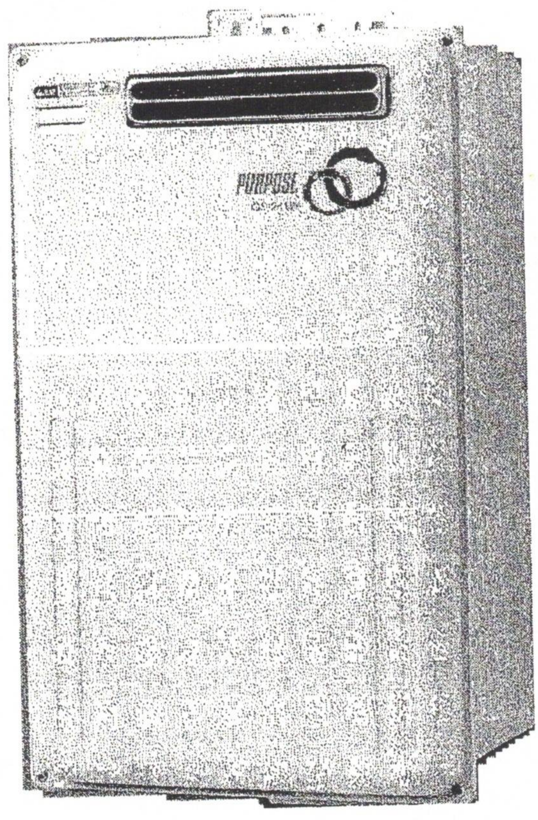
Issued at February 2002

ECO BEST by PURPOSE

SERVICE MANUAL

INSTANTANEOUS GAS WATER HEATER
MODEL : COMFORT 100 / 200 / 300

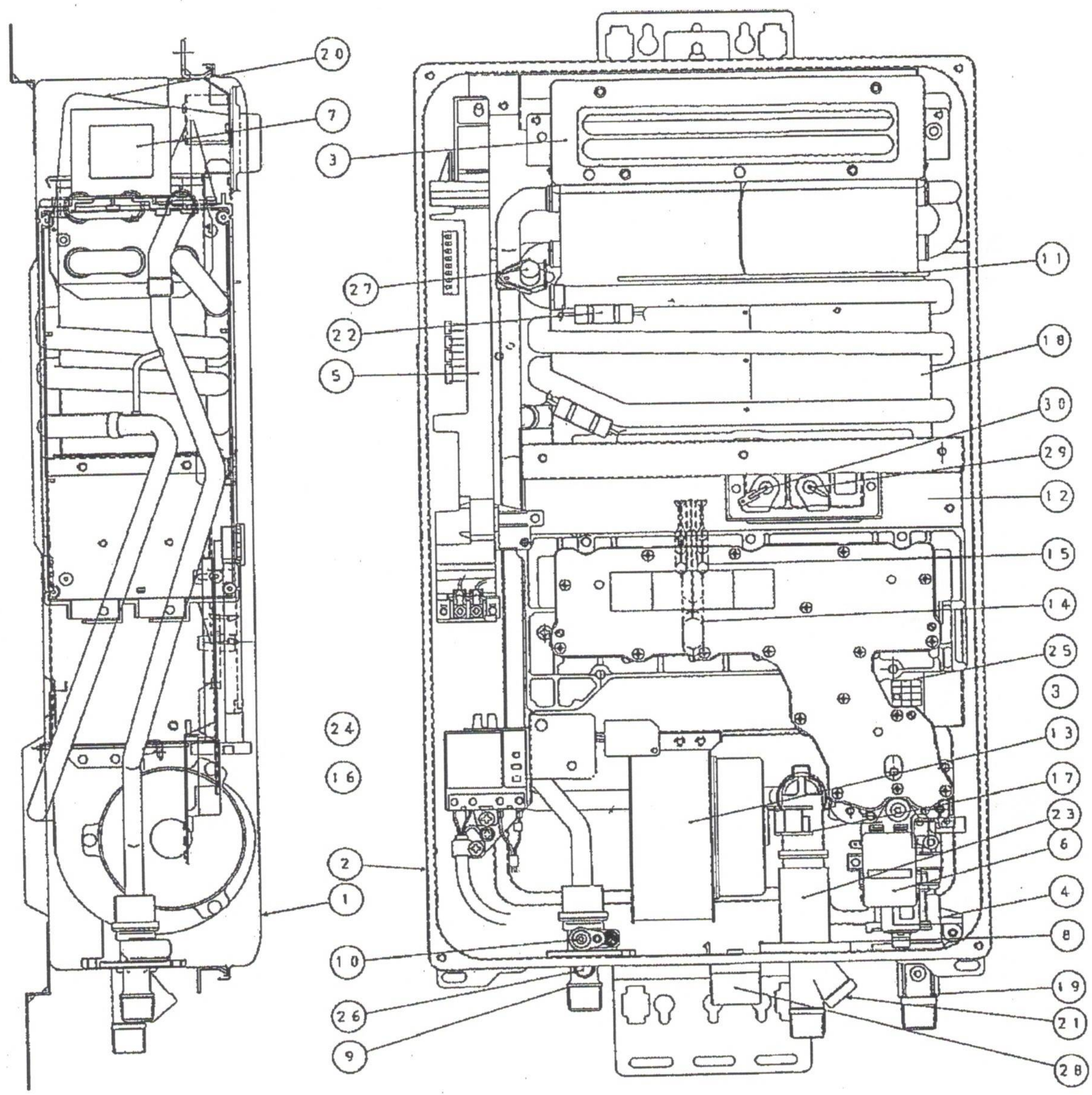


Contents:

Takagi Industries Co., Ltd.

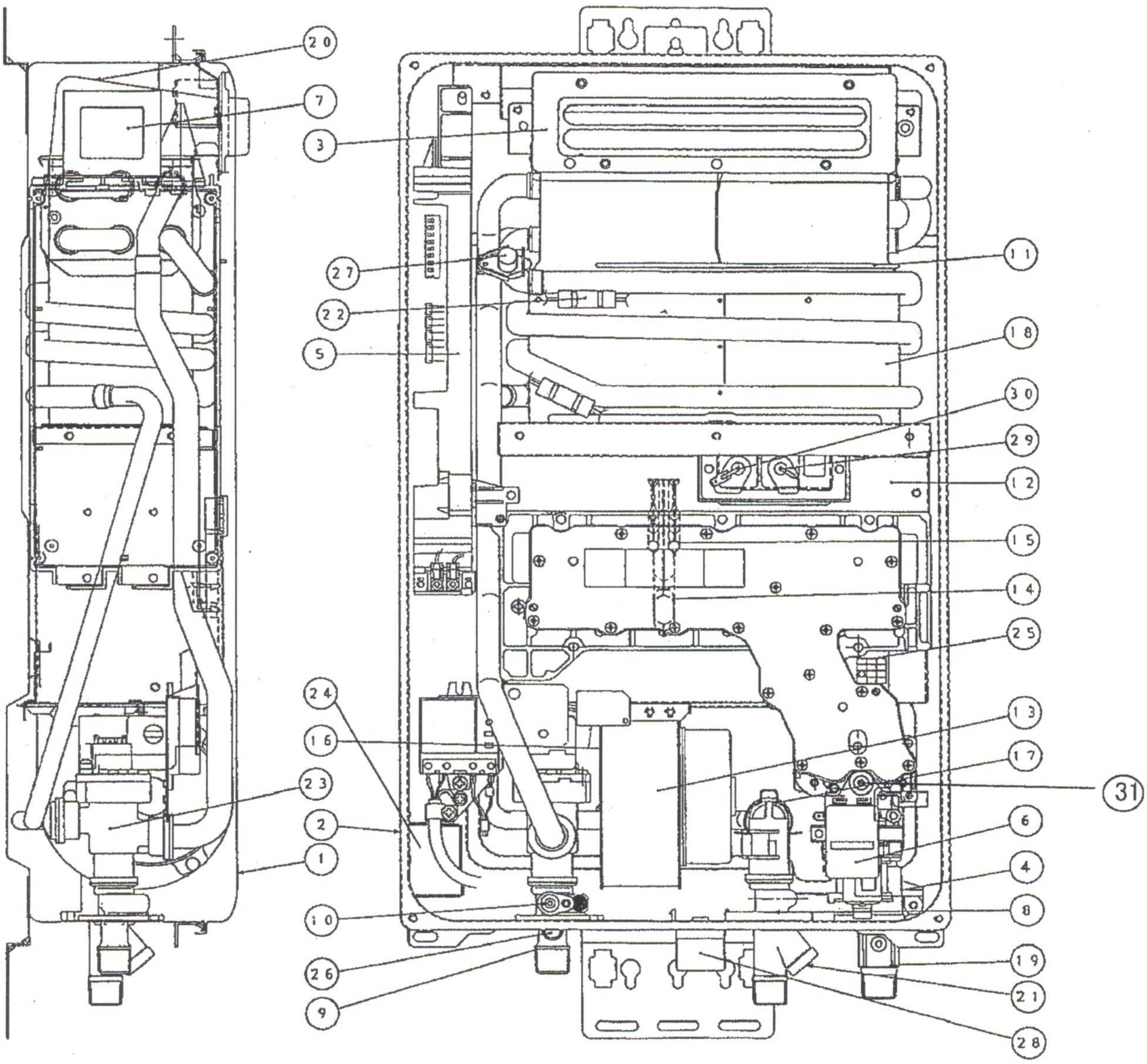
§ 1. Cut-away Diagram

● COMFORT 100



No.	Description	No.	Description	No.	Description
1	Front Panel	13	Fan Motor Assembly	25	Manifold
2	Outer Casing	14	Burner 2	26	Drain Knob
3	Exhaust Flue	15	Burner 1	27	Remaining Flame Safety De.
4	Modulation Valve Unit	16	Frost Sensing Switch	29	Ignition Sparrk Electrode
5	P.C.B. Unit Assembly	17	Water Flow Sensor	30	Flame Sense Electrode
6	Igniter	18	Heat Exchanger	31	Gas Pressure Test Point
7	Transformer (100V)	19	Gas Inlet		
8	Water Inlet	20	Exhaust Chamber		
9	Hot Water Outlet	21	Pressure Relief Valve		
10	Outgoing Water Temp. Thermistor	22	Anti-frost Heater		
11	Thermal Fuse Device	23	Water Control Valve		
		24	Transformer (240V)		

● COMFORT 200



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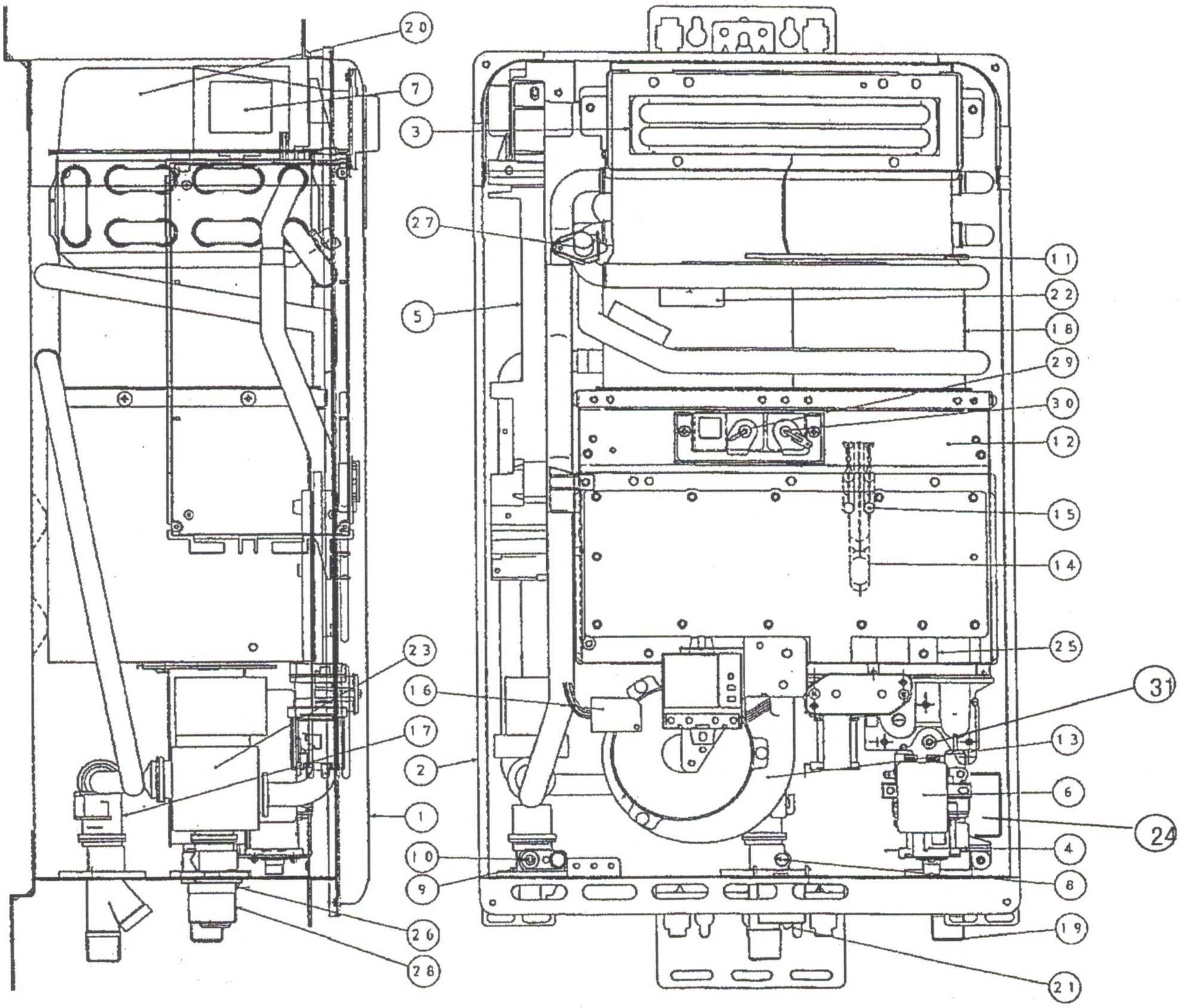
	Thermistor	23	Water Mixing Valve		
11	Thermal Fuse Device	24	Transformer (240V)		

● COMFORT 300



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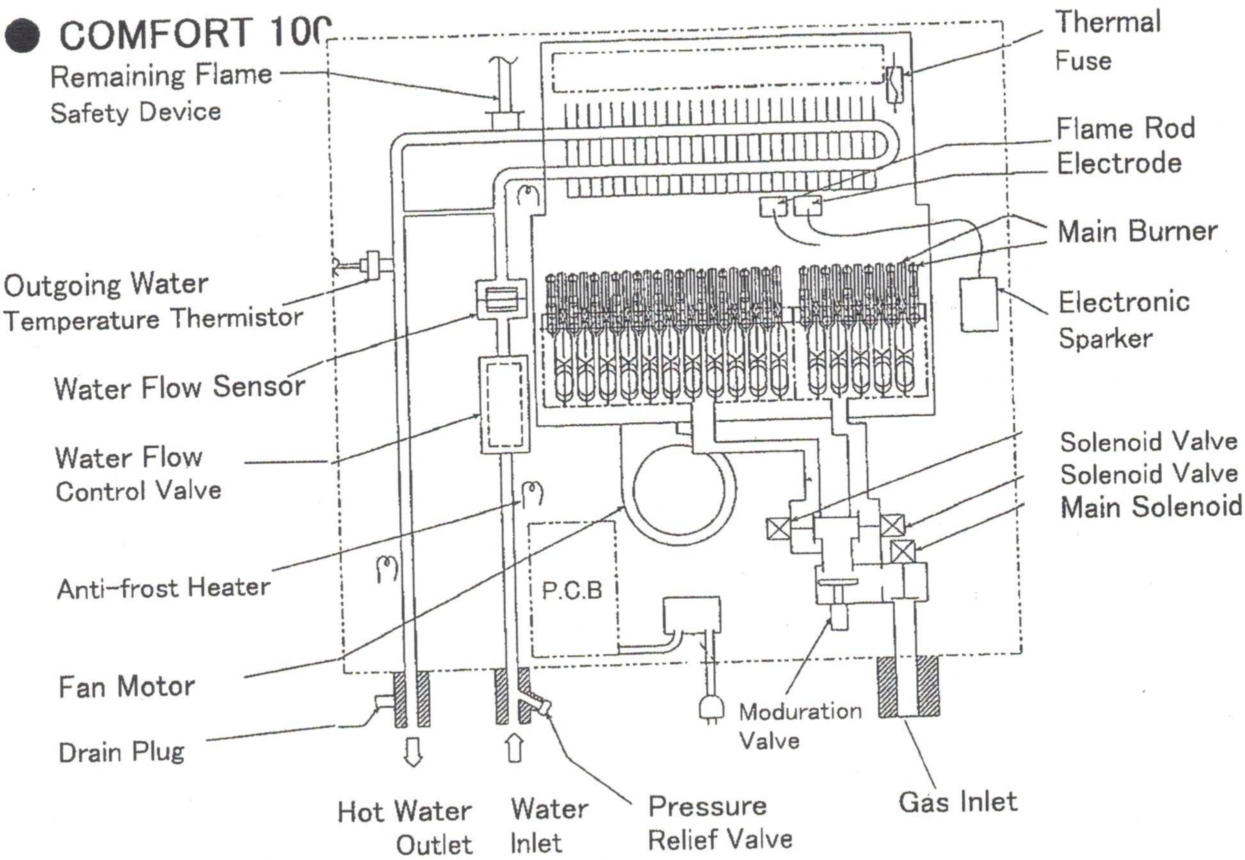
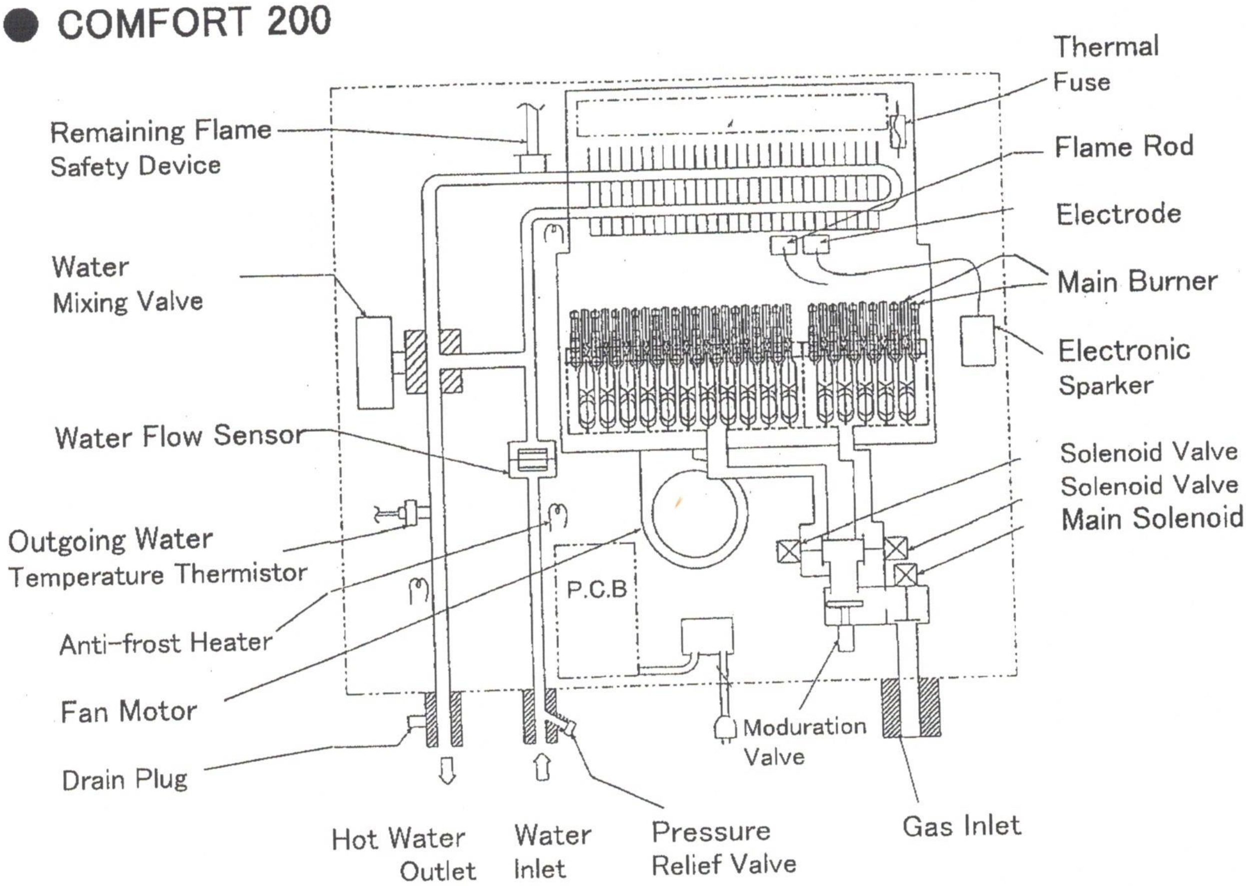
10	Outgoing Water Temp. Thermistor	22	Anti-frost Heater		
		23	Water Mixing Valve		
11	Thermal Fuse Device	24	Transformer (240V)		

§ 2. Schematic Diagram

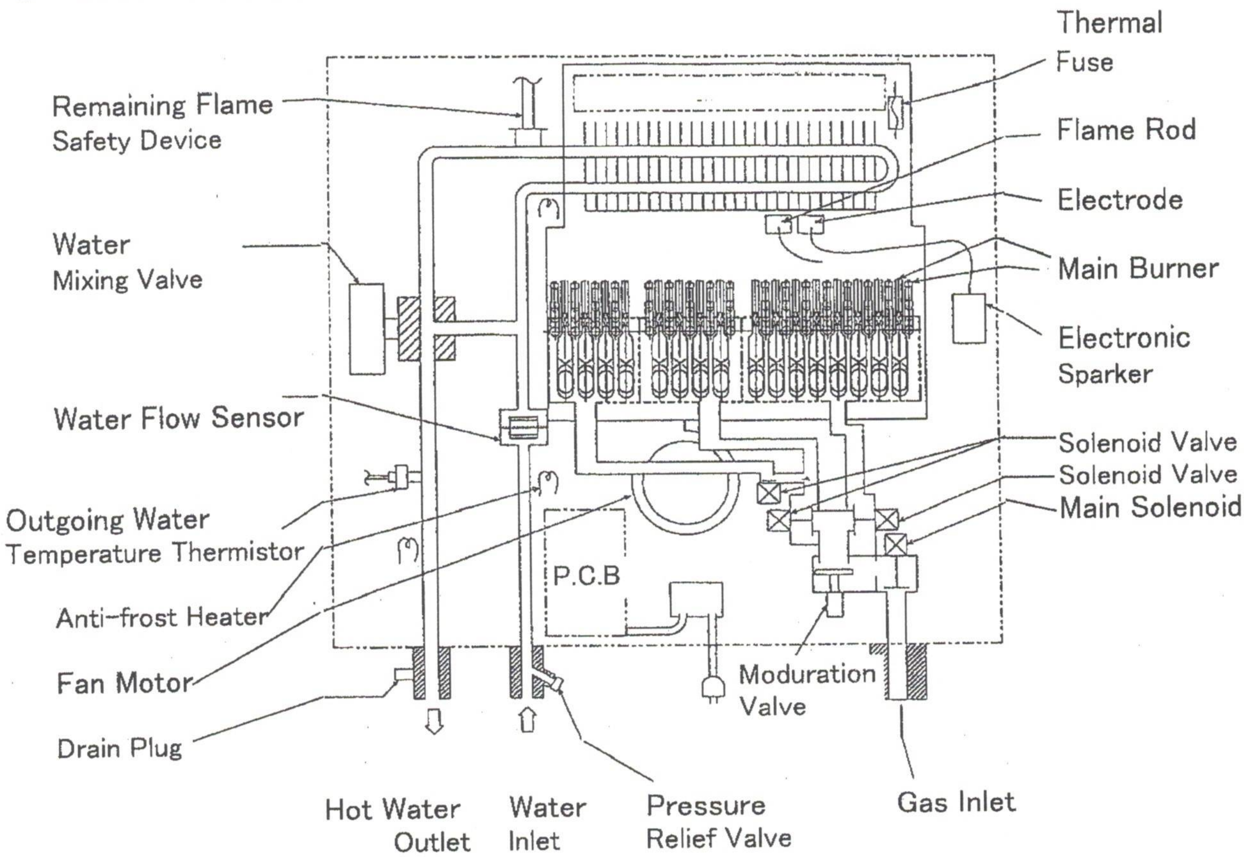
● COMFORT 100



● COMFORT 200



● COMFORT 300


Thermal
Fuse
Remaining Flame
Safety Device
Flame Rod
Electrode
Water
Mixing Valve
Main Burner
Electronic
Sparker
Water Flow Sensor
Solenoid Valve
Solenoid Valve
Main Solenoid
Outgoing Water
Temperature Thermistor
P.C.B
Anti-frost Heater
Fan Motor
Moduration
Valve
Drain Plug
Hot Water
Outlet
Water
Inlet
Pressure
Relief Valve
Gas Inlet

§ 3. Fault Analysis

Remarks:

1 Value of voltage & resistance shown hereunder is normal range.
2 Colour in ( ) hereunder shows colour for wire/lead-wire
3 Please refer to Wiring Diagram for position of check-point .
4 Power to be off when you check continuity/disconnection/resistance-value/etc.
5 Alarm code is shown on remote control unit.

No.	Item	Nature of Fault	Diagnosis	Check point
1	LCD Display of Remote Control Unit	No display even after having switched unit on.	① Fuse at PCB is blown (5A x 2)	
			a) Short-circuit of arrester	
			b) Short-circuit of anti-frost heater	
			② Fault of PCB	
			a) No voltage of remote control terminal	
			(Normal: DC20～35V between <white-black>)	E
			③ Disconnection/short-circuit/grounding of remote cord	
			(Normal: DC20～35V between <white-black>)	E
			④ Fault of PCB of remote control	
			a) Normal voltage is shown at terminal of remote control side	
2	Pre-check	Alarm is shown within four(4)～five(5) seconds after power switch on.	<"On/Off" light is flashing with Alarm code "03">	
			① Fault of Gas Selection Swich	
			<"On/Off" light is flashing with Alarm code "14">	
			① Remaining Flame Safety Device is on (98℃)	
			(Normal: DC1V & less, 1Ω & less between (black)&(black) at 13)	A
			<"On/Off"&"Burner On" light are flashing alternately with Alarm code "31">	
			① Disconnection/short-circuit of Outgoing Water Temp. Thermistor	
			Please check voltage/resistance between (black) & (black) at 113	C
			with refering to character chart of termistor.	
			<"On/Off" light is flashing with Alarm code "51">	
			① Fault of PCB (Fault of drive circuit for Main Solenoid ①)	
			<"On/Off"&"Burner On" light are flashing alternately with Alarm code "65">	
			① Fault of PCB (Fault of drive circuit for water mixing valve)	
			(Normal: DC9～13V between <red-black>)	F
			② Fault of water mixing valve	
			(Normal: DC1V & less, 1Ω & less between (white)&(orange)(Open)	F
			(Normal: DC1V & less, 1Ω & less between (blue)&(orange)(Mixing)	F
			(Normal: DC1V & less, 1Ω & less between (yellow)&(orange)(Neutral)	
			<"On/Off" light is flashing with Alarm code "70">	
			① Fault of PCB (Fault of drive circuit for Outgoing Water Temp. Thermistor)	
			<"On/Off" light is flashing with Alarm code "71">	
			① Fault of PCB (Fault of drive circuit for Main Solenoid ②)	

No.	Item	Nature of Fault	Diagnosis	Check point
3	Water flow sensor	No combustion after tap opened. (No water is detected by Water flow sensor.)	① Less than mimum required flow volume To be 3.0-Litre/Minute & more. ② Fault of PCB a) Please check voltage of control circuit (Normal: DC4.0～5.5V between (red) at + & (black) at −) b) Please check voltage of detecting circuit (Normal: DC1～4V(pulse) between (black) at − & (white) at 85) (1344 pulse/minute = 22.4Hz) ③ Fault of Water flow sensor ④ Sensor covered by dust	D D
4	Fan motor	No start / no revolving of fan motor. (Alarm is shown within twenty(20) seconds after tap opened.)	<"On/Off" & "Burner on" light are flashing simultaneouslly with alarm code "61".> ① Fault of PCB (circuit for fan motor) (Normal: DC 110～160V between (red) & (blue)) ② Fault of fan motor	K
5	No combustion	Start of fan motor, but no combustion. (Alarm is shown within twenty(20) seconds after start of fan motor.)	<"On/Off" & "Burner on" light are flashing simultaneously with alarm code "61".> ① Fault of PCB (Normal: DC 13～17V between (yellow) & (blue)) (Normal: DC 2～6.5V between (orange) & (blue)) ② Fault of fan motor (Normal: DC 3～12V(pulse) between (white) & (blue))	K K
6	Fales flame	Start of fan motor, but no spark.	<"Burner On" light is flashing with Alarm code "72"> ① Fault of PCB (Burner off: AC30～65V between (orange) at 17 & (green) at 18) ② Fault of flame rod (Burner off: Less than DC 0.15 μA between (orange-17) & (orange-17))	B B
7	Igniter/Electrode	No spark. (Alarm is shown after three(3) times fault of spark.)	<"Burner on" light is flashing with alarm code "11"> ① Fault of PCB (Normal: AC 90～110V between (violet) & (violet) at 7) ② Fault of Igniter ③ Crack on electrode ④ Irregular gap between Burner & Electrode. (Normal: 4± 0.5mm)	I
8	Solenoid	No loading of Solenoid. (Alarm is shown after three(3) times fault of spark.)	<"Burner on" light is flashing with alram code "11"> ① Fault of PCB a) No voltage for loading to Main Solenoid ① (MV) (Normal: DC80～100V between (Blue) at COM & (black) at 3) b) No voltage for loading to Main Solenoid ② (SV_1) (Normal: DC80～100V between (Blue) at COM & (white) at 9) c) No voltage for loading to Modulation Valve (Normal: DC2～15V between (yellow) at 10+ & (yellow) at 10−)	J J M

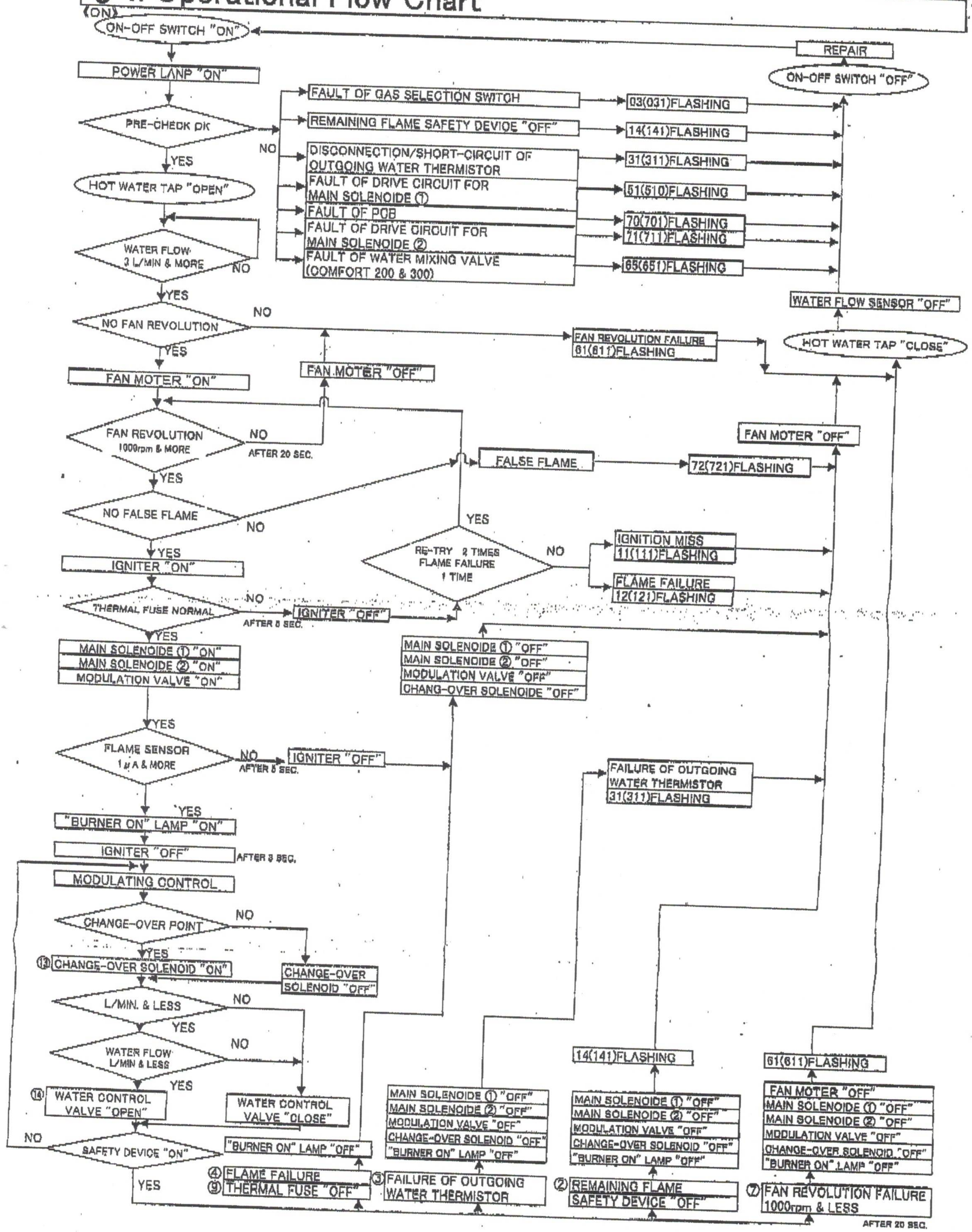
No.	Item	Nature of Fault	Diagnosis	Check point
			② Fault of solenoid a) Disconnection of wiring to Main Solenoid ① (MV) (Normal: 800～1700Ω between (Blue) at COM & (black) at 3) b) Disconnection of wiring to Main Solenoid ② (SV_1) (Normal: 800～1700Ω between (Blue) at COM & (white) at 9) c) Disconnection of wiring to Modulation Valve (Normal: 46～68Ω between (yellow) at 10+ & (yellow) at 10−) ③ Fault of Thermal fuse (Normal: DC1V & less, 1.3Ω & less between (sky) & (sky)at 40)	J J M J1
9	Ignition	No ignition. (Alram is shown after three(3) times fault of spark.)	<"Burner on" light is flashing with alarm code "11"> ① Irregular of inlet gas pressure ② Block of injector by dust ③ Irregular of test point gas pressure	
10	Flame rod	No flame is detected. (Alram is shown after three(3) times fault of spark.)	<"Burner on" light is flashing with code "11"> ① Fault of PCB (circuit for flame rod) (Burner on: AC23～60V between (orange) at 17 & (green) at 18) (Burner off: AC30～65V between (orange) at 17 & (green) at 18) ② Fault of flame rod (Normal: DC 1 μA & more, During no flame: DC 0.15 μA & less between (orange) & (orange) at 17) ③ Crack on flame rod ④ Grounding of lead-wire to flame rod (Normal: 20MΩ & more between (orange) at 17 & (green) at 18)	B B B
11	"Burner on" light of remote control unit	Light is not on during combustion.	① Fault of PCB in remote control unit	
12	Change-over Solenoid	Outgoing water temperature is not correct.	① Fault of PCB a) No voltage for loading to Change-over Solenoid (SV2) (Normal: DC80～100V between (Blue) at COM & (orenge) at 53) b) No voltage for loading to Change-over Solenoid (SV3)(COMFORT 300) (Normal: DC80～100V between (Blue) at COM & (red) at 73) ② Fault of solenoid a) Disconnection of wiring to Change-over Solenoid(SV2) (Normal: 800～1700Ω between (Blue) at COM & (orenge) at 53) b) Disconnection of wiring to Change-over Solenoid(SV3)(COMFORT 300) (Normal: 800～1700Ω between (Blue) at COM & (red) at 73)	J J J J
13	Safety function	Safety function is operated with alarm.	<"On/off" light is flashing with alarm code "14"> ① Remaining flame safety device is operated. (Please refer to item no.3 "Pre-check".) <"Burner on" light is flashing with alarm code "12"> ① Disconnection of wire to thermal fuse (Please refer to item no.8 "Solenoid" para③)	M J1

No.	Item	Nature of Fault	Diagnosis	Check point
			② Fault of solenoid (Please refer to item no.8 "Solenoid" para②) ③ Safety function for no flame is operated (Please refer to item no.10 "Flame rod") <"On/off" & "Burner on" light is flashing simultaneouslly with alarm code "61"> ① Fault of fan motor (Please refer to item 4 "Fan motor" & item 5 "No combustion") <"On/off" & "Burner on" light is flashing alternately with alarm code "31"> ① Disconnection/short-circuit of wire to outgoing water temperature thermistor <black-black> at 113 (Please refer to chart of character of thermistor)	J,D A
14	Close of solenoid	Remaining flame safety device is operated due to no close of solenoid. (Alarm is shown within five(5) seconds)	<"On/off" light is flashing with alarm code "51"> ① Fault of PCB ② Fault of solenoid	
15	Stop of fan motor	No stop of fan motor.	① Fault of PCB	
16	Position of water mixing valve	Position of water mixing valve is not neutral	<"On/Off"&"Burner On" light are flashing alternately with Alarm code "65"> ① Fault of water mixing valve ② Fault of PCB (Normal: DC9～13V between <red-black>) (Normal: DC1V & less, 1Ω & less between (yellow)&(orange)(Neutral)	F F

□Chart for R(resistance)/T(temperature) of Thermistor

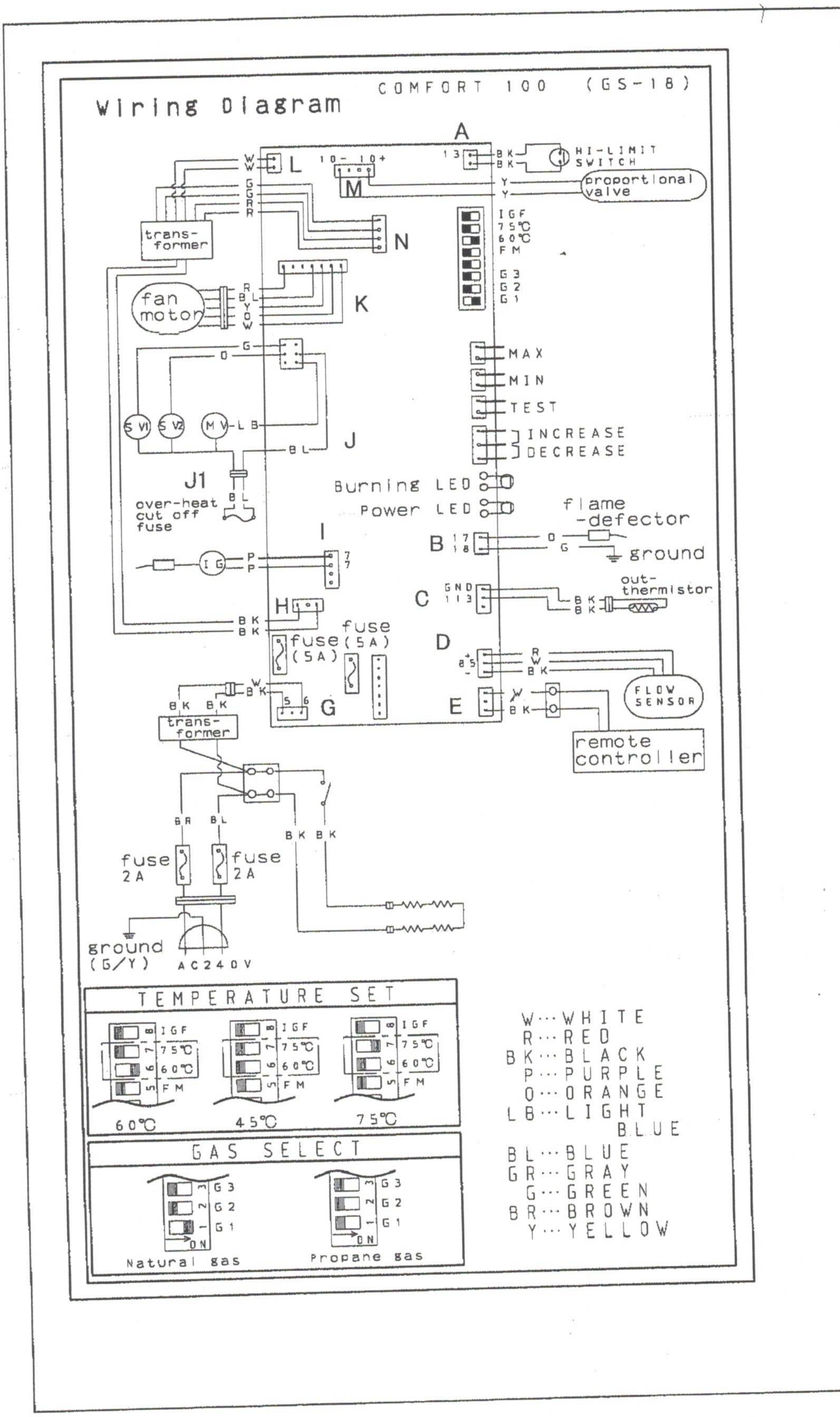
Temperature(℃)	0	5	10	15	20	25	30
Resistance(kΩ)	29.59	23.70	19.13	15.53	12.70	10.44	8.64
Voltage(DC V)	4.42	4.29	4.15	3.99	3.82	3.64	3.44
Temperature(℃)	35	40	45	50	55	60	65
Resistance(kΩ)	7.19	6.01	5.05	4.27	3.62	3.09	2.64
Voltage(DC V)	3.24	3.03	2.82	2.61	2.40	2.20	2.01
Temperature(℃)	70	75	80	85	90	95	100
Resistance(kΩ)	2.27	1.96	1.69	1.47	1.28	1.12	0.99
Voltage(DC V)	1.83	1.66	1.51	1.36	1.23	1.11	1.00

§ 4. Operational Flow Chart

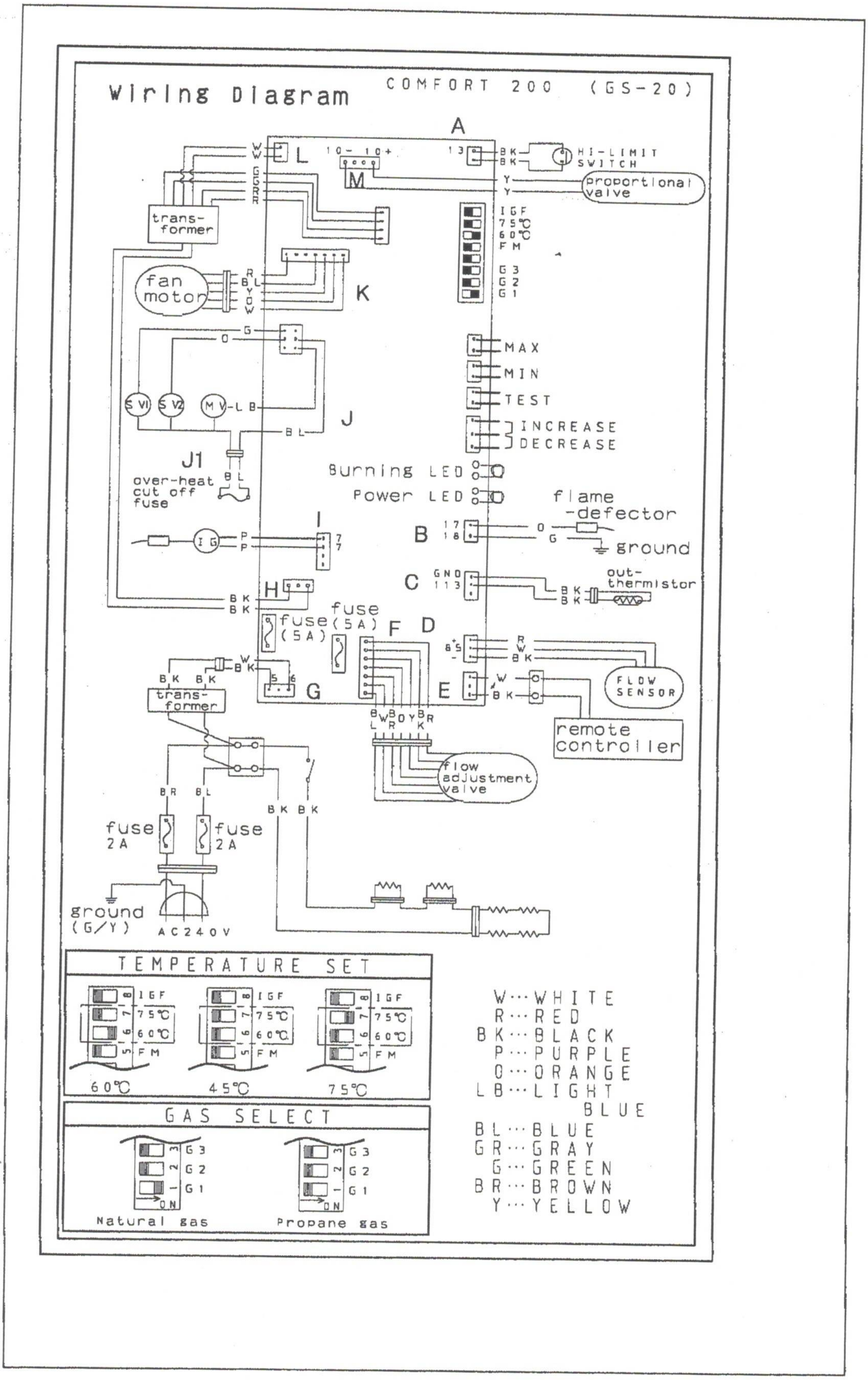


§ 5. Wiring Diagram

● COMFORT 100

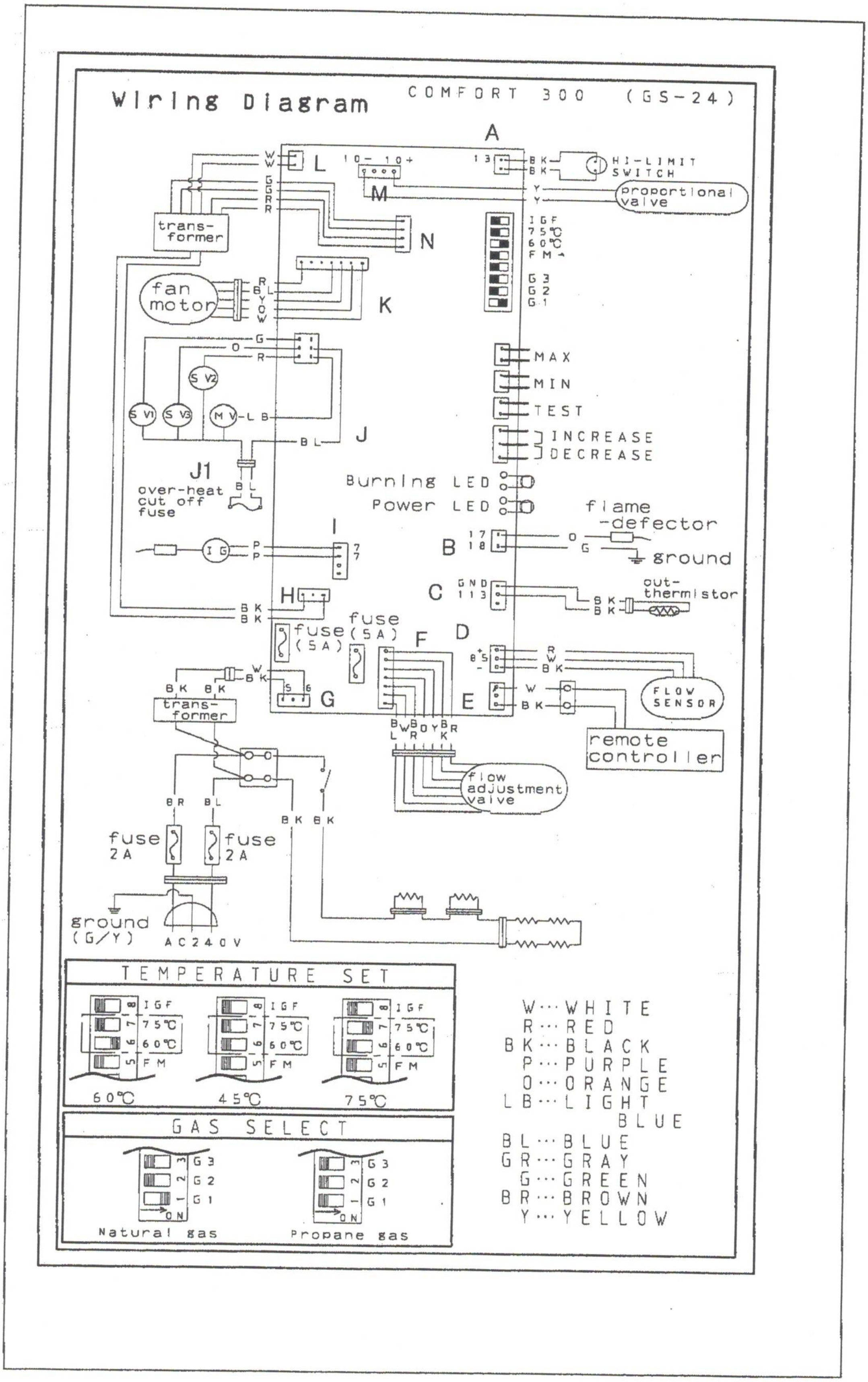


● COMFORT 200



Wiring Diagram
COMFORT 200 (GS-20)
A
HI-LIMIT SWITCH
proportional valve
trans-former
fan motor
K
L
M
J
J1
over-heat cut off fuse
MAX
MIN
TEST
INCREASE
DECREASE
Burning LED
Power LED
flame -defector
ground
B
C
out-thermistor
H
fuse (5A)
fuse (5A)
F
D
E
G
FLOW SENSOR
remote controller
flow adjustment valve
fuse 2A
fuse 2A
ground (G/Y)
AC240V
TEMPERATURE SET
IGF
75℃
60℃
FM
60℃
45℃
75℃
GAS SELECT
G3
G2
G1
ON
Natural gas
Propane gas
W…WHITE
R…RED
BK…BLACK
P…PURPLE
O…ORANGE
LB…LIGHT BLUE
BL…BLUE
GR…GRAY
G…GREEN
BR…BROWN
Y…YELLOW

● COMFORT 300



Wiring Diagram
COMFORT 300 (GS-24)
A
L
M
N
K
J
J1
I
H
G
F
E
D
C
B
HI-LIMIT SWITCH
proportional valve
trans-former
fan motor
SV1
SV2
SV3
MV
over-heat cut off fuse
IG
IGF
75℃
60℃
FM
G3
G2
G1
MAX
MIN
TEST
INCREASE
DECREASE
Burning LED
Power LED
flame -defector
ground
out-thermistor
fuse (5A)
FLOW SENSOR
remote controller
flow adjustment valve
fuse 2A
ground (G/Y)
AC240V
TEMPERATURE SET
60℃
45℃
75℃
GAS SELECT
Natural gas
Propane gas
W…WHITE
R…RED
BK…BLACK
P…PURPLE
O…ORANGE
LB…LIGHT BLUE
BL…BLUE
GR…GRAY
G…GREEN
BR…BROWN
Y…YELLOW

§ 6 Check Point for Diagnosis & Explanation of Alarm

□Check Point for Diagnosis

Check Point		Normal Range
Mark on Electric Diagram	Colour/Number of Wire	
G	White(6) – Black(5)	AC90～110V
E	White – Black	DC20～35V
A	Black(13) – Black(13)	DC1V & less / 1Ω & less
C	Black(113) – Black	Please refer to Chart for Thermistor
D	Red(+) – Black(-)	DC4.0～5.5V
D	White(85) – Black(-)	DC1～4V(Pulse)
F	Black – Red	DC9～13V
F COMFORT 200&300	White – Orange	DC1V & less / 1Ω & less
F COMFORT 200&300	Brown – Orange	DC1V & less / 1Ω & less
F COMFORT 200&300	Blue – Orange	DC1V & less / 1Ω & less
F COMFORT 200&300	Yellow – Orange	DC1V & less / 1Ω & less
K	Red – Blue	DC110～160V
K	Yellow – Blue	DC13～17V
K	White – Blue	DC3～12V(Pulse)
B	Orange(17) – Green(18)	AC23～60V
B	Orange(17) – Orange(17)	DC1 μA & more
I	Violet(7) – Violet(7)	AC90～110V
J1	Blue – Blue	DC1V & less / 1.3Ω & less
J	Blue – Black(3)	DC80～100V / 0.8～1.7kΩ
J	Blue – Red(53)	DC80～100V / 1～1.5kΩ
J	Blue – Green(9)	DC80～100V / 1～1.5kΩ
J COMFORT 300	Blue – Orange(73)	DC80～100V / 1～1.5kΩ
M	Yellow – Yellow	DC2～15V / 46～68Ω

□Explanation of Alarm

Display of Alarm			Fault	Possible Defected Part
Light of Boiler	Main Remote	Shower Remote		
"On/Off" out "Burner On" flashing	11	111	Fault of Ignition	Main PCB, Igniter, Flame rod, Solenoid or other part of Gas circuit
	12	121	Lost of Flame	Main PCB, Flame rod, Solenoid or other part of Gas circuit
	72	721	Fault of Pre-check & Post(After)-check	Main PCB, Flame rod, Solenoid or other part of Gas circuit
"On/Off" flashing "Burner On" out	03	031	Fault of Gas Selection Swich	Gas Selection Swich
	14	141	Remaining flame safety device is operated	Remaining flame safety device
			Fault of loading circuit on PCB for Main Solenoid ①	Main PCB
	51	510	Fault of drive circuit for Main Solenoid ①	Main PCB
	70	701	Fault of PCB	Main PCB
	71	711	Fault of loading circuit on PCB for Main Solenoid ②	Main PCB
"On/Off" flashing "Burner On" flashing simultaneouslly	61	611	Irregular fan speed	Fan motor or Main PCB
"On/Off" flashing "Burner On" flashing alternately	31	311	Disconnection/Short circuit of Outgoing water temperature Thermistor	Outgoing water temp. thermistor or Main PCB

§ 7 Maintenance Information

Number of Information	Discription	Display on Remote ↓ Maintenance Information
1	Total hour of combustion	00～99〔x 100 hours〕
2	Total time of combustion	00～99〔x 10,000 times〕
3	Fan Speed	00～99〔X 100rpm〕
5	Temperature which Outgoing Water Temperature Thermistor detects	00～99(℃)
7	Outgoing water flow volume which Water Flow Sensor detects	00～99〔littre/minute〕
b	Alarm Data no.1(Latest Data)	First two(2) digit of Alarm code
c	Alarm Date no.2	First two(2) digit of Alarm code
d	Alarm Date no.3(Oldest)	First two(2) digit of Alarm code
E	Clear of Alarm Datas	"00" to be shown after clear

Remarks 1) <How to show "Maintenance Information" on Main/Shower Remote>

(a) Whenever power switch is "on" or "off", please press "cool" & "hot" bottun same time more than five(5) seconds.

↓

Number of Information 「--1」 to be shown on LCD-display.

(Remarks: Maintenacne Information to be not shown while LCD-display has Alarm code. Please cut off power switch to clear Alarm code.)

(b) Please press "cool" & "hot" to change Number of Information to have your required Number of Information.

(c) When your required Number of Information is shown,

<for main remote> please press "bath fill lock" bottun to show Display on Remote(=Maintenance Information).

<for shower remote> please press "HR" & "MIN" same time to show Display on Remote(=Maintenance Information).

(d) Now, you can see Maintenance Information 「XXX」(such as 「991」) on LCD-display of remote control.

(First two(2) digits mean Maintenance Information,
last digit means Number of Information)

↓

For instance, 「991」 means 9900hours of total hours of combustion.

Remarks 2) <How to clear Alarm data no.1, 2 & 3>

(a) When Number of information show "b", "c" or "d",

<for main remote> please press "Bath Fill Control" & "Bath Fill Lock" button in same time.

<for shower remote> please press "Set" & "Priority Switch" button in same time

↓

Clear of Alarm data is competed and 「00E」 is shown on LCD-display.