ADMINISTRATION NO.

SPECIFICATIONS NO. F-4531A

–SPECIFICATIONS–

CUSTOMER	TEXAS INSTRUMENTS INCORPORATED
MODEL NAME	LP-CVD FURNACE WITH LOAD LOCK
MODEL NO.	DJ-815V-8L
FILM	Si_3N_4
MANUFACTURING NO.	T2DC2-10473
DATE	April 1995

APPROVED BY	CHECKED BY				CREATED BY	
ENGINEERING DEPT.	INSPECTION DEPT.	PROCESS DEPT.	ENGINEERING DEPT.		ENGINEERING DEPT.	
			MECHANICAL	ELECTRICAL	MECHANICAL	ELECTRICAL
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SEMICONDUCTOR EQUIPMENT DIVISION
KOKUSAI ELECTRIC CO.,LTD.
TOYAMA,JAPAN

SPECIFICATIONS NO. F-4531A

CORRECTION HISTORY

SYMBOL (REV.NO)	DATE	PAGE	ITEM NO.	CONTENTS
	March,1995			First Edition
△1	April,1995	9	9-1 1)	Remarks 「POWER BOX」 → 「MAIN BREAKER BOX」
			9-1 3)	Fitting size 「1/2"」 → 「3/8"」
		10	9-1 5)	Fitting size 「NW40」 → 「NW50」
			9-1 6)	Pure N_2-1 「3/8" VCR」 → 「3/8" STUB」
				SiH_2Cl_2 「1/4" VCR」 → 「3/8" STUB」
				NH_3 「1/4" VCR」 → 「3/8" STUB」
				N_2-3 「3/8" VCR」 → 「1/4" SWAGELOK」
		18		ERROR MESSAGE 「PVALV」 → 「DPOIL」
		21		VALVE PERFORMANCE 「Modification of MBP condition」

VERTICAL CVD SYSTEM SPECIFICATION
MODEL DJ-815V-8L(Si_3N_4)
SPECIFICATION NO.F-4531

1. GENERAL

This equipment is vertical low pressure CVD system.

2. FEATURES

2-1. Since vertical heat resist method and unique wafer transfer system, arrange furnace side by side, put gas system and exhaust valve system in furnace are adopted, the furnace unit of the system occupies a floor space has been diminished.

2-2. O_2 free load lock chamber is equipped under the reaction chamber, therefore this reduces the formation of native oxide on the base layer of wafer.

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. Therefore a fast and flexible wafer transport can be realized.

2-5. Two cassettes simultaneous transport system reduce the cassette transport time remarkably compared with the customary system.

2-6. This equipe the heater slide mechanism therefore change the reactor tube safer and easier.

2-7. The use of the Buffer cassette rack allows the storage of cassettes with wafers to cover two batches of process.

2-8. This system is equipped KE dispersion type process controller which is CX series, therefore operational ability is excellent.

2-9. Add Feed Forward Control System(FFC) to cascade Control Which is using DDC temp. adjuster and direct control to realized high accurate temp. control and improve the temperature recovery time drastically compared with the customary furnace.

2-10. Possible to process for MAX.200mm diameter wafers.

2-11. Equipe the automatic shutter at cassette port to stable internal air flow and improve the safety.

3. CONFIGURATION

3-1. ELECTRICAL FURNACE — 1 set

- RESISTANCE HEATING FURNACE FOR ϕ 200mm WAFER (D4EX04894) — 1 pcs.
- T/C FOR TEMP. CONTROL(NM150SR5) — 4 pcs.
- T/C FOR OVER TEMP. PROTECT(D4EX06094) — 4 pcs.
- 4 PCS. T/C FOR TEMP. MONITOR(D4EX04887) (QUARTZ PROTECTION) — 1 set
- THYRISTER UNIT FOR CONTROL(GD150T8K80U146) — 1 set
- OVER TEMP. PROTECTION UNIT(DN-130LZ , DEV) — 1 set
- BREAKER(AC208V/200A) — 1 set
- INSULATION TRANSFORMER(D4EX03120) — 1 set
- CLEAN UNIT(BV-040CRF-TU-A05/SIDE , D4CX05724/FRONT) — 1 set
  PERCENTAGE OF CLEANLINESS 99.9999%(GRAIN DIA. 0.1 μ m)
  99.999999%(GRAIN DIA. 0.05 μ m)
- RADIATOR(D3CK31056) — 1 set
- COOLING WATER PIPING — 1 set

3-2. DRIVING UNIT — 1 set

- FRONT SHUTTER MECHANISM — 1 set
- CASSETTE STAGE MECHANISM(2 cassettes capable) — 1 set
- CASSETTE LOADER MECHANISM(2 cassette capable) — 1 set
- CASSETTE RACK SLIDE MECHANISM(8 cassettes capable) — 1 set
- WAFER DETECTION SENSOR — 1 set
- WAFER TRANSFER MECHANISM (5 OR 1 WAFER TRANSFER, VARIABLE PITCH) — 1 set
- BOAT ELEVATOR MECHANISM — 1 set
- HEATER SLIDE MECHANISM — 1 set

3-3. CONTROLLER — 1 set

- MAIN CONTROLLER(CX2003A) — 1 set
- MAIN OPERATION(CX1104A) — 1 set
- TEMP. CONTROL(CQ1500A) — 1 set
- EXHAUST SYSTEM CONTROLLER(CX1214) — 1 set
- TRANSFER SYSTEM CONTROLLER(CX1213A) — 1 set
- GAS FLOW PATTERN PANEL(D4EX04875) — 1 set
- MAINTENANCE PANEL (D4EX06323) — 1 set
- CASSETTE LOADER OPERATION PANEL(CX1213P) — 1 set
- PROGRAMABLE CONTROLLER(SYSMAC-C200H) — 1 set
- SIGNAL TOWER(SLF-310V) — 1 set

3-4. GAS SYSTEM

- FOR Si_3N_4 — 1 set

※NOT INCLUDING GAS SUPPLY SYSTEM(CYLINDER BOX etc.),GAS PURIFICATION UNIT,GAS EXHAUST TREATMENT UNIT

3-5.	LOAD LOCK CHAMBER	1 set
	• FURNACE PORT	1 set
	• LOAD LOCK CHAMBER	1 set
	• GAS INLET	1 set
	• DOOR VALVE	1 set
	• FURNACE PORT GATE VALVE	1 set
	• GAS CONTROL FOR N_2 PURGE	1 set
	• EXHAUST PIPING	1 set
	• COOLING WATER PIPING	1 set
3-6.	QUARTZ	1 set
	• QUARTZ OUTER TUBE(D3CK98840)	1 set
	• QUARTZ INNER TUBE(D3CK35850)	1 set
	• QUARTZ ADIABATIC PLATE(D3CK21779)	1 set
	• QUARTZ BOAT(D1CL00329)	1 set
	• QUARTZ NOZZLE(D4CK75771 / STRAIGHT)	1 set
	• QUARTZ NOZZLE(D4CK73746 / L-TYPE)	1 set
	• QUARTZ WAFER CHUCK PLATE	1 set
3-7.	EXHAUST SYSTEM	1 set
	• VACUUM PUMP(SUPPLIED BY CUSTOMER)	1 set
	• EXHAUST PIPING	1 set
	• VACUUM SENSOR	1 set
	• EXHAUST DILUTION LINE	1 set
	• PIEZO VALVE FOR PRESSURE CONTROL	1 set
3-8.	OTHER	
	• O_2 DENSIMETER	1 set
	• T.C. MONITOR TERMINAL BLOCK	1 set
	• WATER LEAK DETECTOR	1 set
	• TAPE HEATER CONTROLLER	1 set
	• EXHAUST PIPE HEATER CONTROLLER	1 set
	• COLD TRAP	1 set

4. SPECIFICATION

4-1. RESISTANCE CARTRIDGE HEATER

• NUMBER OF CONTROL ZONES	4 zone
• HEATER INSIDE DIAMETER	ϕ 335mm
• HEATER WIRE DIAMETER	About ϕ 2mm
• HEATER LENGTH	1200mm
• MAX. TEMP.	850℃(FURNACE TEMP.)
• FLAT ZONE LENGTH	800mm (800±1℃ : HEATER ONLY)
• MAX. CONSUMPTION POWER(RAMP UP)	35.3KVA or less
• STABILITY POWER	8KW or less(800℃)

4-2. DRIVING UNIT

(1) FRONT SHUTTER

(2) CASSETTE STAGE

- TWEEZER WITH VARIABLE PITCH MECHANISM
- CASSETTE LOADER MECHANISM

(3) CASSETTE LOADER

- WAFER HORIZONTAL DIRECTION CASSETTE SET
- 2 CASSETTE SIMULTANEOUSLY TRANSFER
- WAFER NUMBER DETECTION FUNCTION
- CASSETTE TRANSFER TIME 2 mins / within 2 cassettes
  (2 cassettes simultaneously transfer)

(4) CASSETTE RACK MOVEMENT MECHANISM

- HORIZONTAL MOVEMENT METHOD
- NUMBER OF CASSETTE SHELVIES 8 cassettes

(5) WAFER TRANSFER MECHANISM

- TRANSFER VARIABLE PITCH OR SINGLE WAFER
- TWEEZER WITH VACUUM CHUCK
- VACUUM SENSOR
- MOVEMENT TIME 30 secs./ cycle

(6) BOAT ELEVATOR

- 3 STEP SPEED SETTING CAPABLE

(7) FURNACE PORT GATE VALVE

- PENDULUM METHOD

(8) HEATER MOVEMENT MECHANISM

- SLIDE METHOD

(9) DOOR VALVE

- SLIDE METHOD

4-3. CONTROLLER

(1) MAIN CONTROLLER ••••••••••••• • CPU/MEMORY BORD
- POWER FAILURE DETECT AND MEMORY BACK UP
- RECIPE CAPACITY 1024 bite / 1 recipe
- NUMBER OF RECIPE 32(IN MEMORY CARD)
- NUMBER OF EVENTS MAX. APPROX.80 EVENT / 1 recipe

(THOSE VALUES ARE DIFFERENT DEPEND ON SETTING CONTENS)
- AUTO CALIBRATION FUNCTION
- INTERLOCK MAX. NUMBER OF INPUT CHANNELS 64ch

(2) MAIN OPERATION •••••••••••••• • SCREEN DISPLAY EL DISPLAY
(LIFE TIME OF EL SCREEN IS APPROX. 30,000hrs.)
- OPERATION KEY
(DATA KEY, FUNCTION KEY, COMMAND KEY)
- MEMORY CARD INTERFACE

(3) TEMP. CONTROLLER(DDC)

• TEMP. SETTING RANGE	200℃~850℃ (TEMP. DISPLAY 0.0℃~1400℃)
• TEMP, DETECT	T/C
• SETTING RESOLUTION	0.1℃
• CONTROL ACCURACY	850℃±0.5℃ or less 350℃±1.0℃ or less
• OUTPUT	THYRISTOR GATE PULSE
• OUTPUT CONTROL	POWER PROPORTION PHASE CONTROL
• POWER INPUT FOR CONTROL	4 points
• POWER INPUT FOR CALIBRATION	4 points
• CONTROL PERIOD	5.5 secs./1 loop
• CONTROL METHOD	PROGRAMABLE PID CONTROL PROPORTION : 0.1~200% INTEGRAL TIME : 0.01~100.00min DIFFERENTIAL TIME : 0.00~10.00min
• ZERO POINT COMPENSATION	IC TEMP. SENSOR

(4) PRESSURE CONTROL

- CONTROL OBJECT •••••••••••••• PRESSURE CONTROL TYPE PIEZO VALVE (DIAPHRAGM SENSOR INPUT)
- CONTROL ACCURACY•••••••••• SETTING VALVE ±5%(AROUND 50Pa)

(5) GAS FLOW CONTROL

- CONTROL OBJECT •••••••••••••• MASS FLOW CONTROLLER
- CONTROL MODE •••••••••••••••• DIRECT CONTROL RAMPING CONTROL, START CONTROL
- NUMBER OF CHANNEL ••••••••• MAX. 12ch
- FLOW SETTING RANGE •••••••• 0~99.999SLM
- RESOLUTION ABILITY •••••••••• 1/1024 F.S.R.
- ACCURACY •••••••••••••••••••• ±2% F.S.R.(RANGE 10~100% F.S.)
- RAMP RATE •••••••••••••••••••0.001~99.999SLM
- DESIGNATE SOFT START••••••• MAX. PATTERN
- SOFT START TIME•••••••••••••• 0~99%(EACH CHANNEL ONE POINT)
- ERROR DETECTION TIME••••••• 0~255 secs.

(6) VALVE CONTROL

- CONTROL OBJECT •••••••••••••• SOLENOID
- SOLENOID VOLTAGE •••••••••••• DC24V
- NUMBER OF CHANNELS•••••••• MAX. 48ch

(7) INTERLOCK CONTROL

- NUMBER OF CHANNEL ••••••••• MAX. 64ch(NORMALLY OPEN, POSSIBLE TO DESIGNATE TO CLOSE)

(8) COUNTERMEASURE FOR POWER FAILURE

- TIME OF POWER FAILURE •••••• 10 msec or more
- VOLTAGE DESCENT•••••••••••• 80% or less

CONTROLLERS WILL BE SYSTEM DOWN WITH ABOVE CONDITIONS

(9) OVER TEMP. PROTECTION DEVICE(MODEL DN-130LZ , DEV)

- TEMP. DETECTION 4-ZONE SCAN METHOD
- TEMP. DETECTION PERIOD ••••• 1 sec. / 1 zone
- T/C ••••••••••••••••••••••••••TYPE R T.C.
- TEMP. SETTING RANGE •••••••• 0~1300℃

4-4. GAS SYSTEM

• BLOCK DIAGRAM	(Si_3N_4)	
	$SiH_2C\ell_2$, NH_3	
• PIPING MATERIAL	SUS316L 1/4 inch(POLISHED PIPE)	
	JOINTS SUS316 VCR	
• AIR VALVE	FUJIKIN(UP TREATED)	
• PILOT VALVE	SMC	
• CHECK VALVE	FUJIKIN(UP TREATED)	
• NEEDLE VALVE	FUJIKIN(UP TREATED)	
• MASSFLOW CONTROLLER	STEC(POLISHED)	
• FILTER	JAPAN MILIPOA(UP TREATED)	
• PRESSURE GAUGE	NAGANO KEIKI(COMPLEX POLISH TREATED)	
• PRESSURE SWITCH	NAGANO KEIKI(COMPLEX POLISH TREATED)	
• REGULATOR	VERIFLO(ELECTRIC FIELD COMPLEX POLISH TREATED)	
• HAND VALVE	FUJIKIN(UP TREATED)	

4-5. FURNACE PORT

• GAS INLET PORT	1/4 inch.SEAL TYPE O-RING	
• GAS NOZZLE	1/4 inch. QUARTZ TUBE	

4-6. LOAD LOCK CHAMBER EXHAUST PUMP

• EXHAUST PUMP(REACTOR CHAMBER EXHAUST PUMP)		
• MAIN EXHAUST PIPE	SUS 2B	
• EXHAUST VALVE	BELOW VALVE FOR 2 inch.	IRIE KOUKEN
• PIRANI SENSOR	CONTROLLER1101	EDWARDS
	PRL10K(PIRANI GAUGE).	
• CHECK VALVE	1/3 PSIG	FUJIKIN

4-7. QUARTZWARE(FOR ϕ 200min WAFER)

• QUARTZ BOAT	SLOT PITCH : 6.35mm
	TOTAL NUMBER OF SLOTS : 125 SLOTS,
	TOTAL LENGTH : 843mm
• OUTER TUBE	INSIDE DIAMETER : ϕ300mm,
	OUTSIDE DIAMETER : ϕ308mm,
	TOTAL LENGTH : 1180mm
• INNER TUBE	INSIDE DIAMETER : ϕ260mm
	OUTSIDE DIAMETER : ϕ267mm,
	TOTAL LENGTH : 1157mm
	(LOWER EDGE OUTSIDE DIAMETER : ϕ 280mm)

4-8. EXHAUST SYSTEM

・DRY PUMP, MECHANICAL BOOSTER PUMP
(PROVIDE BY CUSTOMER)

	QDP80/QMB1200	EDWARDS
	EXHAUST SPEED 18000ℓ/min	
・MAIN EXHAUST PIPING	SUS3B(IN VALVE BOX)	
	SUS4B(CONNECT PIPE FOR 1F AND 3F)	
・EXHAUST VALVE	BELOW VALVE FOR 3inch.	IRIE KOUKENI
・PIRANI SENSOR	CONTROLLER1101(CONTROLLER)	
	PRL10K(PIRANI GAUGE)	EDWARDS
・DIAPHRAGM SENSOR	628A11TBE(10Torr / 100℃)	MKS
・CHECK VALVE	1/3 PSIG	FUJIKIN
・PIEZO VALVE	PV-2000(10ℓ/min)	STEC
・MASS FLOW METER	SEF-4400(10ℓ/min)	STEC

5. PAINT COLOR

KE STANDARD COLOR	・MANSEL 5GY 8/0.5	(MAIN BODY)
	・MANSEL N3	(OPERATION PANEL etc.)
DESIGNATED TREATMENT	・BUFFING POLISHED	(FRONT PANEL)

6. OUTER DIMENSION

	WIDTH	DEPTH	FLOOR DIMENSION	HIGHT	REMARKS
FURNACE	1,000mm	2,050mm	2.05m^2	3,100mm	
POWER BOX	500mm	800mm	0.40m^2	1,200mm	
MAIN BREAKER BOX	200mm	800mm	0.16m^2	1,200mm	

・ABOVE DIMENSIONS ARE NOT INCLUDING DUCT, CONNECTING PIPE

7. WEIGHT

FURNACE(GAS BOX, CONTROLLER BOX INCLUDED)	APPROX.	2,400kg
POWER BOX	APPROX.	500kg

8. RELATED DRAWING

REFER TO ATTACHED DRAWING

・GAS FLOW PATTERN	D1CL15597
・LAYOUT	D1CL15599

9. CONSTRUCTION CLASSIFICATION

9-1. PROVISIONS BY CUSTOMER

1) CONSTRUCTION FOR POWER SUPPLY

Wiring construction and material to connect the switchboard to KE furnace receive terminal.

UNIT NAME	POWER CAPACITY	QUANTITY	REMARKS
FOR HEATER	1 ϕ AV208V 35.3KVA (RAMP UP)	1 (1 ϕ AV208V 42.3KVA)	MAIN BREAKER BOX (M12 PLUG)
FOR CONTROLLER FOR CLEAN UNIT	1 ϕ AV120V 5.0KVA		
FOR TAPE HEATER	1 ϕ AV120V 2.0KVA		
FOR PUMP	3 ϕ AV208V 12.0KVA	1	PUMP BOX

⚠

(a) Voltage deviation is $\pm$10%

(b) Frequency is 60Hz

2) GROUND

Wiring construction and materials to connect ground terminals to KE ground terminal.

3) COOLING WATER

Piping and materials from your facility for water supply and drainage KE system.

WATER PRESSURE	FLOW RATE	CONNECTION PORT DIAMETER	QUANTITY	USE FOR
3.5kgf/cm^2	15ℓ/min	3/4"SWAGELOK	1	SUPPLY WATER FOR FURNACE
0.5kgf/cm^2	–	3/4"SWAGELOK	1	DRAIN WATER FOR FURNACE
3.5kgf/cm^2	10ℓ/min	3/8"SWAGELOK	1	SUPPLY WATER FOR PUMP
0.5kgf/cm^2	–	3/8"SWAGELOK	1	DRAIN WATER FOR PUMP

⚠ ⚠

(a) Cooling water temp. should be 23$\pm$3℃

(b) Please, use following quality of water to prevent stuck.

PH	M ALKALI	Ca , Mg	Fe ION	Cl ION	RESISITIVITY
7~8	40 ppm or less $CaCO_3$ CONVERSION	40ppm or less $CaCO_3$ CONVERSION	10.1ppm or less	110ppm or less	10K Ω-cm or more

(c) Install filter mesh size 70 μ m or less.

4) Common exhaust duct construction

Duct construction and material to connect KE common duct to connection flange of your duct.

UNIT NAME	QUANTITY	EXHAUST VOLUME
HEATER EXHAUST	1	$5m^3/min$
MAIN EXHAUST IN THE FURNACE		
GAS SYSTEM EXHAUST		
PUMP EXHAUST	1	$2m^3/min$

5) PROCESS EXHAUST PIPING CONSTRUCTION

Piping construction and material from KE equipment exhaust to your process exhaust system.

UNIT NAME	QUANTITY	JOINT TYPE
EXHAUST-1	1	1/2" VCR
EXHAUST-2	1	3/8" VCR
⚠ EXHAUST-3	1	NW50

6) Each gas construction and materials from your divergence valves to KE equipment.

(Si_3N_4)

GAS TYPE	QUANTITY	JOINT TYPE	GAS PRESSURE (kgf/cm^2)	MAX. FLOW RATE	REMARKS
AIR/N_2	1	3/8" SWAGELOK	5.0	—	FOR AIR VALVE
⚠ PURE N_2-1	1	3/8" STUB	2.0	113.6	GAS BOX L/L CHAMBER
⚠ SiH_2Cl_2	1	3/8" STUB	1.0	0.1	GAS BOX
⚠ NH_3	1	3/8" STUB	1.0	2.0	GAS BOX
N_2-1	1	1/4" VCR	3.0	60.0	FOR GAS VENT DILUTION
N_2-2	1	1/4" VCR	3.0	90.0	TO BREAK VACUUM PRESSURE
⚠ N_2-3	1	1/4" SWAGELOK	3.0	40.0	FOR PUMP PURGE

7) Customer shall bear that connect wafer chuck vacuum to KE equipment.

(260～160mmHgG 40Nℓ/min)

CONNECTION JOINT ••••••••••••••••••••••1/4" SWAGELOK

8) Customer shall bear supplement of wafers and gas, etc.

9-2. KE BEARS THE FOLLOWING

1) Transportation to customers designated warehouse.

2) Assembly, adjustment and work on items which are on test inspection check list.

10. WARRANTY

10-1. This equipment is warranted for one year from the date of acceptance.

10-2. Warrant the specification of this specifications.

KE provide that gratuitous repair, in case the trouble has been caused by ke responsibility during the above warranty period.

This warranty shall be void in case of the followings.

① The accident caused in case neglect to maintenance which is described in operation manual.

② The accident caused in case did not operate proper usage which is described in operation manual.

③ The cause of the accident belongs to other besides furnace

④ Disaster, calamity, or others which is not KE responsibility

And also, the following parts are not warranted.

① Quartzware, thermocouple, pump, mass flow controller, vacuum sensor, teflon parts, check valve, consumable article, an example o-ring. (Ref. spare parts list)

② Accessories

③ Spare parts

④ Maintenance parts

⑤ Supplies by customer

10-3. Warranty for accuracy of the supplied quartzware(Quartz tube, quartz boat, quartz cap etc.)
The accident which caused by accuracy of supplied quartzware is not KE responsibility.

10-4. If you had some modifications or change without KE design dept. agreement,above warranties will be void as that work is started.

10-5. Since this equipment uses high-pressured, explosive, flammable, corrosive and toxic gases, extreme care must be exercised in its operation. The manufacturer shall by no means take responsibility for any accident caused by usage.

10-6. After this specification has approved, this specification prior to changes from meeting. However, it is only for that which has been mutual, confirmed by the meeting record.

11. ACCEPTANCE TEST CONDITION

11-1. INSPECTION AT FACTORY. (KOKUSAI)

(1) Water leak test

- Apply water 3.5kgf/cm^2 and water for 30 min. at the specified pressure and flow rate.

(2) Vacuum test

- Base pressure should be 0.67pa or less.

(3) Leak rate test

- 12 hours after pressurize 2.0kgf/cm^2 of N_2 gas, descended pressure should be 0.05kgf/cm^2 or less.(gas system only)
- Leak rate should be 1.0ℓusec or less under following conditions.(process chamber only)
  ① Pump down to base pressure for 15 minutes with furnace at conditions temperature.
  ② Close isolation valve.
  ③ Measure pressure rise once every 5 minutes for 30 minutes total.

(4) He. leak test

- Leakage amount of 1×10^{-8}torrℓ/sec or less in process chamber and load lock chamber. (use He. leak detector)

(5) Interlock test

- Interlock should work correctly.

(6) Vacuum, Air/N_2 line leak check

- Confirm the pressure changing by visually.

(7) O_2 concentration test

- O_2 concentration, load lock chamber should be descended 1ppm or less within 35 minutes.

※(2), (3), (4) (7) will be sent, please confirm.

11-2. INSPECTION AFTER INSTALLATION AT CUSTOMER SITE.

(1) Water leakage test

- Supply 3.5kgf/cm^2 cooling water 30 mins. and should not be leaked.

(2) Vacuum test

- Base pressure should be 0.67pa or less 0.67pa.

(3) Leak rate test

- 12 hours after pressurize 2.0kgf/cm^2 of N_2 gas, descended pressure should be 0.05kgf/cm^2 or less.(gas system only)
- Leak rate should be 1.0ℓusec or less under following conditions.(process chamber only)
  ① Pump down to base pressure for 15 minutes with furnace at conditions temperature.
  ② Close isolation valve.
  ③ Measure pressure rise once every 5 minutes for 30 minutes total.

(4) He. leak test

- Leakage amount of 1×10^{-8}torrℓ/sec or less in process chamber and load lock chamber. (use He. leak detector)

(5) Growth test

GROWTH CONDITION	FILM	Si_3N_4
	WAFER SIZE	ϕ 200mm
	REACTION GAS	SiH_2Cl_2, NH_3 (1 : 15)
	NUMBER OF WAFERS (WAFERS PER BATCH)	100
	PROCESS TEMP.	745℃ / CENTER
	PROCESS PRESSURE	26.6Pa
	DEPOSITION RATE	—
	FILM THICKNESS	60Å
	PROCESS CYCLE	20 BATCH
CRITERIA	FILM THICKNESS NONUNIFORMITY ※(1)	
	WITHIN WAFER	≦2.0%
	WAFER TO WAFER	≦2.1%
	BATCH TO BATCH	≦2.2%
	REFRACTIVE INDEX	1.99~2.03

※(1) The circle area of 5mm from the circumference of the wafer shall be excluded.

◎MEASUREMENT METHOD

(a) Test equipment ELLIPSOMETER

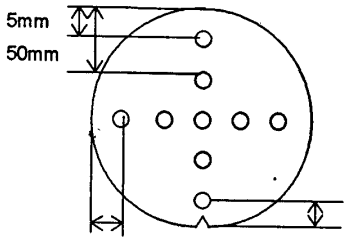
(b) Numerical value

① Measurement point

The center 1 point

From 5mm of the outside 4 points

From 50mm of the outside 4 points



② Calculation formulas for judgment criterion

Calculation formulas are based on customer definition

(6) Wafer transfer test

- Reliability test(3000 wafers pass)

  30 cycles of "cassette charge → wafer charge → boat load → boat unload → wafer discharge → cassette discharge" movement has no trouble.

- Movement time(cassette ←→ boat)

  Complete that 100 of wafers charge and discharge within 15 minutes each.

(7) Particle test

- Front side defect density — 0.05 particles /cm^2 (0.15 μ m or greater)

  SL with load / unload only

- Back side defect density — 1.0 particles /cm^2 (0.20 μ m or greater) —※

  SL with load / unload only

- Front side defect density — 0.13 particles /cm^2 (0.20 μ m or greater)

  SL with process

※We will comply this value within 1 year after installation.

(Initial acceptance value=32 particles / cm^2)

(8) Temp. stabilization test

- 800±0.5℃ for 10 hours or longer.(measure this 60 pa or less)

(9) Flat zone test

- Flat zone of heater temp. should be 650mm or greater.

  (Within 800±1.0℃ full load of wafers)

  Using a profile T.C. ,chart temperature in one inch(2.54cm) increments.

(10) Interfacial oxide layer test

- Interfacial oxide should be 7 Å or less after deposition per standard conditions.

(11) If any problems occur through above test, they must be discussed and be solved between KE and customer.

12. SPARE PARTS

SPECIAL CONTRACT

13. PROVISION BY CUSTOMERS

• Si WAFER FOR DEPOSITION TEST(ϕ 200mm)	50
• DUMMY WAFER FOR DEPOSITION TEST(ϕ 200mm)	100
• WAFER CASSETTE	8 pcs.
• PUMP SYSTEM	1 set

14. ACCESSORIES

• TEST RESULT	2 copies
• MANUAL(CLEAN PAPER)	2 copies

ERROR MESSAGE F-4531A

ERROR NUMBER	ERROR MESSAGE	RECOVERY REPORT	ERROR TYPE	DETECTOR METHOD OR SENSOR NUMBER	ALARM SET POINT	HEATER POWER OFF
1	G-N2 ER	YES	GAS SYSTEM N_2 PRESSURE DOWN	PRESSURE GAUGE PG/PS1	1.00kgf/cm^2 OR LESS	
2	SIHCL ER	YES	GAS SYSTEM SiH_2CL_2 PRESSURE DOWN	PRESSURE GAUGE PG/PS2	0.80kgf/cm^2 OR LESS	
3	NH3 ER	YES	GAS SYSTEM NH_3 PRESSURE DOWN	PRESSURE GAUGE PG/PS3	0.80kgf/cm^2 OR LESS	
4	F-AIR ER	YES	AIR/N_2 PRESSURE DOWN	PRESSURE SWITCH PS11	3.50kgf/cm^2 OR LESS	
5	LL-N2 ER	YES	L/L CHAMBER N_2 PRESSURE DOWN	PRESSURE GAUGE PG/PS12	1.00kgf/cm^2 OR LESS	
6	VENT1 ER	YES	NH_3 VENT DILUTION N_2 FLOW PATE DOWN	MASSFLOW GAUGE FL1	20ℓ/min OR LESS	
7	VENT2 ER	YES	NH3 VENT DILUTION N2 PRESSURE DOWN	PRESSURE GAUGE PG/PS4	2.00kgf/cm^2 OR LESS	
8	GDUCT ER	YES	GAS SYSTEM EXHAUST PRESSURE DOWN	MANOMETER (SWITCH)	2.0mmH_2O OR LESS	
9	HDUCT ER	YES	HEATER CHAMBER EXHAUST PRESSURE DOWN	MANOMETER (SWITCH)	2.0mmH_2O OR LESS	
10	CDUCT ER	YES	COMMON EXHAUST PRESSURE DOWN	MANOMETER (SWITCH)	2.0mmH_2O OR LESS	
11	F-CLN ER	YES	FRONT(CASSETTE STAGE)CLEAN UNIT STOP	MANOMETER (SWITCH)	2.0mmH_2O OR LESS	
12						
13	S-CLN ER	YES	SIDE CLEAN UNIT STOP	MANOMETER (SWITCH)	2.0mmH_2O OR LESS	
14	FAN-P ER	YES	POWER FOR EXHAUST FAN DOWN	CONTACTOR/THERMAL SWITCH	—	
15	F-WAT ER	YES	15SECS AFTER FURNACE COOLING WATER FLOW RATE DOWN	MASSFLOW SWITCH	10ℓ/min OR LESS	●
16	ILWAT ER	YES	INLET FLANGE UPPER COOLING WATER FLOW RATE DOWN	MASSFLOW GAUGE	0.5ℓ/min OR LESS	
17	GVWAT ER	YES	FURNACE PORT GATE VALVE COOLING WATER FLOW RATE DOWN	MASSFLOW GAUGE	1.0ℓ/min OR LESS	

ERROR NUMBER	ERROR MESSAGE	RECOVERY REPORT	ERROR TYPE	DETECTOR METHOD OR SENSOR NUMBER	ALARM SET POINT	HEATER POWER OFF
18	HEAT1 ER	YES	HEATER TEMP. ABNORMAL	THERMAL SWITCH	130℃ OR MORE	●
19	HEAT2 ER	YES	RADIATOR TEMP. ABNORMAL	THERMAL SWITCH	100℃ OR MORE	●
20	H-WAT ER	YES	HEATER COOLING WATER LEAK	WATER LEAK DETECTOR		●
21	LLATM ER	YES	L/L CHAMBER ATM. PRESSURE	PRESSURE SWITCH PS51-1	0.00kgf/cm^2 OR MORE	
22	LLOUP ER	YES	L/L CHAMBER OVER PRESSURE	PRESSURE SWITCH PS51-2	0.10kgf/cm^2 OR MORE	
23	R.ATM ER	YES	REACTOR CHAMBER ATM.PRESSURE	PRESSURE SWITCH PS71-1	0.00kgf/cm^2 OR MORE	
24	R.OVP ER	YES	REACTOR CHAMBER OVER PRESSURE	PRESSURE SWITCH PS71-2	0.10kgf/cm^2 OR MORE	
25	VG1-1 ER	YES	VG11 SET POINT1 IS ON	PIRANI GAUGE VG11	10Torr OR LESS	
26	VG1-2 ER	YES	VG11 SET POINT2 IS ON	PIRANI GAUGE VG11	100Torr OR LESS	
27	VG2-1 ER	YES	VG12 SET POINT3 IS ON	PIRANI GAUGE VG12	10Torr OR LESS	
28	VG3-1 ER	YES	VG13 SET POINT1 IS ON	PIRANI GAUGE VG13	10Torr OR LESS	
29	O2-LO ER	YES	O_2 CONCENTRATION IN LOAD LOCK CHAMBER IS OVER SET POINT(Lo)	O_2 DENSIMETER	1PPM OR MORE	
30	O2-HI ER	YES	O_2 CONCENTRATION IN LOAD LOCK CHAMBER IS OVER SET POINT(Hi)	O_2 DENSIMETER	3PPM OR MORE	
31						
32						
33	TEMP ER	YES	HEATER OVER TEMP.	DN-130LZ(HEATER)	850℃ OR MORE	●
				THERMAL SW.(SCR)	80℃ OR MORE	
				THERMAL SW. (TRANSFORMER)	150℃ OR MORE	
34	TAPE1 ER	YES	TAPE HEATER OVER TEMP.	TEMP.CONTROLLER	50℃ OR MORE	
35	TAPE2 ER	YES	TAPE HEATER TEMP. DOWN	TEMP.CONTROLLER	25℃ OR LESS	

F-4531A

ERROR NUMBER	ERROR MESSAGE	RECOVERY REPORT	ERROR TYPE	DETECTOR METHOD OR SENSOR NUMBER	ALARM SET POINT	HEATER POWER OFF
36	TAPE3 ER	YES	EXHAUST PIPING HEATER OVER TEMP.	TEMP.CONTROLLER	150℃ OR MORE	
37	TAPE4 ER	YES	EXHAUST PIPING HEATER TEMP.DOWN	TEMP.CONTROLLER	80℃ OR LESS	
38						
39						
40						
41						
42						
43						
44						
45	EP-N2 ER	YES	EXHAUST PURGE N_2 PRESSERE DOWN	PRESSURE SWITCH PS13	2.00kgf/cm^2 OR LESS	
46						
47						
48						
49						
50	PALM1 ER	YES	PUMP WARNING	PUMP(QDP80)		
51	PALM2 ER	YES	PUMP HAZARD	PUMP(QDP80)		
52	PSTOP ER	YES	PUMP STOP	PUMP(QDP80)		
53	DP-N2 ER	YES	DRY PUMP N_2 FLOW RATE DOWN	PUMP(QDP80)		
54	DPOIL ER	YES	DRY PUMP OIL LEVEL LOW	PUMP(QDP80)		
55						
56						
57	EXT1 ER	YES	EXTERNAL SIGNAL INPUT1	PLEASE,PROVIDE AT YOUR SITE		
58	EXT2 ER	YES	EXTERNAL SIGNAL INPUT2	PLEASE,PROVIDE AT YOUR SITE		
59	EXT3 ER	YES	EXTERNAL SIGNAL INPUT3	PLEASE,PROVIDE AT YOUR SITE		

ERROR NUMBER	ERROR MESSAGE	RECOVERY REPORT	ERROR TYPE	DETECTOR METHOD OR SENSOR NUMBER	ALARM SET POINT	HEATER POWER OFF
60	EXT4 ER	YES	EXTERNAL SIGNAL INPUT4	PLEASE,PROVIDE AT YOUR SITE		
61						
62	SYSMC	YES	SEQUENCER ABNORMAL	SEQUENCER C200H		
63	SEND	YES	COMMUNICATION ERROR BETWEEN CX2003 AND SEQUENCER	MAIN CONTROLLER CX2003		
64	MANTE	YES	MAINTENANCE MODE	MAINTENANCE SWITCH		●

VALVE PERFORMANCE F-4531A

VALVE NO.	CONDITION OF VALVE OPERATION
AV1(N.O)	WHEN REACTOR CHAMBER IS NOT OVER PRESSURIZED,POSSIBLE TO OPEN
AV2(N.O)	WHEN REACTOR CHAMBER IS NOT OVER PRESSURIZED,POSSIBLE TO OPEN
AV3(N.O)	WHEN REACTOR CHAMBER IS NOT OVER PRESSURIZED,POSSIBLE TO OPEN
AV4(N.O)	WHEN REACTOR CHAMBER IS NOT OVER PRESSURIZED,POSSIBLE TO OPEN
AV5(N.O)	WHEN REACTOR CHAMBER IS NOT OVER PRESSURIZED,POSSIBLE TO OPEN
AV6(N.O)	WHEN REACTOR CHAMBER IS NOT OVER PRESSURIZED,POSSIBLE TO OPEN
AV7	WHEN AV8 IS CLOSED,POSSIBLE TO OPEN
AV8	WHEN AV7 IS CLOSED,POSSIBLE TO OPEN
AV9	WHEN AV8,AV11,AV51,AV52,AV53,AV70,AV71,AV72 ARE CLOSED AND PUMP IS RUNNING,POSSIBLE TO OPEN
AV10	WHEN AV11,AV51,AV52,AV53,AV70,AV71,AV72 ARE CLOSED AND PUMP IS RUNNING, POSSIBLE TO OPEN
AV11	WHEN AV9,AV10 ARE CLOSED AND AV71 IS OPEN,POSSIBLE TO OPEN
AV12	WHEN AV13 IS CLOSED,POSSIBLE TO OPEN
AV13	WHEN AV12 IS CLOSED,POSSIBLE TO OPEN
AV14	WHEN AV13,AV15,AV16,AV51,AV52,AV53,AV70,AV71,AV72 ARE CLOSED AND PUMP IS RUNNING,POSSIBLE TO OPEN
AV15	2SECS AFTER THE TIME THAT AV14,AV16 ARE CLOSED AND WHEN FL1(N2 FOR DILUTING GAS VENT)IS ON,POSSIBLE TO OPEN
AV16	WHEN AV14,AV15 ARE CLOSED AND AV71 IS OPEN,POSSIBLE TO OPEN
AV51	WHEN L/L GATE VALVE,FURNACE PORT GATE VALVE,L/L DOOR,AV9,AV10,AV14, AV70,AV71,AV72 ARE CLOSED AND PUMP IS RUNNING,POSSIBLE TO OPEN
AV52	WHEN L/L GATE VALVE,FURNACE PORT GATE VALVE,L/L DOOR,AV9,AV10,AV14, AV70,AV71,AV72 ARE CLOSED AND PUMP IS RUNNING,POSSIBLE TO OPEN
AV53	WHEN L/L GATE VALVE,FURNACE PORT GATE VALVE ,L/L DOOR,AV9,AV10,AV14, AV70,AV71,AV72 ARE CLOSED,PUMP IS RUNNING AND VG11 IS 100Torr OR LESS, POSSIBLE TO OPEN
AV54	WHEN AV9,AV10,AV14,AV51,AV52,AV53 ARE CLOSED,AV61 OR AV62 IS OPEN,10SECS AFTER THE TIME THAT AV70,AV71,AV72 ARE CLOSED,FURNACE PORT CAP IS NOT CLOSED,PUMP IS RUNNING AND L/L CHAMBER IS ATM.PRESSURIZED,IT IS AUTOMATICALLY OPEN
AV60	WHEN(AV1,AV4 OR AV2,AV5 OR AV3,AV6 ARE OPEN)AND AV71 IS CLOSED,IT IS AUTOMATICALLY OPEN

VALVE NO.	CONDITION OF VALVE OPERATION
AV61(N.O)	WHEN L/L GATE VALVE,L/L DOOR ARE CLOSED,L/L DOOR CLUMP IS ON AND L/L CHAMBER IS NOT OVER PRESSURIZED,POSSIBLE TO OPEN
AV62	WHEN L/L GATE VALVE,L/L DOOR ARE CLOSED,L/L DOOR CLUMP IS ON AND L/L CHAMBER IS NOT OVER PRESSURIZED,POSSIBLE TO OPEN
AV64(N.O)	WHEN(AV61 OR AV62 IS OPEN AND L/L CHAMBER IS ATM.PRESSURIZED)OR L/L CHAMBER IS OVER PRESSURIZED,IT IS AUTOMATICALLY OPEN
AV65	WHEN L/L CHAMBER IS OVER PRESSURIZED,IT IS AUTOMATICALLY OPEN
AV66	WHEN L/L CHAMBER IS ATM.PRESSURIZED,POSSIBLE TO OPEN
AV67(N.O)	WHEN AV66 IS CLOSED,IT IS AUTOMATICALLY OPEN
AV70	WHEN AV9,AV10,AV14,AV51,AV52,AV53,FURNACE PORT GATE VALVE OR FURNACE PORT CAP ARE CLOSED AND PUMP IS RUNNING,POSSIBLE TO OPEN
AV71	WHEN AV9,AV10,AV14,AV51,AV52,AV53 ARE CLOSED,FURNACE PORT GATE VALVE OR FURNACE PORT CAP IS CLOSED,PUMP IS RUNNING AND VG12 IS 10Torr OR LESS,POSSIBLE TO OPEN
AV72	WHEN AV9,AV10,AV14,AV51,AV52,AV53,FURNACE PORT GATE VALVE OR FURNACE PORT CAP ARE CLOSED AND PUMP IS RUNNING,POSSIBLE TO OPEN
AV73(N.O)	WHEN(AV1,AV4 OR AV2,AV5 OR AV3,AV6 ARE OPEN AND REACTOR CHAMBER IS ATM. PRESSURIZED)OR REACTOR CHAMBER IS OVER PRESSURIZED,IT IS AUTOMATICALLY OPEN
AV74(N.O)	WHEN REACTOR CHAMBER IS OVER PRESSURIZED,IT IS AUTOMATICALLY OPEN
AV75	WHEN VG12 IS 10Torr OR LESS,POSSIBLE TO OPEN
AV76	WHEN PUMP IS RUNNING,POSSIBLE TO OPEN
AV77(N.O)	WHEN PUMP IS STOPPED,IT IS AUTOMATICALLY OPEN
AV78(N.O)	WHEN AV73,AV74 ARE CLOSED, IT IS AUTOMATICALLY OPEN
DP	WHEN PUMP IS NORMAL,POSSIBLE TO START
MBP	WHEN(AV51 OR AV52 OR AV53 IS OPEN AND VG11 IS 10 Torr OR LESS)OR(AV70 OR AV71 OR AV71 IS OPEN AND VG12 IS 10Torr OR LESS)OR(AV51,AV52,AV53,AV70, AV71,AV72 ARE CLOSED AND VG13 IS 10Torr OR LESS),IT IS AUTOMATICALLY START

GAS SYSTEM PARTS LIST

	SYMBOL	DESCRIPTION	MODEL OR RATING	SPEC	Q'TY	VENDOR	REMARK
	PG/PS 1~3	PRESS. GAUGE W/SWITCH	ZT21-123 (D4CX03122)	CAT	3	NAGANO KEIKI	VCR, UC-TREATED
			※DIGITAL PRESSURE METER WITH	OUT PUT	1~10Kg/cm²		
1	MP 1~3	REGULATOR	SQ140-50-2P-FS1/4-FF-PM	CAT	3	VERIFLO	VCR, CP-TREATED
	F 1~3	FILTER	WGMSA1HRU (METAL)	CAT	3	JPN MILLIPORE	VCR, UP-TREATED
	HV 1~5	HAND VALVE	FUDDFL-71-6.35-2-UP (FEMALE)	CAT	5	FUJIKIN	UJR, UP-TREATED
	HV 10~14	HAND VALVE	FUDDFL-TB-71-6.35-UP	CAT	5	FUJIKIN	UJR, UP-TREATED
	CV 1.2.4.7	CHECK VALVE	FUCL-715-6.35-0.07-UP (MALE)	CAT	4	FUJIKIN	UJR, UP-TREATED
	CV 3.5.6.8	CHECK VALVE	FUCL-715-6.35-0.07-SI-UP (MALE)	CAT	4	FUJIKIN	UJR, UP-TREATED
1	AV 1~6	AIR VALVE	FP-SD-71-6.35-2(NO)	CAT	6	FUJIKIN	UJR, UP-TREATED
1	AV 7-8-9 12-13-14	AIR VALVE(3-4B)	FBSDT-6.35-3B4-BGC(NC-NC-NC)	CAT	2	FUJIKIN	UJR, UP-TREATED
1	AV 10-11 15-16	AIR VALVE(2-3B)	FBSDV-6.35-2B3-BGC(NC-NC)	CAT	2	FUJIKIN	UJR, UP-TREATED
2 1	MFC 1.2	MASSFLOW CNT	SEC-7340MO-502-4CR-N2-UC	CAT	2	STEC	
2 1	MFC 3	MASSFLOW CNT	SEC-7330MO-501-4CR-N2-UC	CAT	1	STEC	
2 1	MFC 4	MASSFLOW CNT	SEC-7330MO-101-4CR-SiH2Cl2-UC	CAT	1	STEC	
2 1	MFC 5	MASSFLOW CNT	SEC-7330MO-202-4CR-NH3-UC	CAT	1	STEC	
2 1	MFM 1	MASSFLOW MET	SEF-7330M-101-4CR-SiH2Cl2-UC	CAT	1	STEC	
2 1	MFM 2	MASSFLOW MET	SEF-7330M-202-4CR-NH3-UC	CAT	1	STEC	

NOTE :	EV" s, MFC P/S	AND OPERATION/SETTING UNIT ARE		INSTALLED ON CONTROL UNIT SIDE.			
	TUBINGS	SUS 316L, 1/4" EP-TREATED TUBE					
	GASKETS	NI-4-VCR-2-GR-VS					1SET
	JOINTS	SUS 316L, UJR OR EQUIVALENT					(EXCLUDING AIR
							SUPPLY TUBINGS)
	FLOW PATTERN	D3VL25961 S3					

REVISIONS : 1 94.12.21 Change MP Model and MFC Model M.Urano K.Tometsuka
2 95.1.12 Change MFC MFM Model M.Urano K.Tometsuka

APPR	JUDG'D	DESIGN	TRACED	CHECKED	ISSUED
K.Tometsuka	M.Hirano	Y.Nishino	M.Urano	M.Shimada	

MODEL/TYPE : DJ-815V

TITLE : GAS UNIT PARTS LIST

DWG NO : D4VX10257 REV.