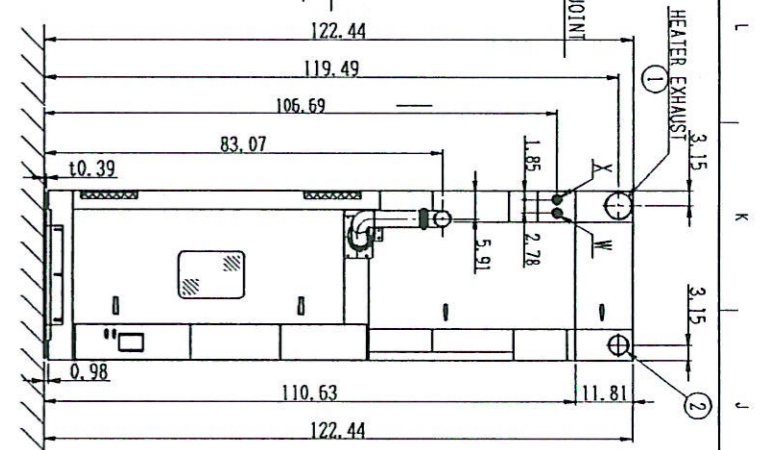
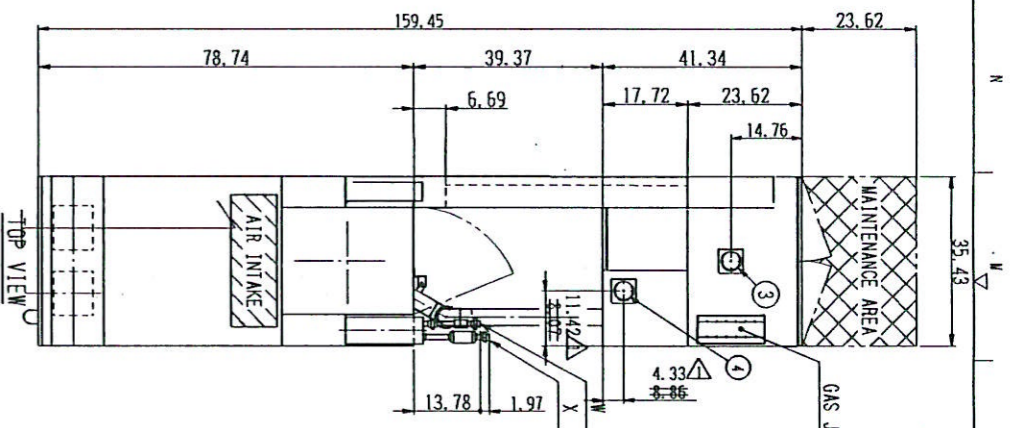
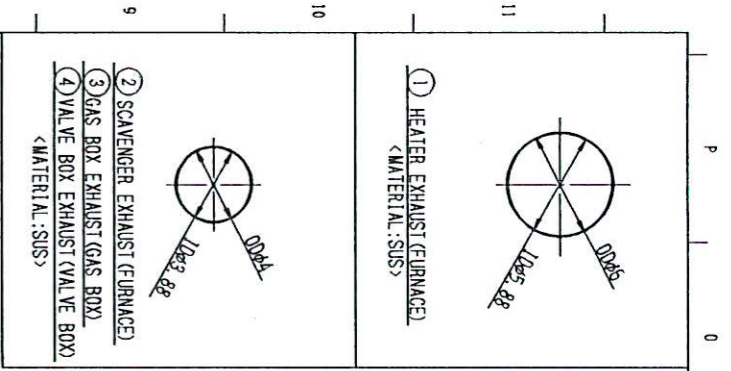


- AIR VALVE
- REGULATOR
- REGULATOR WITH PRESSURE GAUGE
- PRESSURE GAUGE
- PRESSURE SWITCH
- CHECK VALVE
- HAND VALVE
- NEEDLE VALVE
- 3WAY HAND VALVE
- SOLENOID VALVE
- FLOW CONT
- FLOW METER
- MASS FLOW CONT
- FILTER
- MIXER
- ϕ 9.52 SUS TUBE
 ϕ 6.35 SUS TUBE
 ϕ 9.52 TEFLON TUBE
 ϕ 6.35 TEFLON TUBE
- VCR COUPLING
- BODY SIDE
NUT GLAND SIDE

MODEL	DJ-853V-6BL					D4VX29650		S3
EQPT. NAME	VERTRON-III(J)	QUANTITY	PARTS No.	PARTS NAME	SPECIFICATIONS	MATERIAL	REMARKS	
TOLERANCES		CHECKED	Y. Hada	DATE	Jul. 7-00	SCALE	UNIT	mm
DRAWN	M. Yanai	DATE	Jul. 7-00	APPROVED	N. Kasashima	DATE	Jul. 7-00	TITLE
DSGN OR ENGR	S. Sano	DATE	Jul. 7-00	RELEASED		DATE		GAS UNIT FLOW PATTERN
KOKUSAI ELECTRIC CO., TOKYO JAPAN						DWG. NO.	D3VM94745	



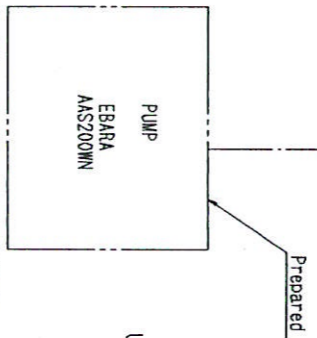
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MFG No.	T1DC3-00675, 00677	EGRT. NAME	VE
GAS UNIT FLOW PATTERN	D3VM94745	TOLERANCES	
PROCESS	S i 3 N 4	DRAWN	
		DESIGN OR ENGR	
			KOI

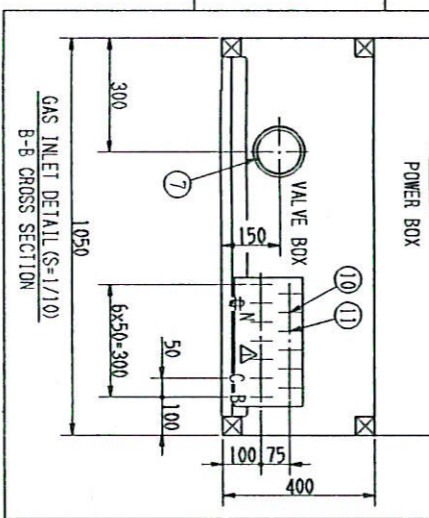
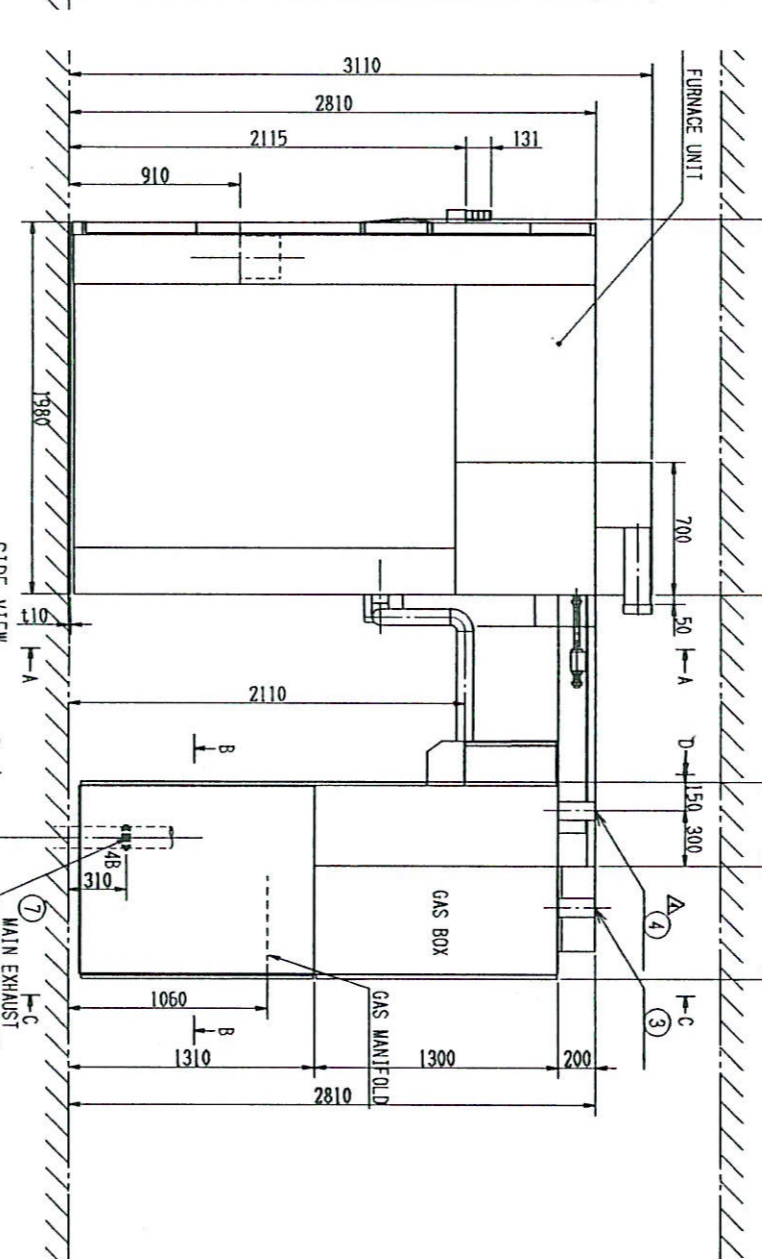
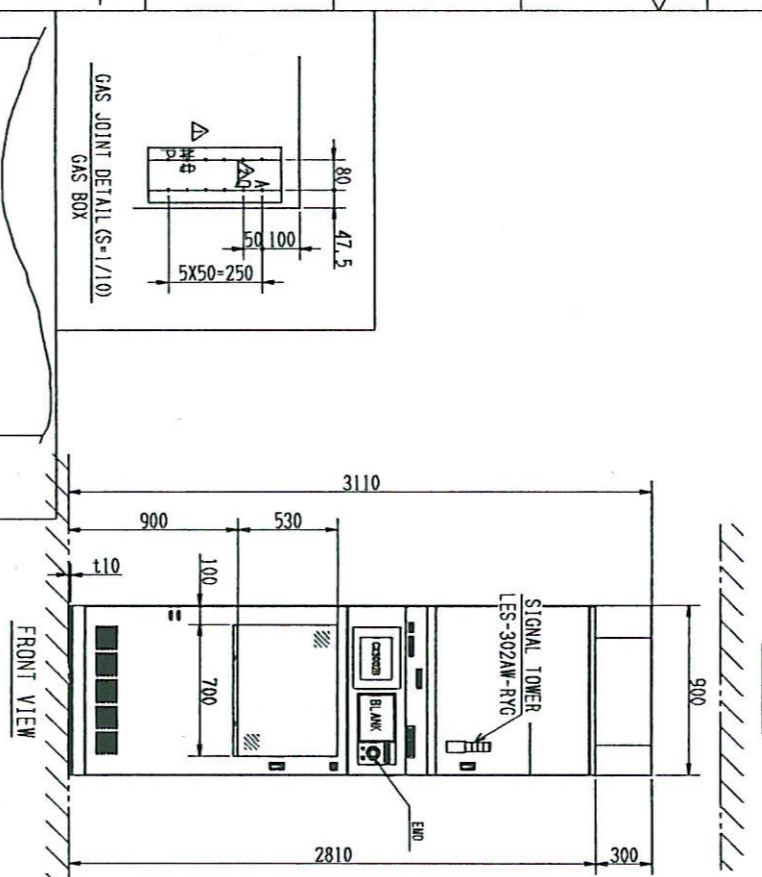
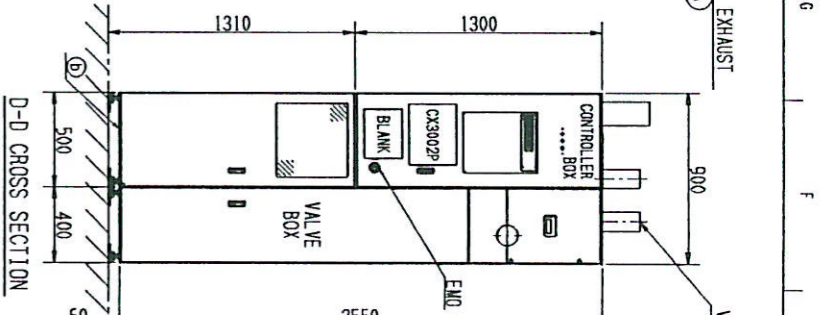
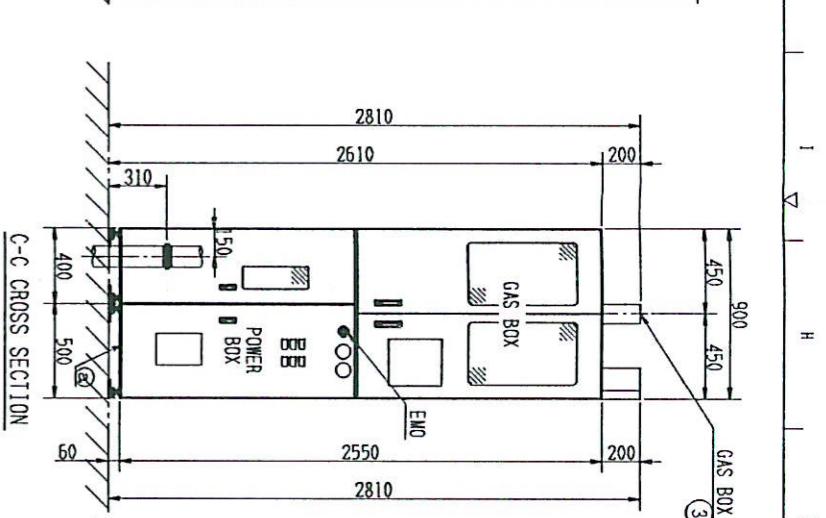
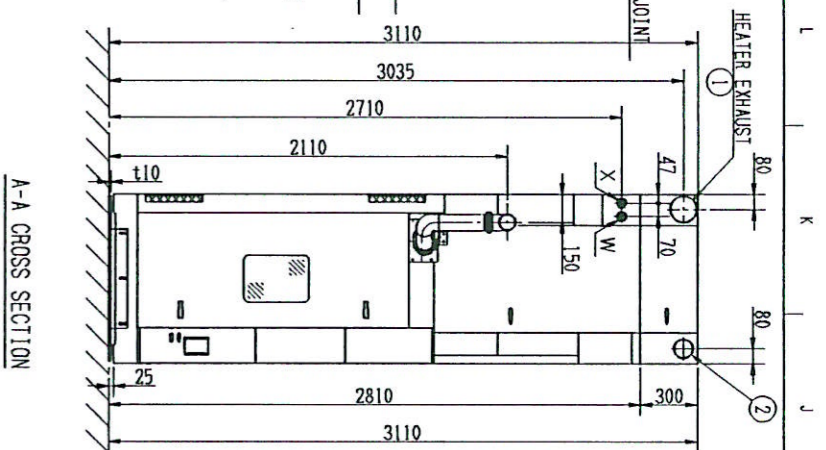
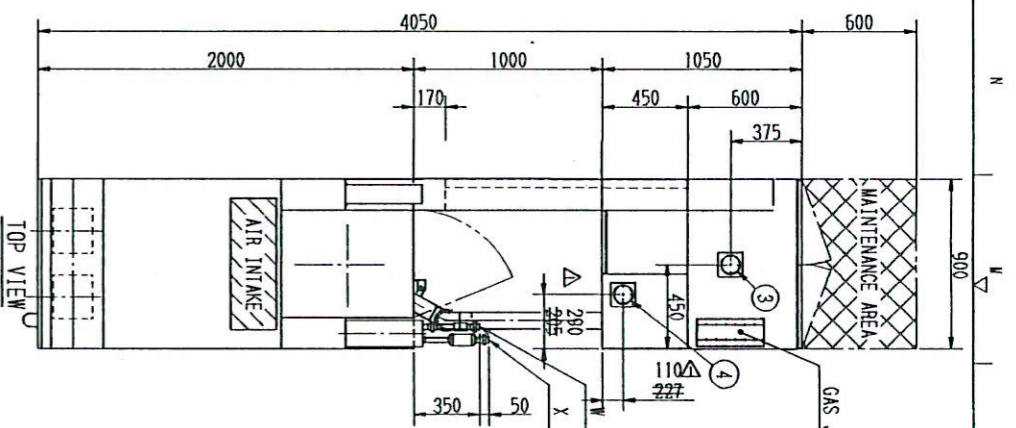
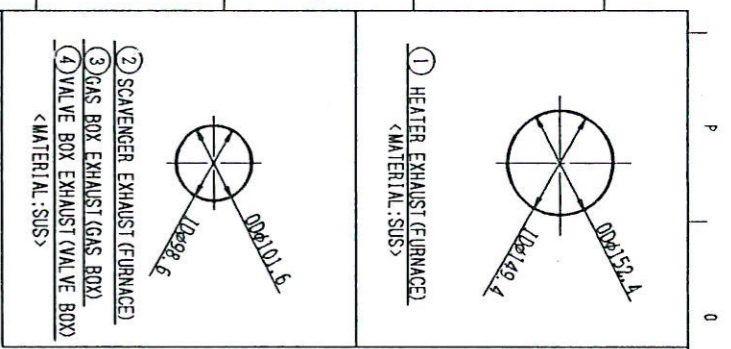


KE MEMO	EDU N.O.
UTILITY JOINT OF DETAIL: D3CM40546	WAFER SIZE FILM
	GAS PATTERN
	MAN N.O.
	WAFER SIZE
	φ 6
	S13N4
	D2CM94746

CAUTIONS

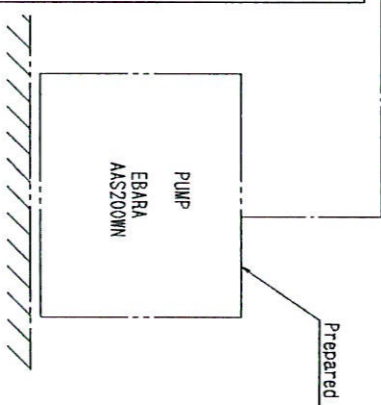
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PH	WATER	Ca. WE	Fe ION	Cl ION	RESISTIVITY
7~8	40ppm or less	40ppm or less	0.1 ppm or less	10 ppm or less	10 KΩ-cm or higher
USE AFFILTRATION ACCURACY 70μm FILTER					

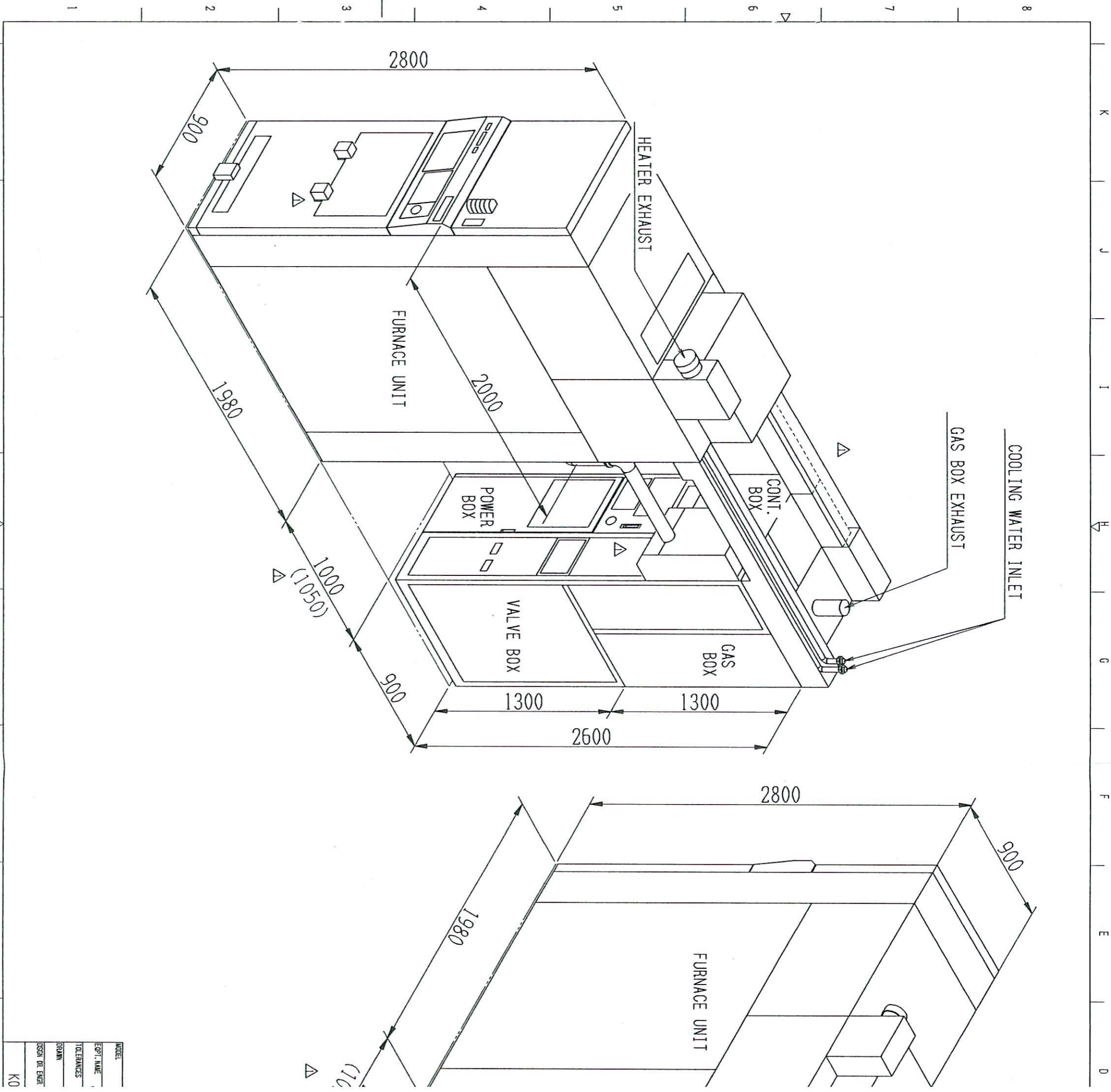




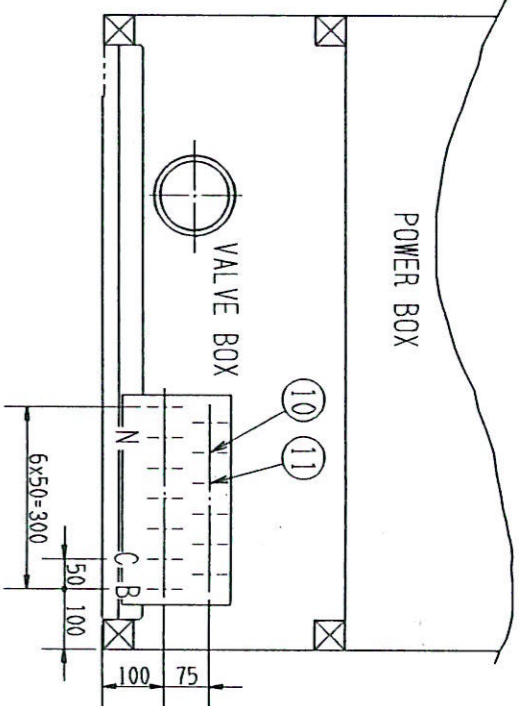
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FILM		S13N4		DZCM94746	
GAS PATTERN					

1. COOLING WATER SPECIFICATION				2. PROVIDE A SECURE GROUND.			
PH	WATER	Ca. Me	FE ION	CL ION	RESISTIVITY	TEMP	
7~8	40ppm or less	40ppm or less	0.1 ppm	10 ppm	10 KΩ-cm	23.0 ± 3.0 °C	
	CaCO3 conv.	CaCO3 conv.	or less	or less	or higher		

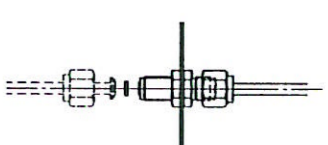
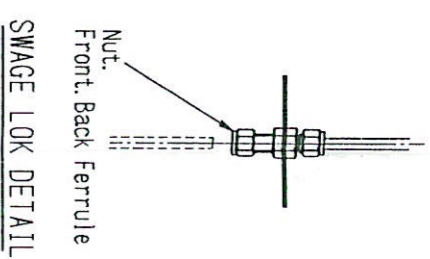




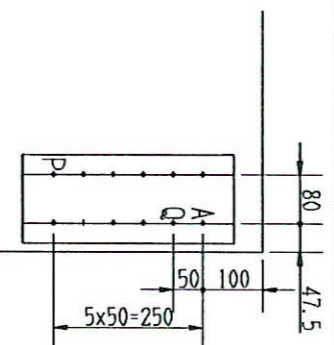
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EQPT. NAME	
TOLERANCES	
DRAWN	
DESIGN OR ENGR.	
	K0



NAME	JOINT
(B) SiH ₂ Cl ₂	6.35 VCR
(C) NH ₃	6.35 VCR
(N) LOADER VACCUUM	6.35 SWAGE LOK
(10) EXHAUST-2	9.52 VCR
(11) VENT	6.35 VCR



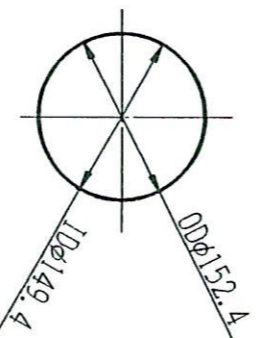
GAS INLET DETAIL (Free)
VALVE BOX



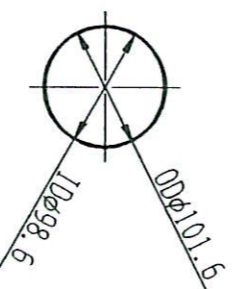
NAME	JOINT
(A) N ₂ -1 (PURE N ₂)	6.35 VCR
(P) Air/N ₂	6.35 SWAGE LOK
(Q) N ₂ -2	9.52 VCR

GAS JOINT DETAIL (Free)
GAS BOX

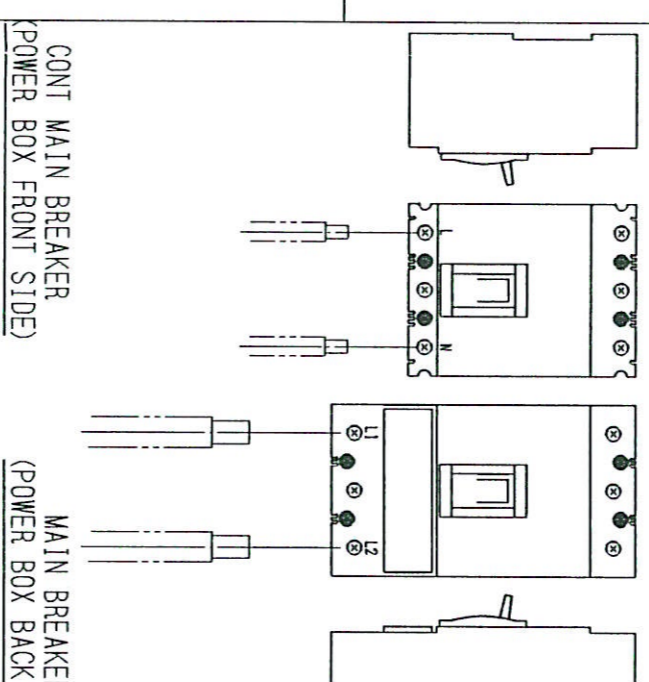
NOTE: VTF=VCR Equivalent
BI-LOK=SWAGELOK Equivalent



① HEATER EXHAUST (FURNACE)
<MATERIAL:SUS>



② SCAVENGER EXHAUST (FURNACE)
③ GAS BOX EXHAUST (GAS BOX)
④ VALVE BOX EXHAUST (VALVE BOX)
<MATERIAL:SUS>



POWER BOX DETAIL (S=Free)
BREAKER DETAIL

MODEL	V-3 (J)	QUANTITY	
EQPT. NAME	DJ-853V-6BL	CHECKED	
TOLERANCES		APPROVED	
DRAWN	M. Saito	DATE	10.4.00
DSGN OR ENGR	H. Hajikano	DATE	10.4.00
		RELEASED	

KOKUSAI ELECTRIC CO.,