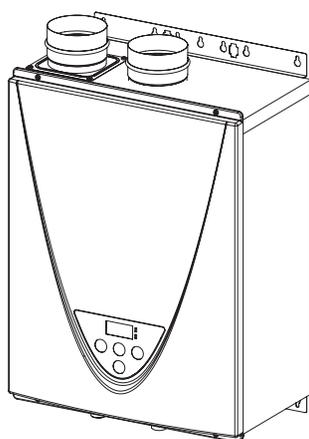


240 (T-H3J), 340 (T-H3S) and 540 (T-H3) Models

On-Demand Water Heater Service Manual



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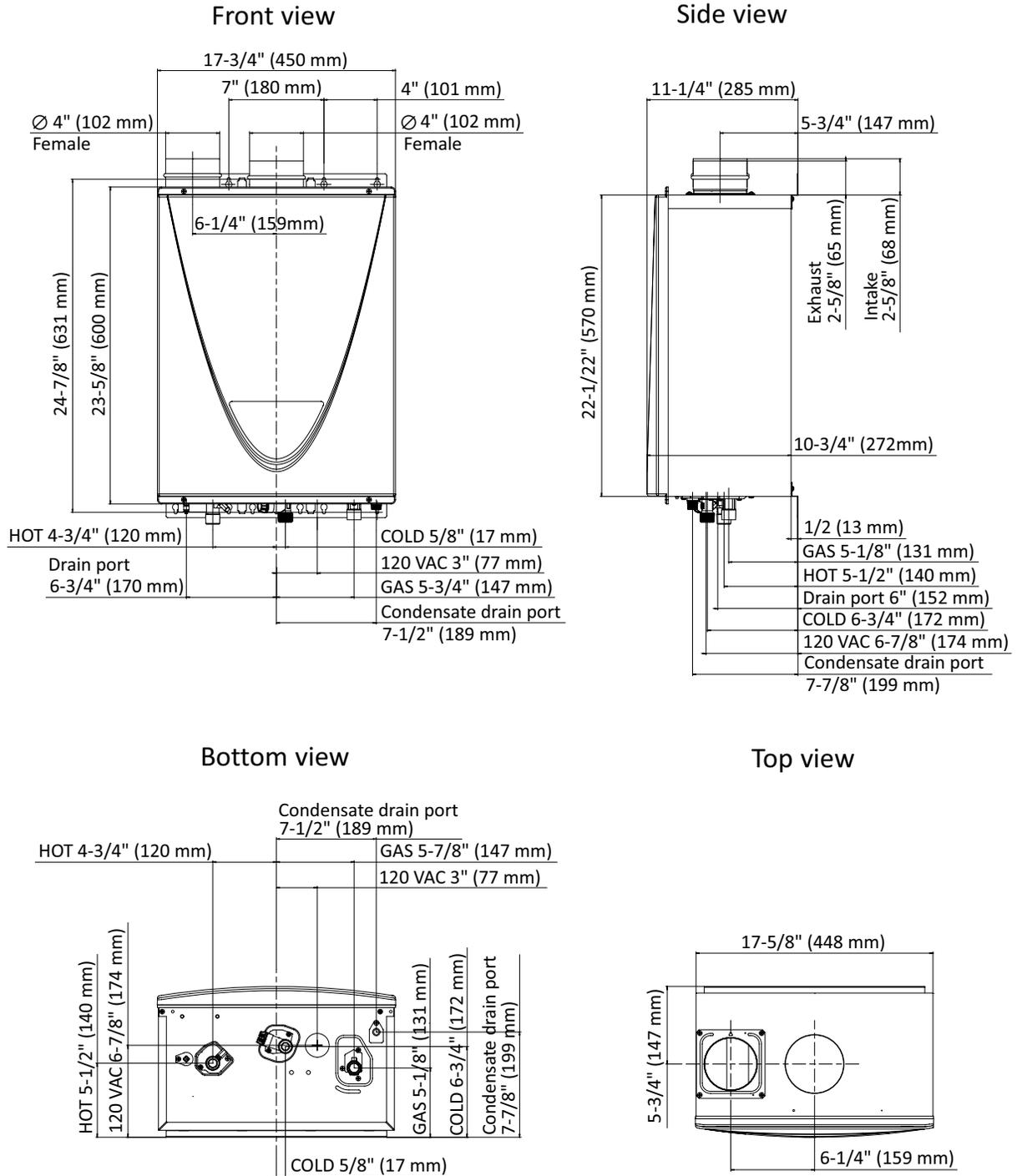
1. Specifications

Model		240 Indoor (T-H3J-DV)	240 Outdoor (T-H3J-OS)	340 Indoor (T-H3S-DV)	340 Outdoor (T-H3S-OS)	540 Indoor (T-H3-DV)	540 Outdoor (T-H3-OS)	
Dimensions	inch	H 22.4 x W 17.7 x D 10.7 570 (H) x 450 (W) x 272 (D)						
	mm							
Weight	lbs. (kg)	58 (26.3)	58 (26.2)	58 (26.3)	58 (26.2)	58 (26.8)	58 (26.9)	
Combustion	INPUT BTU/h	Max	160,000		180,000		199,000	
		Min	Propane 13,000 Natural gas 15,000					
	Combustion system Installation	Power vent						
	Installation	Direct-vent Indoor	Outdoor	Direct-vent Indoor	Outdoor	Direct-vent Indoor	Outdoor	
	Fan motor	PWM turbo fan						
	Manifold Pressure* ("W.C.)	Max	Propane 2.2 Natural 1.9	Propane 2.2 Natural 2.0	Propane 2.6 Natural 2.4	Propane 2.7 Natural 2.4	Propane 3.2 Natural 2.8	Propane 3.2 Natural 2.9
		Min	Propane 0.6 Natural 0.7	Propane 0.7 Natural 0.7	Propane 0.6 Natural 0.7	Propane 0.7 Natural 0.7	Propane 0.6 Natural 0.7	Propane 0.7 Natural 0.7
Water control	Flow rate	GPM 0.5 to 6.6		0.5 to 8.0		0.5 to 10.0		
	Available set temperatures	°F 100 to 140 (38 to 60) default: 120 (49)		°F 100 to 185 (38 to 85) default: 120 (49)				
	Temperature DIPswitch settings	°F 120 (49), 140 (60)						
	Bypass valve	N/A				Yes		
	Thermistors	2 thermistors (In, Out)				3 thermistors (In, Out, Heat exchanger)		
Operation	Temperature control	Temperature controller : Direct Vent Indoor models Temperature remote controller (TM-RE40) : Outdoor models						
	PCB model	240 Part # 319143-543 (EK186)		340 Part # 319143-544 (EK175)		540 Part # 319143-545 (EK176)		
	Indicators	Stand-by LED						
	Power supply control	Surge absorber & Power ON-OFF switch						
Features	Freeze protection	Ceramic heaters (All models) and Auto-firing system (Only 540 Direct Vent Indoor models (T-H3-DV) models)						
	Self-combustion improvement	Air-Fuel Ratio Detection System						
	Easy-Link system	N/A				Yes (Up to 4 units)		
	Multiple-system	N/A				Yes (Up to 20 units)		

*The manifold pressure measurement is based on conditions without front cover.

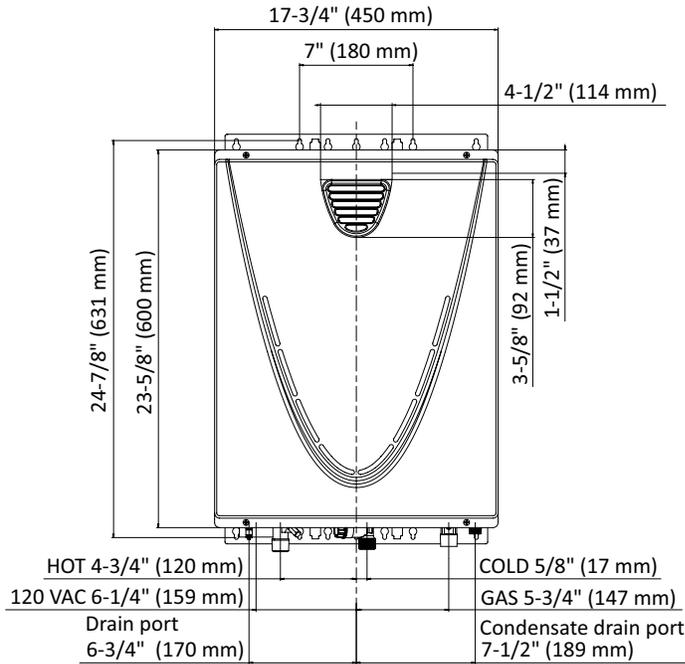
2. Exterior view

Direct Vnet Indoor models

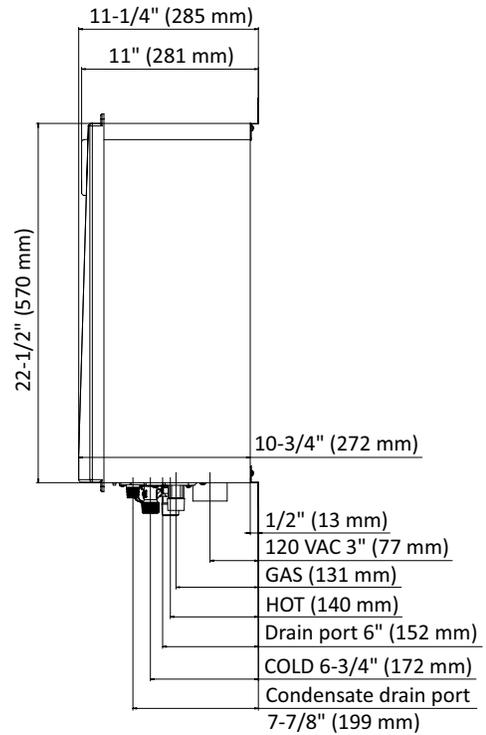


Outdoor models

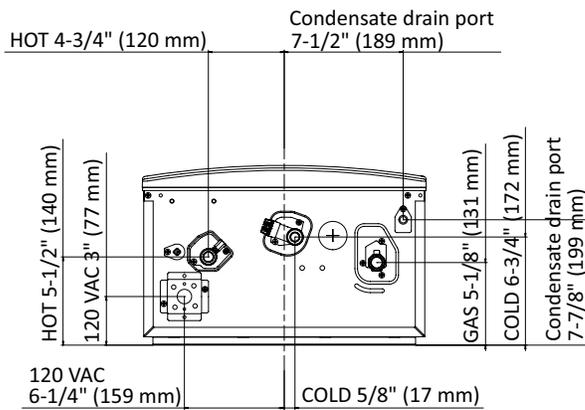
Front view



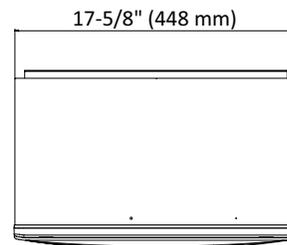
Side view



Bottom view

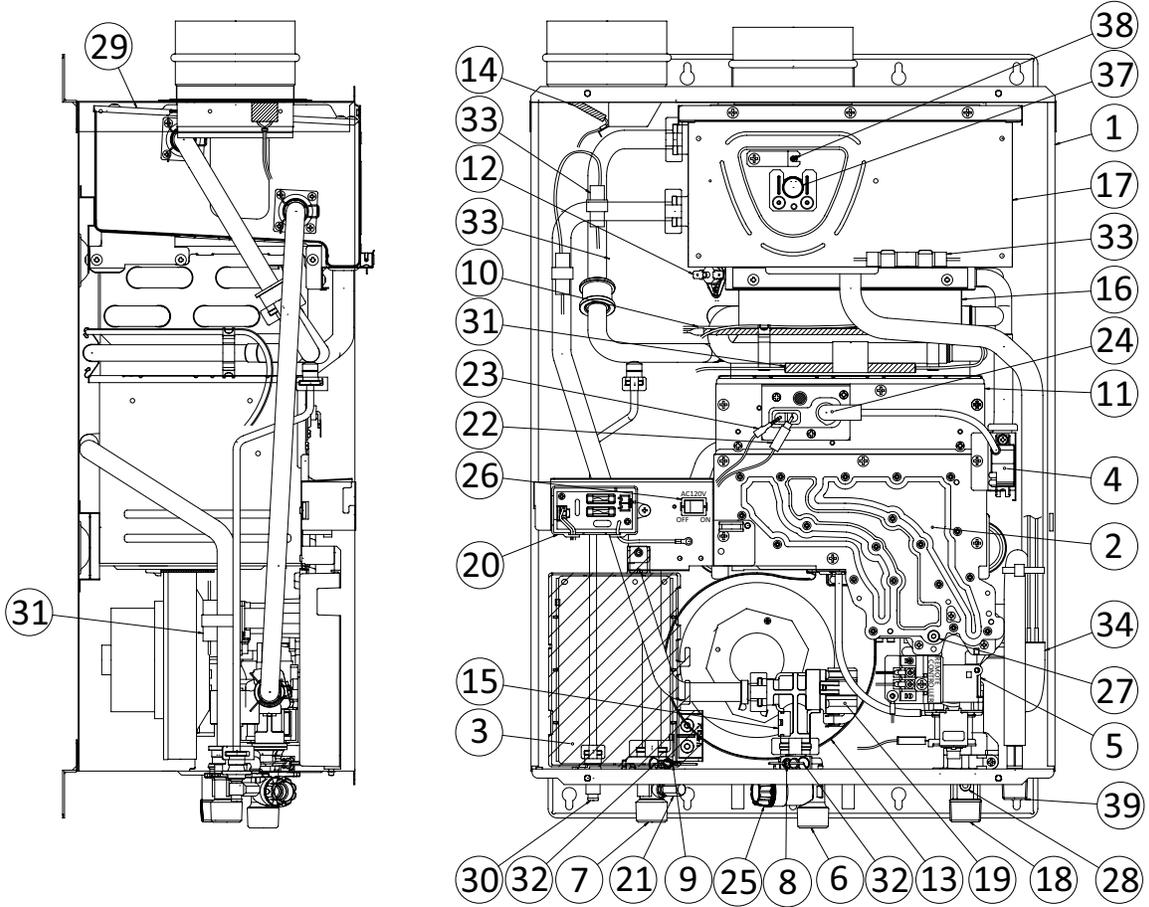


Top view

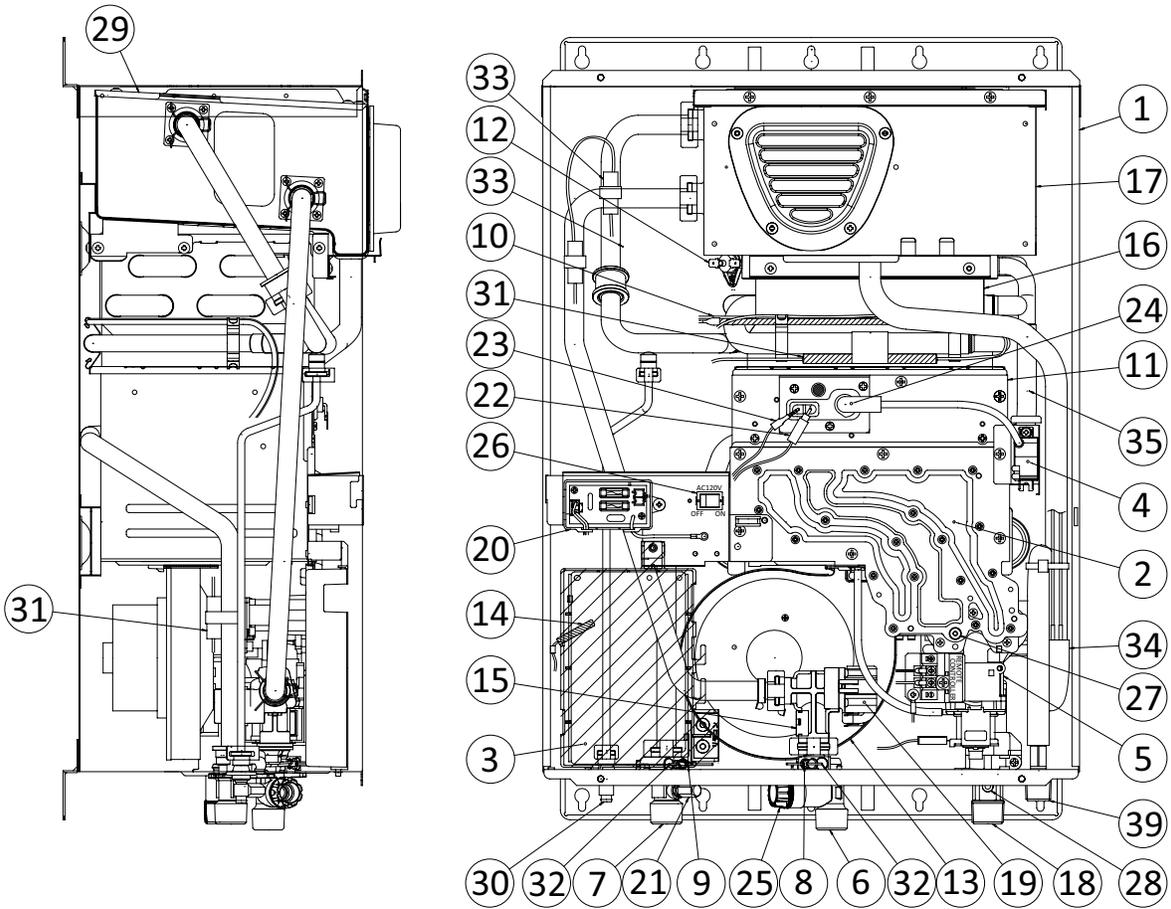


3. Interior view

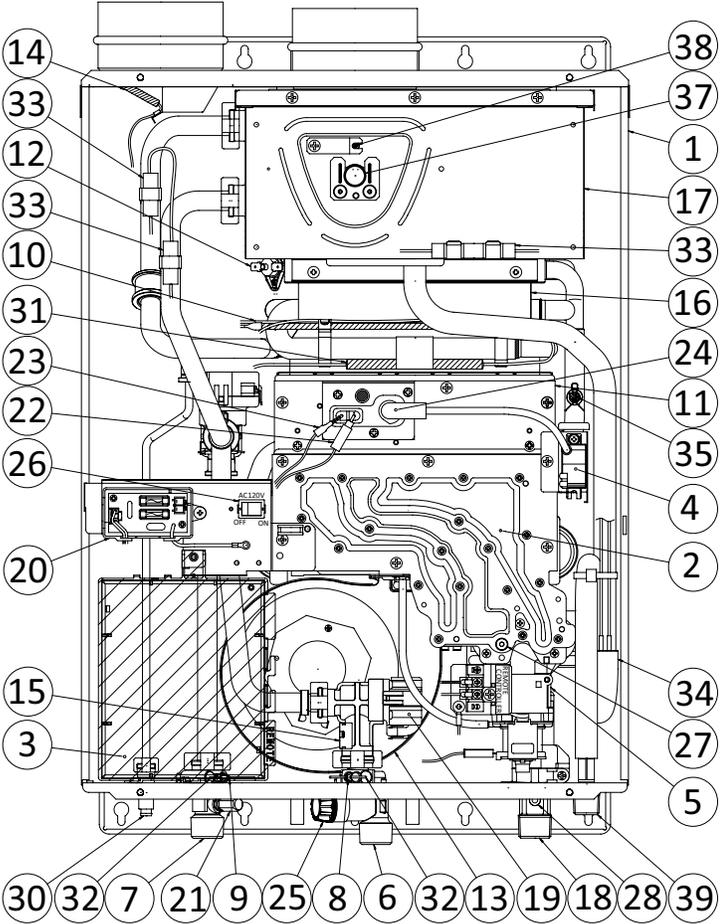
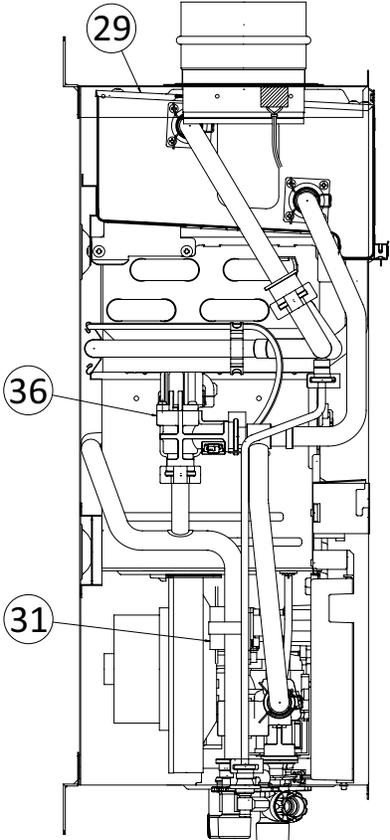
240 Indoor (T-H3J-DV)
340 Indoor (T-H3S-DV)



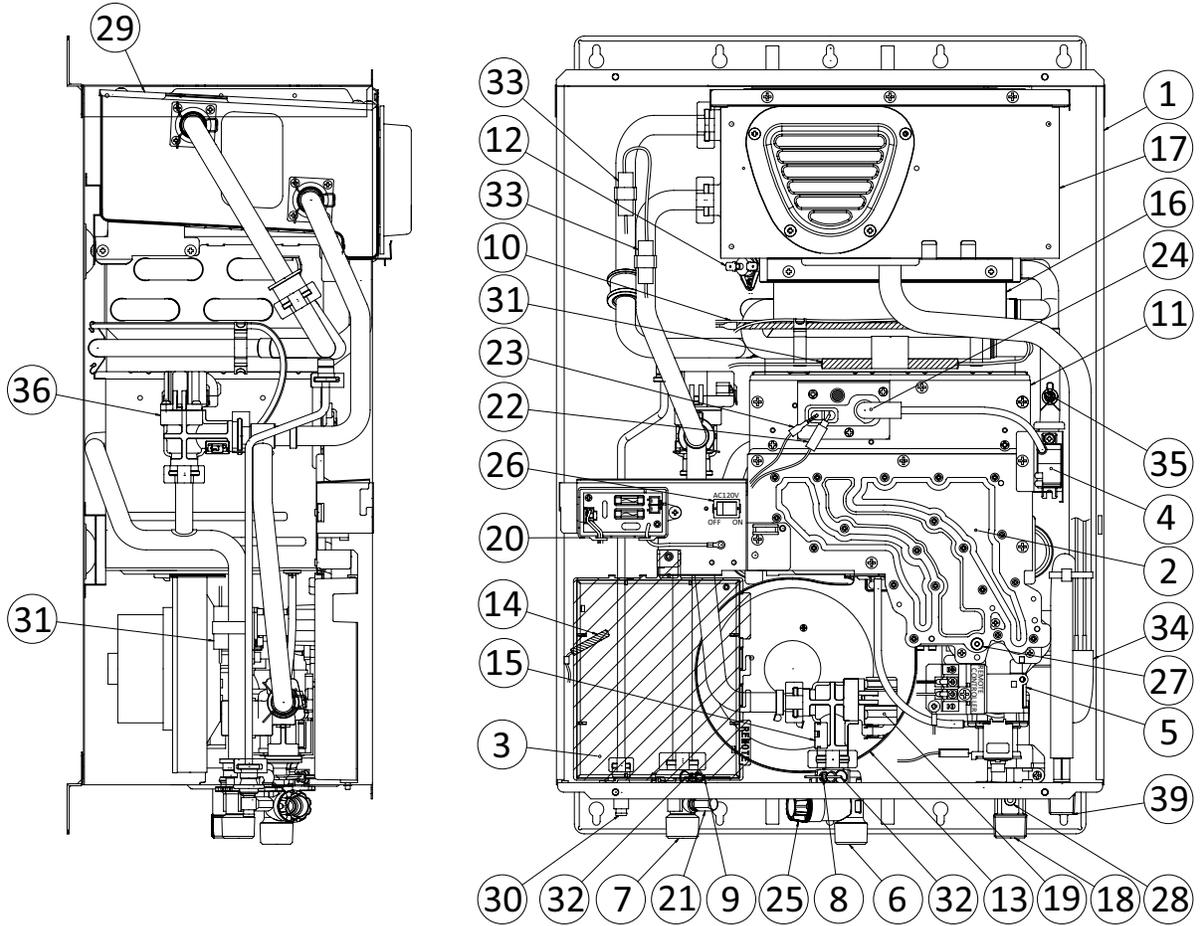
**240 Outdoor (T-H3J-OS)
340 Outdoor (T-H3S-OS)**



540 Indoor (T-H3-DV)



540 Outdoor (T-H3-OS)



4. List of main components in the interior view

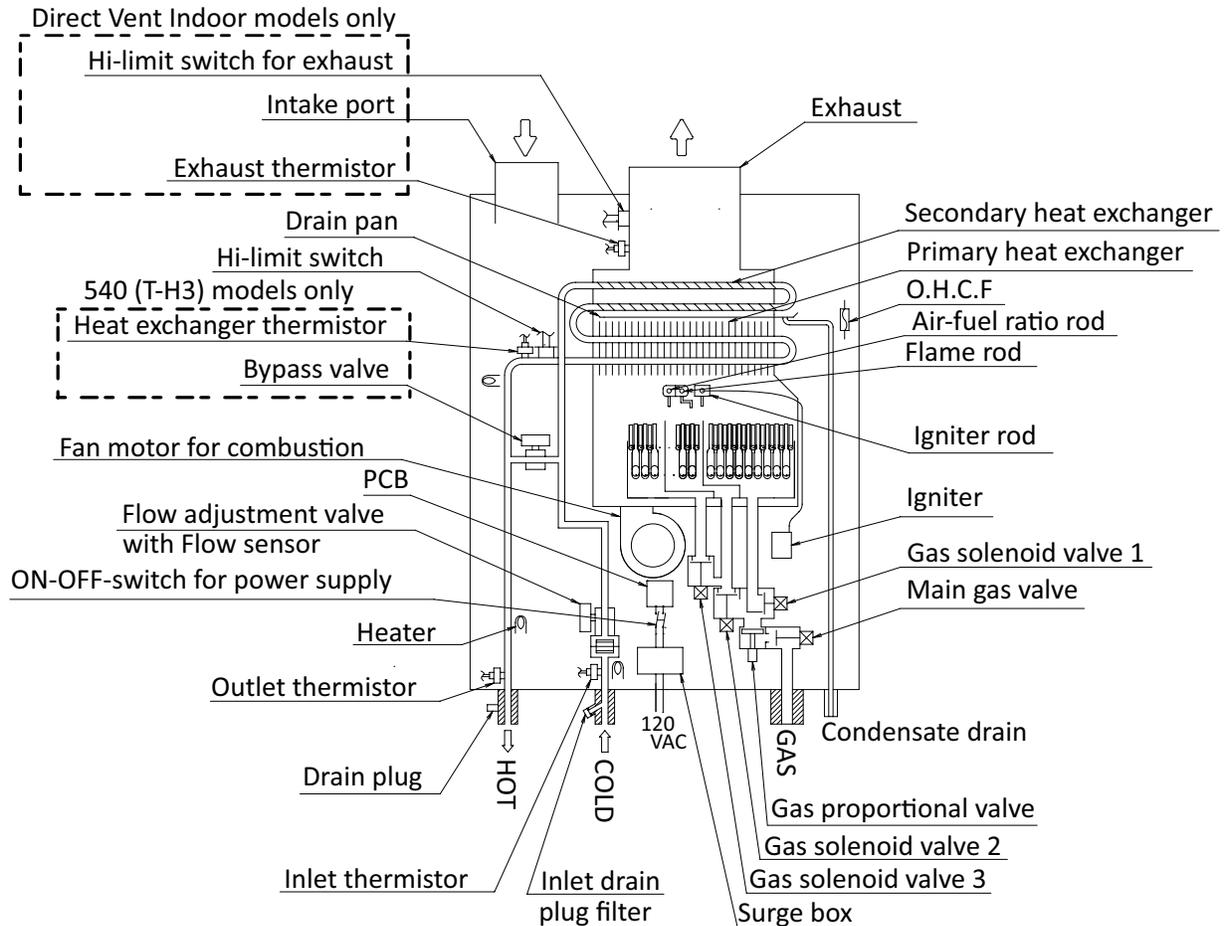
No.	Description		Items# in components diagram	Part #	
				240, 340 and 540 models	T-H3J, T-H3S and T-H3 models
1.	Case assembly	Indoor models	001	N/A	EK159
		Outdoor models		N/A	EK164
2.	Manifold assembly with gas valve assembly	LP model	102	319143-515	EK181
		NA model		319143-516	EK182
3.	Computer board		701	319143-543 (240 models)	EK186 (T-H3J models)
				319143-544 (340 models)	EK175 (T-H3S models)
				319143-545 (540 models)	EK176 (T-H3 models)
4.	Igniter		711	319143-479	EK153
5.	Gas valve assembly	LP model	Included in #102	319143-515	EK181
		NA model		319143-516	EK182
6.	Water inlet		404	319143-193	EKK1U
7.	Water outlet		409	319143-530	EK208
8.	Inlet thermistor		407	319143-214 (240/340 models)	EKK4J (T-H3J/T-H3S models)
				319143-465 (540 models)	EK137 (T-H3 models)
9.	Outlet thermistor		408	319143-529 (240/340 models)	EK207 (T-H3J/T-H3S models)
				319143-190 (540 models)	EKK1A (T-H3 models)
10.	Overheat cut-off fuse		413	319143-149	EK333
11.	Burner assembly		101	319143-514	EK192
12.	Hi-limit switch		412	319143-228 (240/340 models)	EM212 (T-H3J/T-H3S models)
				319143-095 (540 models)	EKN34 (T-H3 models)

No.	Description		Items# in components diagram	Part #	
				240, 340 and 540 models	T-H3J, T-H3S and T-H3 models
13.	Fan motor	Indoor models	103	319143-443	EK109
		Outdoor models		319143-043	EKK25
14.	Freeze protection thermostat	Indoor models	713	319143-496	EK184
		Outdoor models		319143-497	EK185
15.	Flow sensor		402	319143-463	EK129
16.	Primary heat exchanger assembly	Indoor models	401	319143-525 (240/340 models)	EK198 (T-H3J/T-H3S models)
				319143-527 (540 models)	EK200 (T-H3 models)
		Outdoor models		319143-526 (240/340 models)	EK199 (T-H3J/T-H3S models)
				319143-528 (540 models)	EK206 (T-H3 models)
17.	Secondary heat exchanger assembly	Indoor models	Included in #401	319143-525 (240/340 models)	EK198 (T-H3J/T-H3S models)
				319143-527 (540 models)	EK200 (T-H3 models)
		Outdoor models		319143-526 (240/340 models)	EK199 (T-H3J/T-H3S models)
				319143-528 (540 models)	EK206 (T-H3 models)
18.	Gas inlet		118	319143-455	EK117
19.	Flow adjustment valve		402	319143-463	EK129
20.	Surge box		703	320273-128	EK280
21.	Outlet drain plug		410	319143-199	EKK2E
22.	AFR rod		108	319143-517	EK193
23.	Flame rod		108	319143-517	EK193
24.	Igniter rod		109	319143-037	EKK0F
25.	Inlet drain plug (water filter)		405	319143-197	EKK2B
26.	120 VAC Power ON-OFF switch		706	319143-141	EKK4V

No.	Description		Items# in components diagram	Part #	
				240, 340 and 540 models	T-H3J, T-H3S and T-H3 models
27.	Manifold port		N/A	N/A	N/A
28.	Gas inlet port		N/A	N/A	N/A
29.	Exhaust chamber	Indoor models	Included in #401	319143-525 (240/340 models)	EK198 (T-H3J/T-H3S models)
				319143-527 (540 models)	EK200 (T-H3 models)
		Outdoor models		319143-526 (240/340 models)	EK199 (T-H3J/T-H3S models)
				319143-528 (540 models)	EK206 (T-H3 models)
30.	Secondary heat exchanger drain plug		411	319143-096	EKK2T
31.	Pipe heater		414	319143-531	EK209
32.	Inlet / Outlet heater		417	319143-468	EK105
33.	Block heaters	Indoor models	415	319143-532	EK210
		Outdoor models		319143-533	EK211
34.	Flat heater		464	319143-535	EK217
35.	Heat exchanger thermistor		411	319143-096	EKK2T
36.	Bypass valve		403	319143-464	EKD58
37.	Hi-Limit switch for exhaust		472	319143-104	EKH6G
38.	Exhaust thermistor		471	319143-111	EX13L
39.	Condensate drain port		009	319143-018	EKH23

5. Schematic diagram

The diagram below refers to both the Direct Vent Indoor models and Outdoor models.

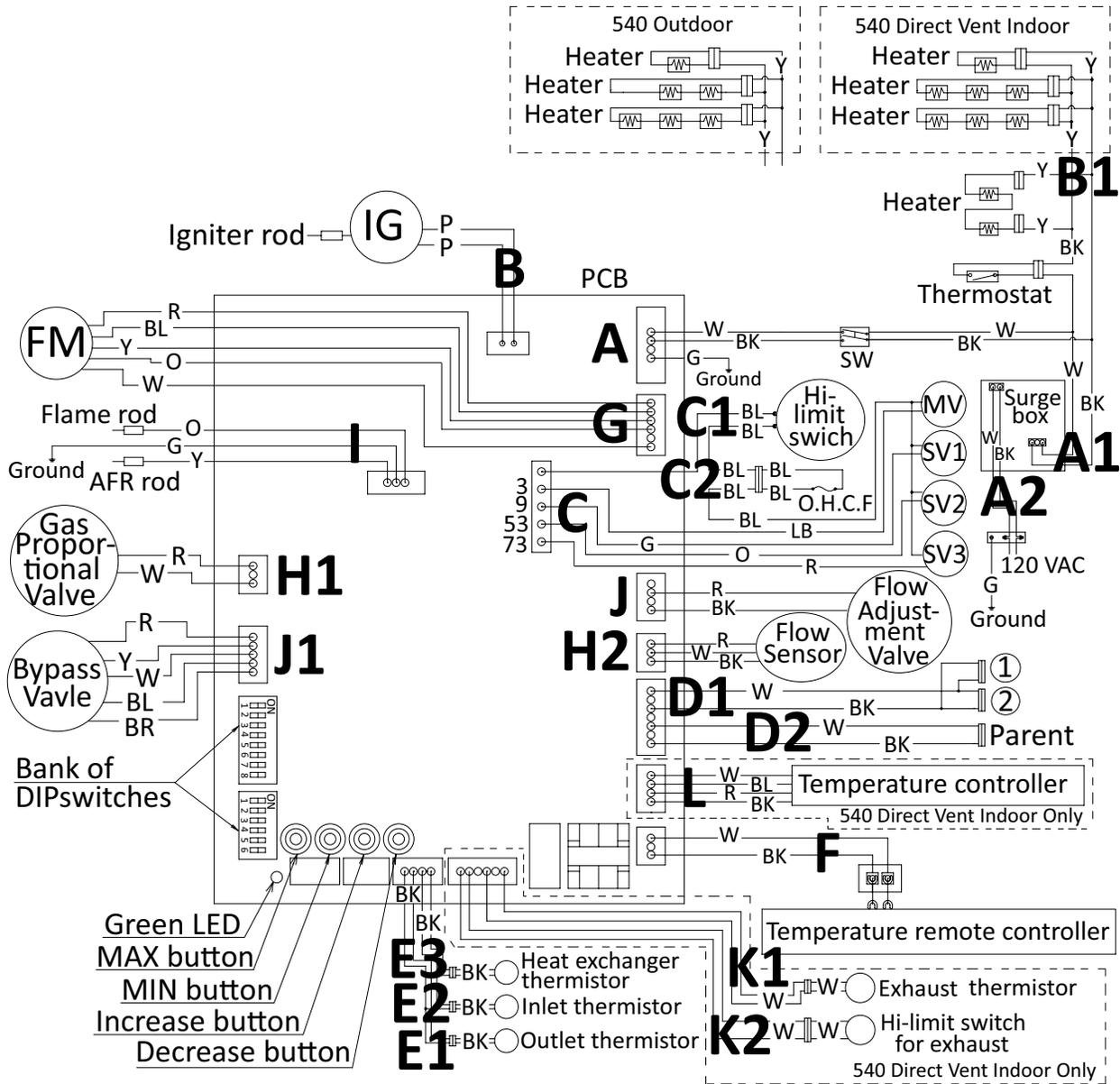


1. When a hot water tap is opened, cold water enters the water heater.
2. The water flow sensor detects this water flow and sends this information to computer.
3. The computer initiates fan motor and sends signal to igniter to create ignition spark.
4. The main, proportional, and solenoid gas valves open to allow gas input.
5. The gas ignites and flames appear inside the burner chamber.
6. Water circulates through the heat exchanger and is heated up to the set temperature.
7. Using thermistors to measure temperatures, the computer modulates the gas and water valves to ensure proper output water temperatures.
8. When the tap is closed, the water heater shuts down.

NOTICE The Direct Vent Indoor models detects the exhaust temperature by using exhaust thermistor and hi-limit switch for exhaust during procedures of 3 to 8.

540 (T-H3) models

W: WHITE BK: BLACK LB: LIGHT BLUE
R: RED BL: BLUE Y: YELLOW
G: GREEN O: ORANGE BR: BROWN P: PURPLE



7. Wiring diagram check points for diagnosis

The table below applies to both the the Direct Vent Indoor models and Outdoor models.

Check-point	Part and Description	Color of wires	Normal range
A	120V Power supply	White – Black	108 to 132 VAC
A1, A2	120V Power supply	Black - White	108 to 132 VAC
B	Igniter	Purple - Purple	108 to 132 VAC
B1	Heater	Yellow - Yellow	108 to 132 VAC
C	Gas valves	Light blue - blue at COM (MV)	93 to 120 VDC (during operation) / 1.35 to 1.65 k Ω
		Green - blue at COM (SV1)	93 to 120 VDC (during operation) / 1.35 to 1.65 k Ω
		Orange - blue at COM (SV2)	93 to 120 VDC (during operation) / 1.35 to 1.65 k Ω
		Red - blue at COM (SV3)	93 to 120 VDC (during operation) / 2.07 to 2.53 k Ω
C1	Hi-limit switch	Blue - Blue	Less than 1 VDC and less than 1.0 Ω
C2	Overheat cutoff fuse	Blue - Blue	Less than 1 VDC and less than 1.0 Ω
D1, D2	Easy-link connectors 540 (T-H3) models only	Black - White	15 VDC (during Easy-link operation)
E1	Outlet thermistor	Black - Black	See table on p. 18
E2	Inlet thermistor	Black - Black	
E3	Heat exchanger thermistor 540 (T-H3) models only	Black - Black	See table on p. 19

Check-point	Part and Description	Color of wires	Normal range
F	Remote controller	White – Black	11 to 25 VDC
G	Fan motor	Red - Blue	132 to 192 VDC
		Yellow - Blue	13 to 17 VDC
		Orange - Blue	2.0 to 6.5 VDC
H1	Gas proportional valve	White - red	1.0 to 15 VDC (during operation) and 20 to 40 Ω
H2	Flow sensor	Red - Black	4.0 to 5.5 VDC
		White - Black	1.0 to 4.0 VDC (pulse) 1,080 pulse / min (more than 18 Hz)
I	Air-fuel ratio rod	Yellow - AFR rod (Between the AFR rod and the computer board)	More than 1 μA (during operation)
	Flame rod	Orange - Flame rod (Between the flame rod and the computer board)	More than 1 μA (during operation)
J	Flow adjustment valve	Red - Black	7.0 to 16 VDC and 0.09 to 0.2 kΩ
J1	Bypass valve 540 (T-H3) models only	Brown - Red	3.0 to 11 VDC and 50 to 85 Ω
K1	Exhaust thermistor	White - White	See table on p. 19
K2	Hi-limit switch for exhaust	White - White	Less than 1 VDC and less than 1.0 Ω
L	Temperature controller	White – Black	11 to 25 VDC

8. (A) Resistance values of the temperature thermistors

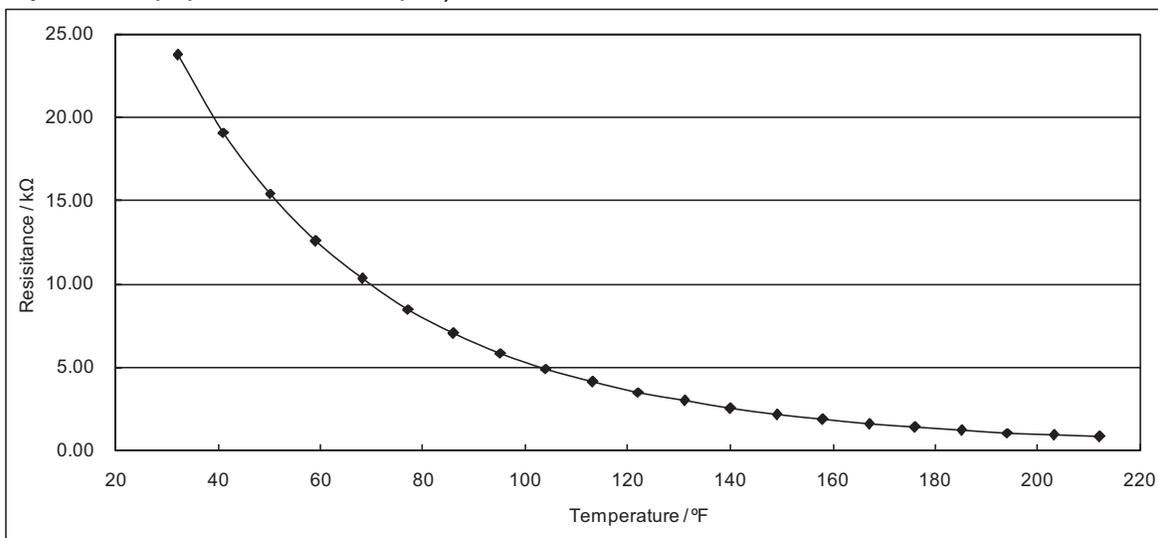
The the Direct Vent Indoor models and Outdoor models use the same thermistors.

Resistance values at different temperatures

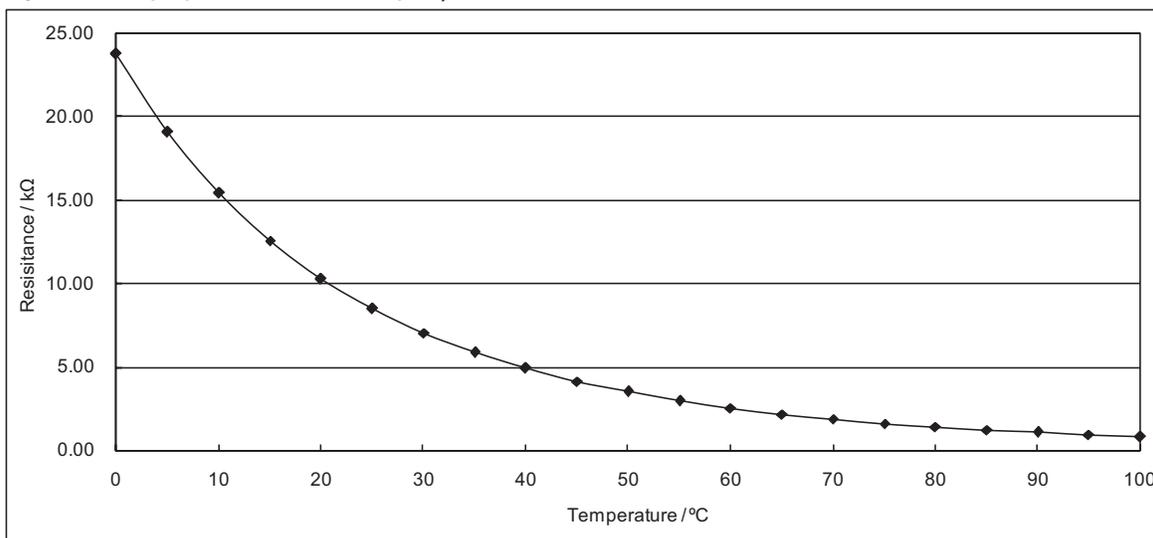
Temperature	°F	32	41	50	59	68	77	86	95	104	113
	°C	0	5	10	15	20	25	30	35	40	45
Resistance	kΩ	23.76	19.08	15.43	12.56	10.28	8.47	7.02	5.85	4.90	4.12

Temperature	°F	122	131	140	149	158	167	176	185	194	203	212
	°C	50	55	60	65	70	75	80	85	90	95	100
Resistance	kΩ	3.49	2.96	2.53	2.16	1.86	1.60	1.39	1.21	1.05	0.92	0.81

Temperature (°F) vs Resistance (kΩ)



Temperature (°C) vs Resistance (kΩ)



8. (B) Resistance values of the temperature exhaust thermistor

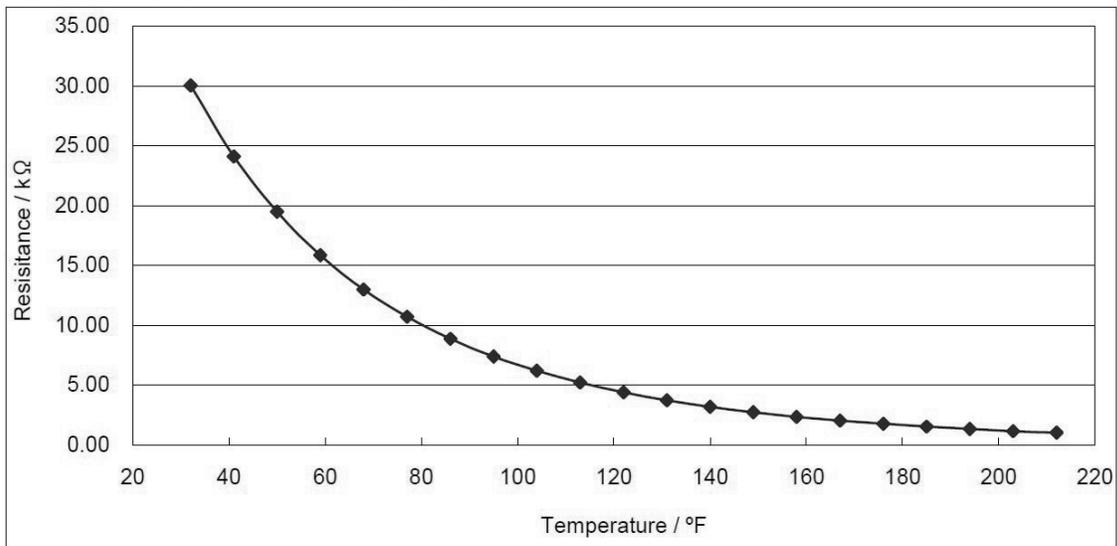
Only the Direct Vent Indoor models are equipped with the exhaust thermistor.

Resistance values at different temperatures

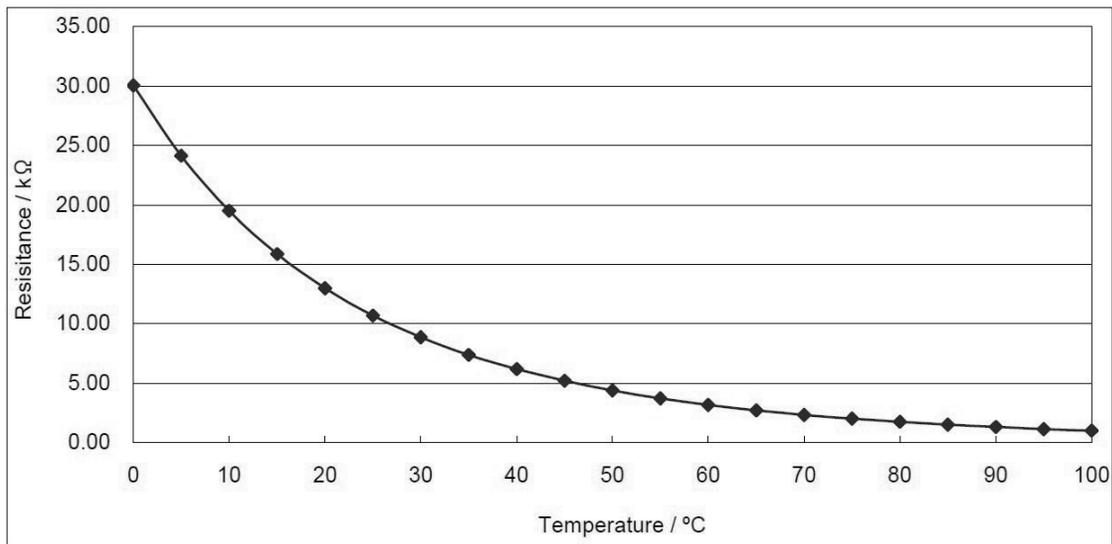
Temperature	°F	32	41	50	59	68	77	86	95	104	113
	°C	0	5	10	15	20	25	30	35	40	45
Resistance	kΩ	30.04	24.12	19.50	15.87	13.00	10.71	8.87	7.39	6.19	5.21

Temperature	°F	122	131	140	149	158	167	176	185	194	203	212
	°C	50	55	60	65	70	75	80	85	90	95	100
Resistance	kΩ	4.41	3.74	3.19	2.73	2.35	2.03	1.76	1.53	1.33	1.16	1.02

Temperature (°F) vs Resistance (kΩ)

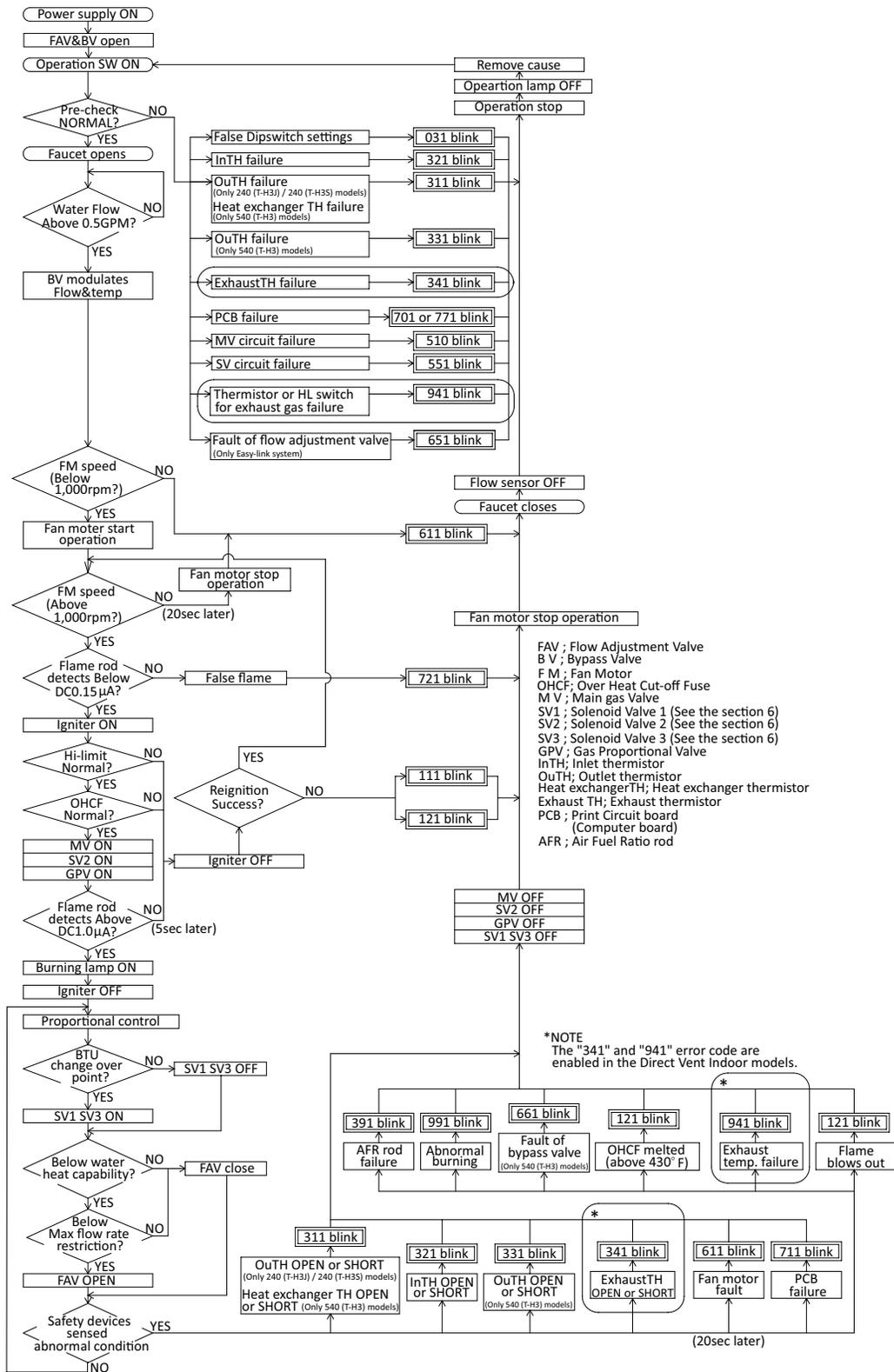


Temperature (°C) vs Resistance (kΩ)



9. Operational flow chart

The diagram below refers to both the Direct Vent Indoor models and Outdoor models.

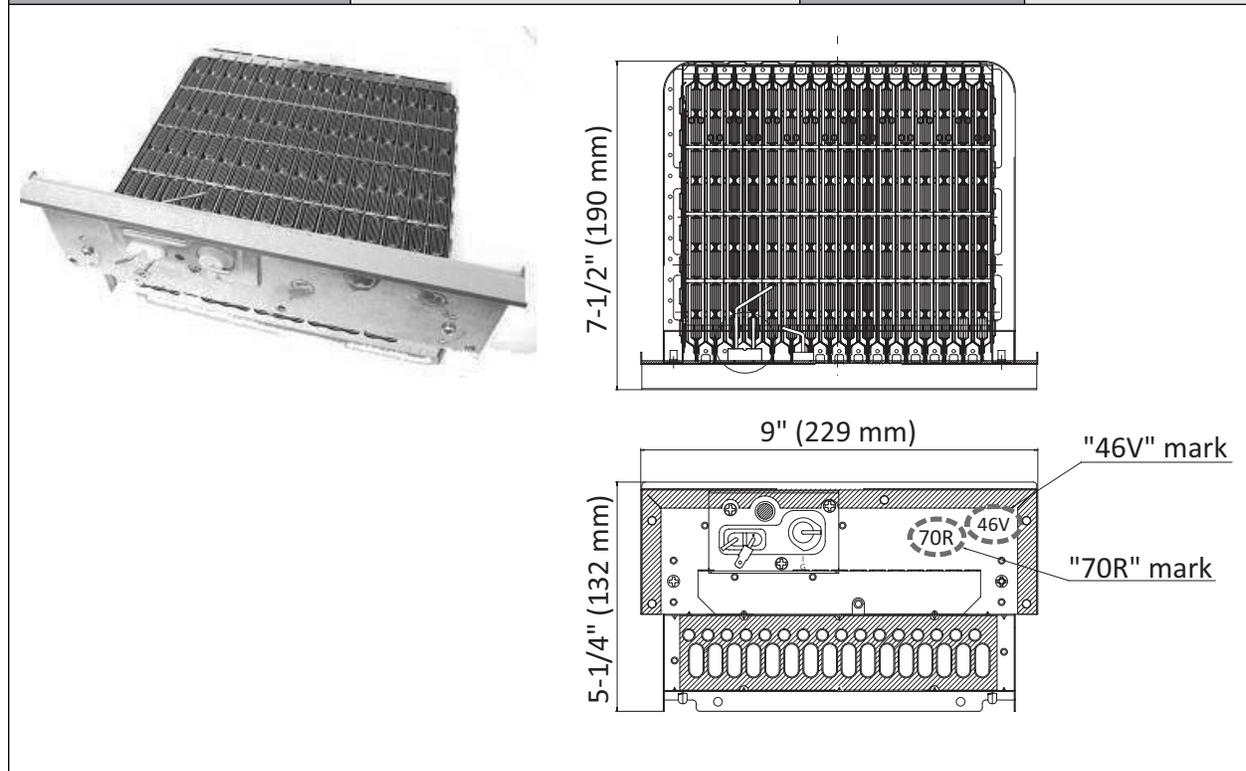


10. Component specifications

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10-17. Freeze protection heaters.....	42
10-18. Computer board.....	43
10-19. Igniter.....	44
10-20. Freeze protection thermostat.....	45
10-21. Surge box.....	46

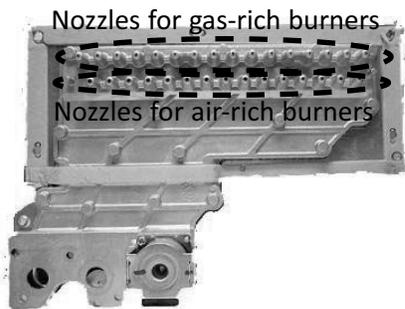
10-1. Burners

Part #	• 319143-514 (EK192)	Unit Part#	#101
Function	There are 2 types of burners in the burner assembly: the gas-rich burner stabilizes the flames within the combustion chamber and the air-rich burner produces more heat in the combustion chamber. The burners facilitate the air/gas mixture necessary to produce the proper heat during the combustion reaction.		
Failure events	<ol style="list-style-type: none"> 1. Unable to initialize/sustain combustion. 2. Dust or soot deposit on the burner surface. 3. Cracks on the burners. 4. Gas leakage from the burners. 		
Effects on the water heater if burners fails	<ol style="list-style-type: none"> 1. Unexpected combustion. 2. Unstable flame conditions and/or flame loss. 3. Ignition failure. 4. Back-firing. 		
Error codes when the burners fails	101	111	121 991
Diagnostic	Visual inspection: excessive dust deposit on the burner surface and/or unstable flame conditions during operation.		
Color / Number of wires	N/A	Checkpoint	N/A

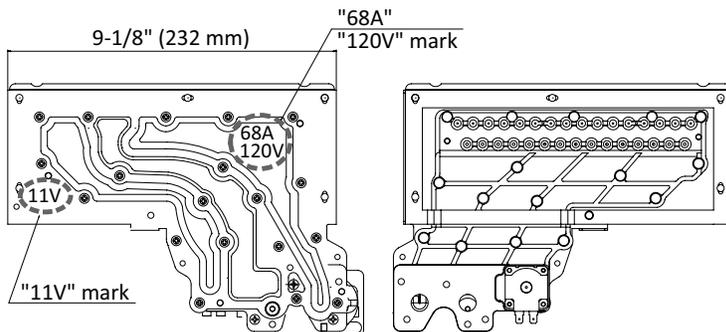


10-2. Gas manifold

Part #	<ul style="list-style-type: none"> • 319143-515 (EK181) : Propane • 319143-516 (EK182) : Natural gas 	Unit Part#	Included in #102
Function	<ol style="list-style-type: none"> 1. The manifold distributes gas from the gas valves to the burners. The manifold has two types of the nozzles: one type for gas-rich burners (16 nozzles) and the other for air-rich burners (15 nozzles) 2. There are 3 zones within the manifold, to ensure efficient combustion operation. 		
Failure events	<ol style="list-style-type: none"> 1. Dust deposit on the manifold. 2. Gas leakage from a failed manifold. 3. Ignition failure. 4. Imperfect combustion. 		
Effects on the water heater if the manifold fails	<ol style="list-style-type: none"> 1. The burners cannot receive proper gas flow from the manifold, which can cause poor combustion in the combustion chamber. In this case, the AFR rod will detect an improper flame condition and computer will take safety measures. 2. Gas leakage from the manifold. 		
Error codes when the manifold fails	101	111	121 991
Diagnostic	<ol style="list-style-type: none"> 1. Visual inspection: Excessive dust deposit around the nozzles or cracks on the manifold. 2. Check voltages and resistance: proper range of values shown below. 		
Color / Number of wires	Blue - Red	93 to 120 VDC / 2.07 to 2.53 kΩ	Checkpoint N/A

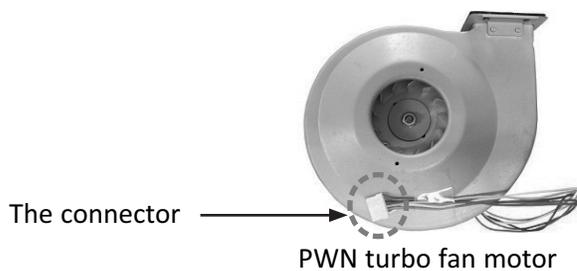


319143-515 (EK181) for Propane model and 319143-516 (EK182) for Natural gas model is an assembly of the gas manifold with the gas valve assembly. For safety reasons, these assemblies should be installed in the unit as a whole set. The gas manifold has the "68A" "120V" mark on the manifold plate.

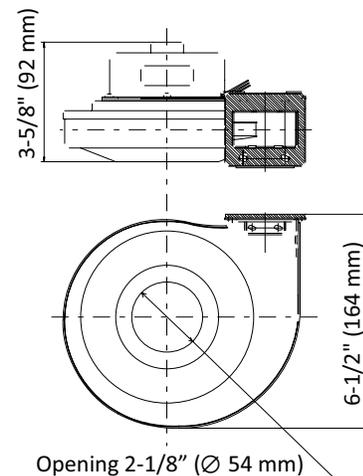


10-3. Fan motor

Part #	<ul style="list-style-type: none"> • 319143-443 (EK109) : Direct Vent Indoor model • 319143-043 (EKK25) : Outdoor model 	Unit Part#	#103
Function	To provide combustion air into the combustion chamber and to exhaust flue gas.		
Failure events	<ol style="list-style-type: none"> 1. Fan speed failure, causing abnormal sounds with or without combustion during operation. 2. Unexpected activation caused by the connectors of the fan motor getting wet. 3. Disconnects from the bottom of the combustion chamber. 		
Effects on the water heater if fan motor fails	<ol style="list-style-type: none"> 1. The water heater does not function properly. 2. Failure to ignite or abnormal ignition. 3. Unstable combustion conditions. 		
Error codes when the fan motor fails	101	111	121 611 991
Diagnostic	<ol style="list-style-type: none"> 1. Visual inspection: connection/breakage of wires or dust (causing electrical shortage) 2. Voltage check: proper range of voltages shown below. 		
Color / Number of wires	Blue - Red	132 to 192 VDC (Input)	
	Yellow - Blue	13 to 17 VDC (Input)	
	Orange - Blue	2.0 to 6.5 VDC (Input)	
	White - Blue	Verify the fan motor speed using the Diagnostics Mode of the controller. See Section 12-1 for details.	
		Check point	G



! The fan motor for indoor model has the **red** connector and the fan motor for outdoor model has the **white** connector.

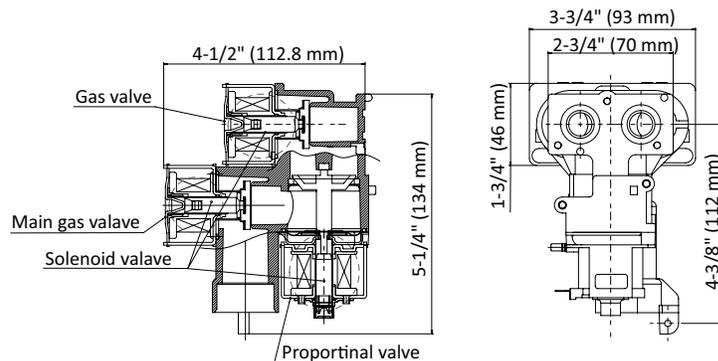


10-4. Gas valve assembly

Part#	<ul style="list-style-type: none"> • 319143-515 (EK181) : Propane • 319143-516 (EK182) : Natural gas 	Unit Part#	Included in #102
Function	Opens and closes the gas pathways of the water heater (main and solenoid gas valves) Modulates the gas flow from the gas inlet (proportional gas valve)		
Failure events	1. Gas leak from the valves. 2. Unable to open/close (main and solenoid gas valves) 3. Unable to modulate the gas flow (proportional gas valve)		
Effects on the water heater if valves fails	1. Gas leak from the assembly. 2. Excess carbon monoxide emissions. / No flames. 3. Lack of water temperature control.		
Error codes when the fvalves fails	101	111	121 991
Diagnostic	1. Visual inspection: connection/breakage of wires. 2. Listen for "clunk" sounds from the gas valves opening right after fan motor initiates. 3. Check voltages and resistance of coils; proper range of values shown below.		
Color / Number of wires	Blue - Light blue (MV) 93 to 120 VDC (during operation) / 1.35 to 1.65 kΩ Blue - Green (SV ₁) 93 to 120 VDC (during operation) / 1.35 to 1.65 kΩ Blue - Orange (SV ₂) 93 to 120 VDC (during operation) / 1.35 to 1.65 kΩ Blue - Red (SV ₃) 93 to 120 VDC (during operation) / 2.07 to 2.53 kΩ White - Red (Proportional valve) 1.0 to 15 VDC (during operation) / 20 to 40 Ω	Check point	C



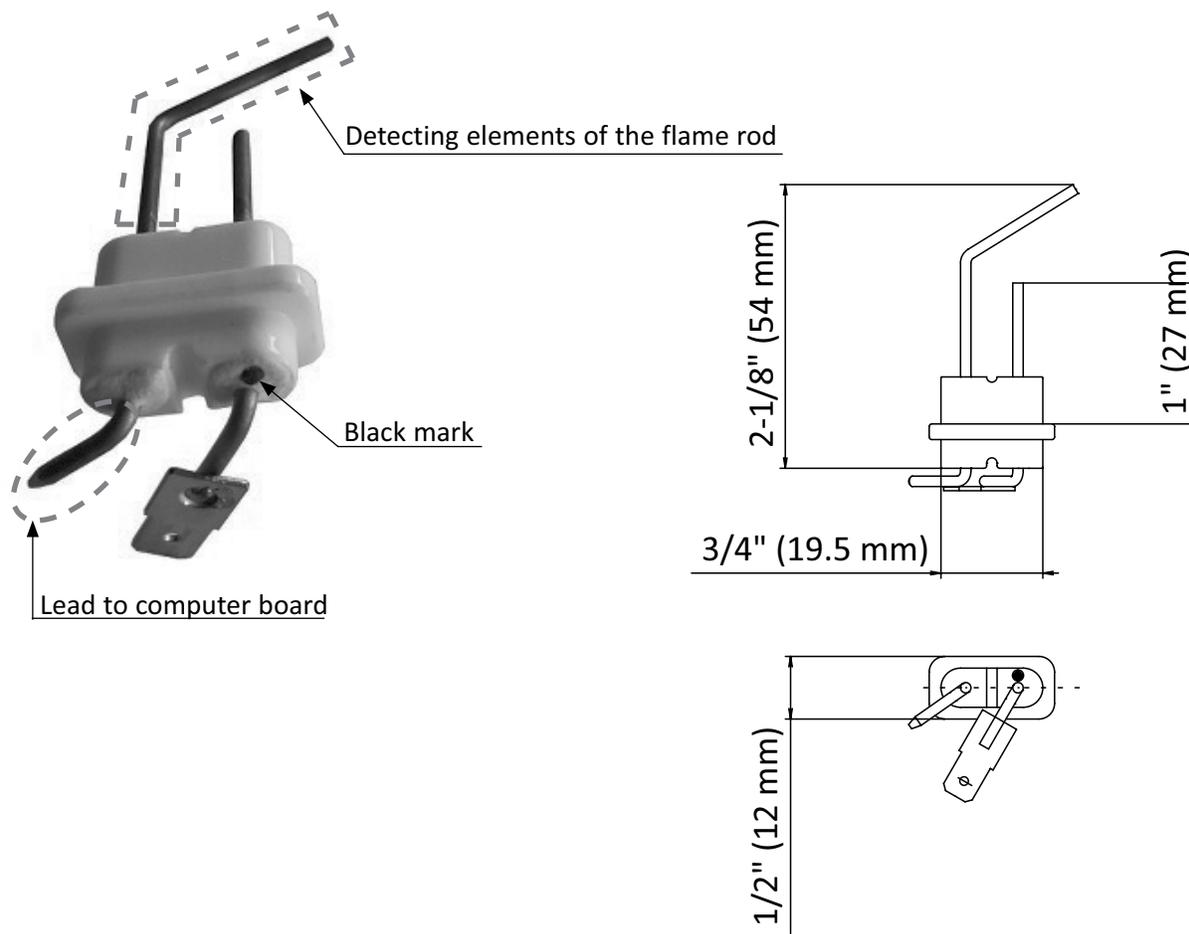
319143-515 (EK181) for Propane model and 319143-516 (EK182) for Natural gas model is an assembly of the gas manifold with gas valve assembly. For safety reasons, these assemblies should be installed in the unit as a whole set. The diagram below shows the gas valve assembly.



10-5. Flame rod

Part #	• 319143-517 (EK193)	Unit Part#	#108
Function	To detect flames while the water heater is in operation.		
Failure events	1. Unable to detect flames when flames actually do occur. 2. Detecting a false flame when no flames actually occur.		
Effects on the water heater if flame rod fails	1. The water heater stops operating. The "111" and/or "121" error code(s) will display. 2. The water heater will not initiate the ignition process. The "721" error code will display.		
Error codes when the flame rod fails	111	121	721
Diagnostic	1. Visual inspection: connection / breakage of wires or soot buildup on rod. 2. Check Amperes: proper range of values shown below.		
Color / Number of wires	Orange - Flame rod (Between the flame rod and the computer board)	(During operation) More than DC 1 μ A	Check point I

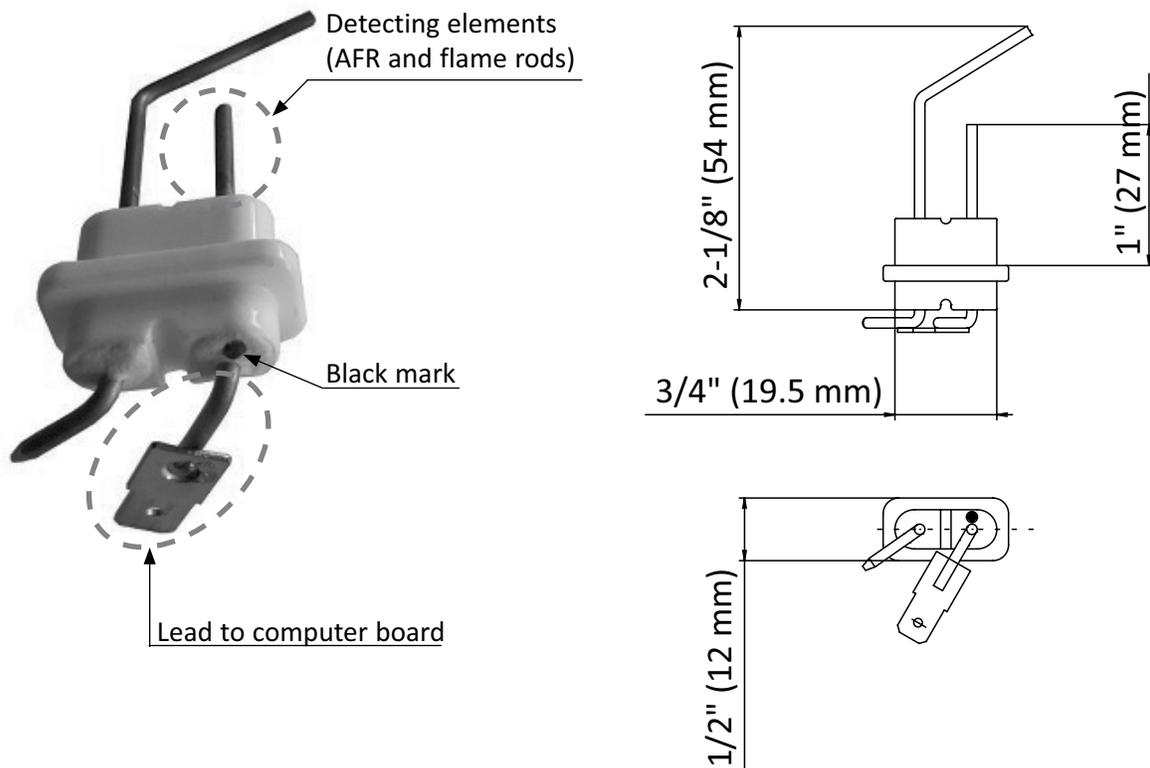
The flame rod is assembled with the AFR rod.



10-6. AFR rod

Part #	• 319143-517 (EK193)	Unit Part#	#108
Function	Checks flame conditions during combustion. When AFR rod detects unexpected flame conditions, the computer of the water heater makes adjustments in the fan motor speed to compensate.		
Failure events	1. Unable to detect flames when flames actually do occur. 2. Detecting a false flame when no flames actually occur.		
Effects on the water heater if AFR rod fails	1. The water heater stops operating. The "111" and/or "121" error code(s) will display. 2. The water heater will not initiate the ignition process. The "721" error code will display. 3. The fan motor speed cannot be modulated properly under abnormal flame conditions, which can result in excessive CO emission.		
Error codes when the AFR rod fails	101	391	991
Diagnostic	1. Visual inspection: connection/braking of wires, soot on it. 2. Check voltages: proper range of values are shown below.		
Color / Number of wires	Yellow - AFR rod (Between the AFR rod and the computer board)	(During operation) More than DC 1 μ A	Check point I

The flame rod is assembled with the AFR rod.



10-7. Heat exchanger

Part#	*See the table below	Unit Part#	#401
Function	Absorbs heat from combustion and transfer it to water through the heat exchanger pipes.		
Failure events	<ol style="list-style-type: none"> 1. Clogged heat exchanger fins and/or cracks on the heat exchanger walls. 2. Leaking exhaust gas. 3. Improper heat transfer can cause the water in heat exchanger to boil. 		
Effects on the water heater if the heat exchanger fails	<ol style="list-style-type: none"> 1. Water leakage from the heat exchanger. 2. Exhaust gas leakage (if this occurs, an overheat cutoff fuse is in place to detect this event and immediately stop the water heater from operating) 3. Abnormal sounds during combustion . 		
Error codes when the heat exchanger fails	N/A		
Diagnostic	<ol style="list-style-type: none"> 1. Visual inspection: soot deposits, cracks on the heat exchanger walls, and/or water leakage from the heat exchanger. 2. In the event of abnormal sounds during combustion: <ol style="list-style-type: none"> A. Inspect for soot buildup inside the heat exchanger. B. Inspect for scale buildup inside the heat exchanger pipes. Scale buildup obstructs proper heat transfer to the water, thereby overheating the heat exchanger and causing damage. 		
Color / Number of wires	N/A	Checkpoint	N/A

NOTE: Pictures are on the following page

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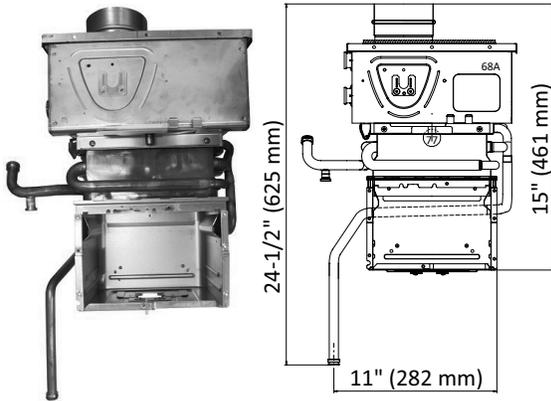
Part #	Model
319143-525	EK198 240 Indoor (T-H3J-DV) / 340 (T-H3S-DV)
319143-526	EK199 240 Outdoor (T-H3J-OS) / 340 (T-H3S-OS)
319143-527	EK200 540 Indoor (T-H3-DV)
319143-528	EK206 540 Outdoor (T-H3-OS)

10-7. Heat exchanger

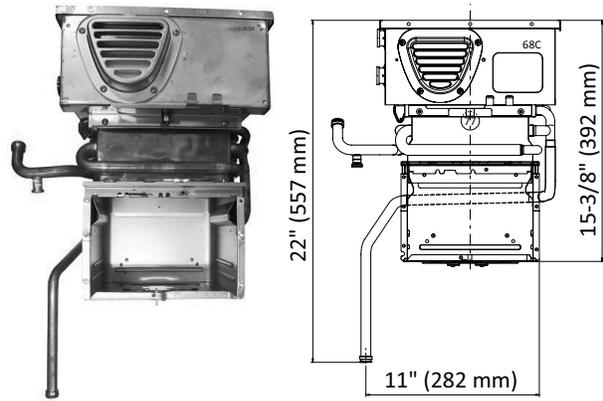


The heat exchanger of the 240 (T-H3J) and 340 (T-H3S) models have the "77" mark, and 540 (T-H3) models have the "P77" mark as shown below.

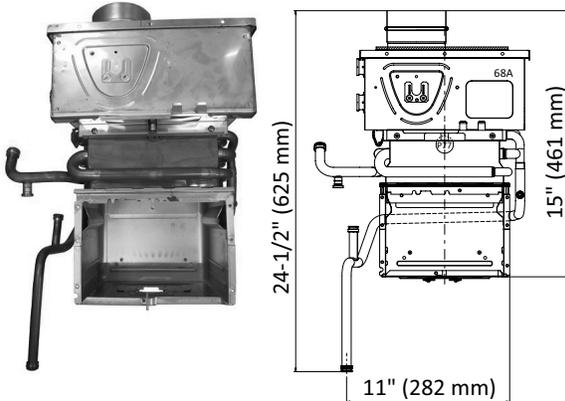
240, 340 Indoor (T-H3J, T-H3S-DV)



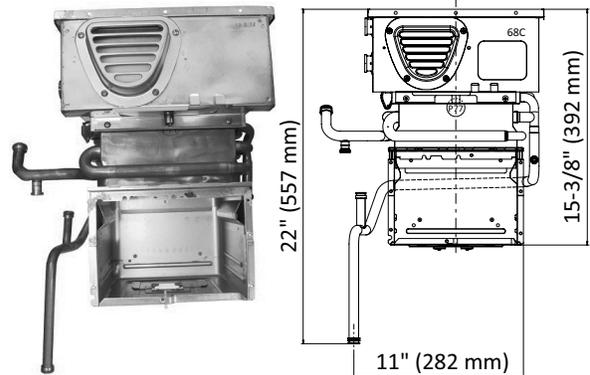
240, 340 Outdoor (T-H3J, T-H3S-OS)



540 Indoor (T-H3-DV)



540 Outdoor (T-H3-OS)



10-8. Secondary heat exchanger

Part#	*See the table below	Unit Part#	#401
Function	Absorb latent heat from exhaust gas and transfer the water through the secondary heat exchanger pipes, which can improve heat efficiency of the unit by approximately 12%.		
Failure events	1. Water leakage from the secondary heat exchanger. 2. Leaking exhaust gas.		
Effects on the water heater if the secondary heat exchanger fails	1. Water leakage from the secondary heat exchanger. 2. Exhaust gas leakage 3. Abnormal sounds during combustion		
Error codes when the secondary heat exchanger fails	N/A		
Diagnostic	1. Visual inspection: soot deposits, cracks on the secondary heat exchanger walls, and/or water leakage from the secondary heat exchanger. 2. In the event of abnormal sounds during combustion: Inspect for soot buildup inside the secondary heat exchanger.		
Color / Number of wires	N/A	Checkpoint	N/A

NOTE: Pictures are on the following page

*

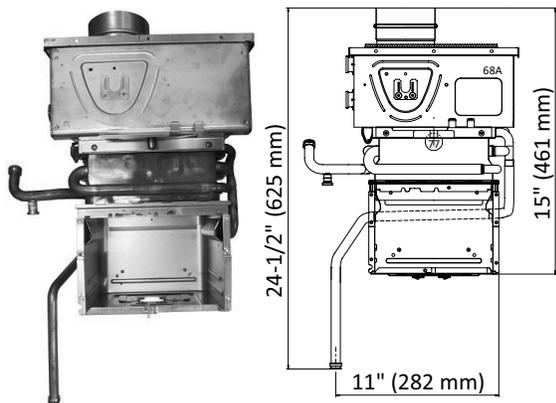
Part #	Model
319143-525	EK198 240 Indoor (T-H3J-DV) / 340 (T-H3S-DV)
319143-526	EK199 240 Outdoor (T-H3J-OS) / 340 (T-H3S-OS)
319143-527	EK200 540 Indoor (T-H3-DV)
319143-528	EK206 540 Outdoor (T-H3-OS)

10-8. Secondary heat exchanger

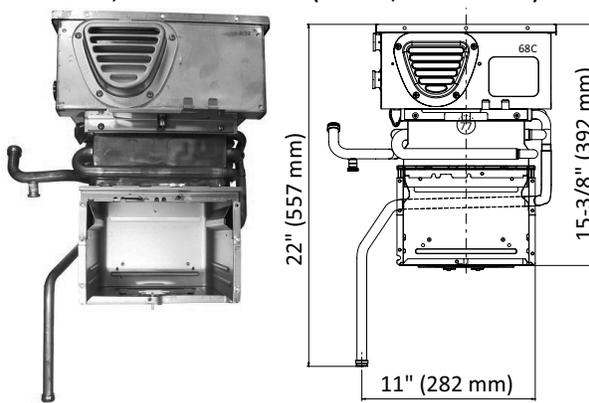


The heat exchanger of the 240 (T-H3J) and 340 (T-H3S) models have the "77" mark, and 540 (T-H3) models have the "P77" mark as shown below.

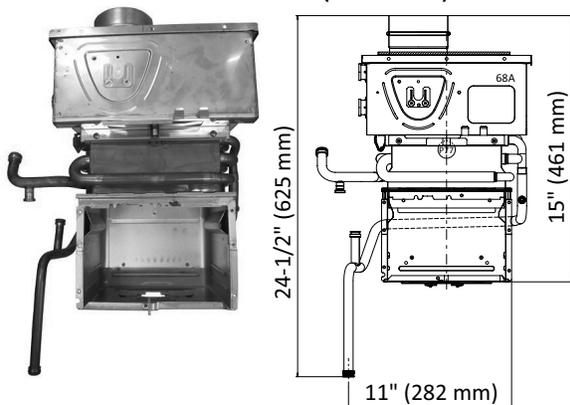
240, 340 Indoor (T-H3J, T-H3S-DV)



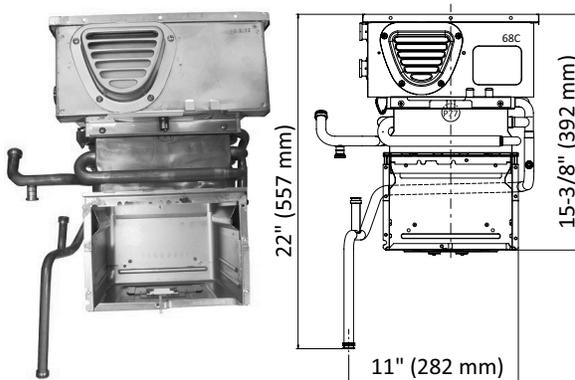
240, 340 Outdoor (T-H3J, T-H3S-OS)



540 Indoor (T-H3-DV)



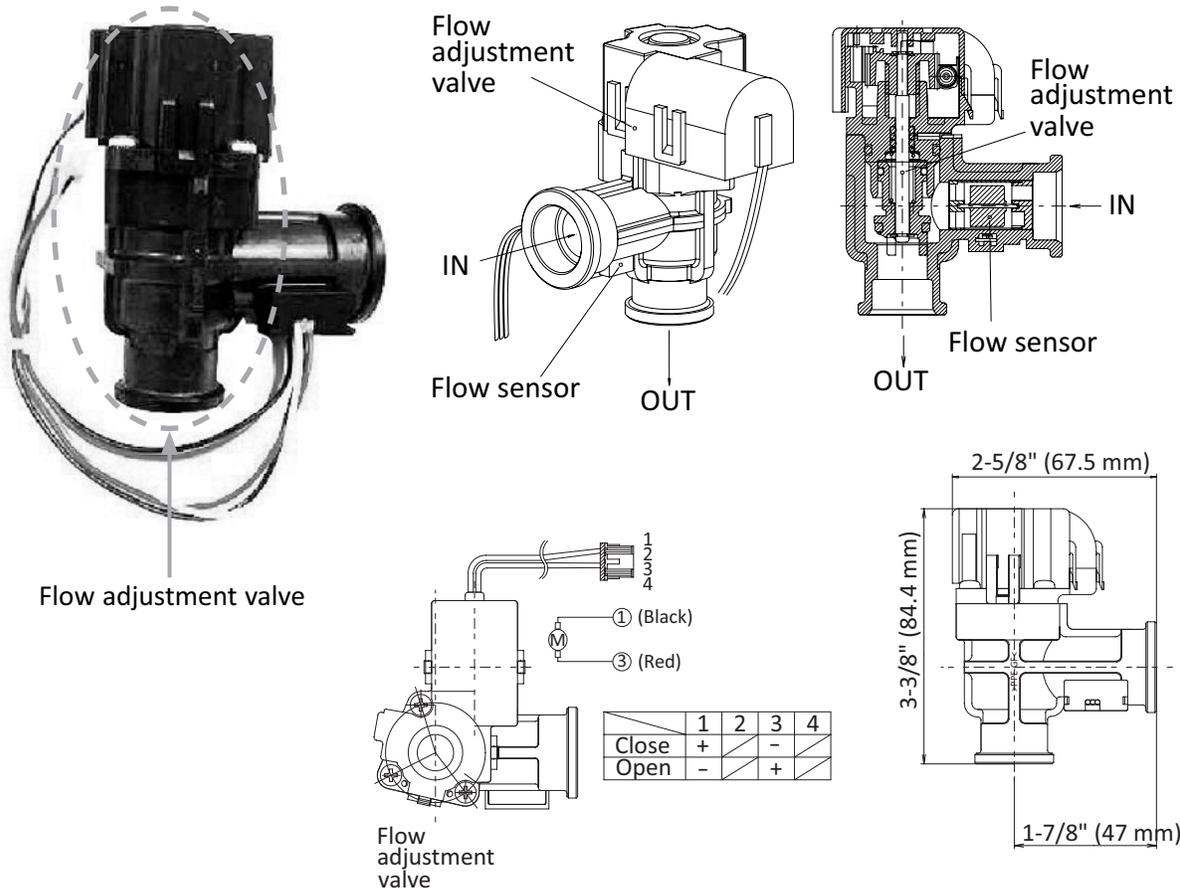
540 Outdoor (T-H3-OS)



10-9. Flow adjustment valve

Part#	• 319143-463 (EK129)	Unit Part#	#402
Function	Controls water flow to properly control the output hot water temperature.		
Failure events	<ol style="list-style-type: none"> 1. Water leakage from valve. 2. The valve cannot modulate or make open/close positions. 		
Effects on the water heater if flow adjustment valve fails	<ol style="list-style-type: none"> 1. Water leakage from failed valve can damage other water heater components. 2. Temperature fluctuations in the hot water output. 3. Within an Easy-Link system, the "651" error code can occur. 		
Error codes when flow adjustment valve fails	651 (only within Easy-Link systems)		
Diagnostic	<ol style="list-style-type: none"> 1. Visual inspection: connection/breakage of wires, motor drive locked due to scale buildup, and/or water leakage. 2. Check voltages and resistance; proper range of values shown below. 		
Color / Number of wires	Black - Red 7.0 to 16 VDC and 0.09 to 0.2 kΩ	Checkpoint	J

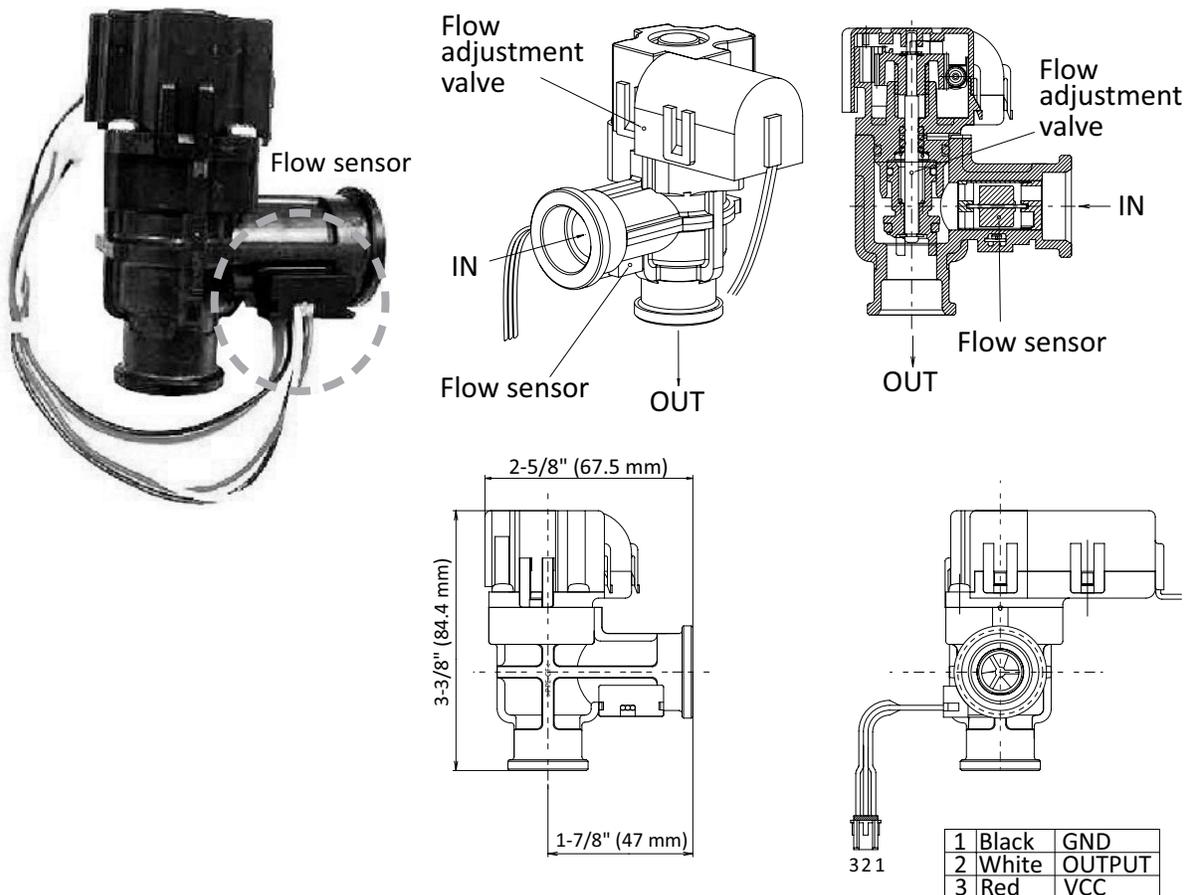
The flow adjustment valve is assembled with the flow sensor.



10-10. Flow sensor

Part#	• 319143-463 (EK129)	Unit Part#	#402
Function	Detects and measures water flow rate using a spinning impeller and magnetic pick-up.		
Failure events	Unable to detect or measure any water flow rate.		
Effects on the water heater if flow sensor fails	Ignition sequence does not start (water heater will not initiate any operation)		
Error codes when flow sensor fails	441 (only within Easy-Link systems)		
Diagnostic	1. Visual inspection: connection/breakage of wires and/or debris on impeller. 2. Check voltages: proper range of values shown below.		
Color / Number of wires	Red - Black	4.0 to 5.5 VDC (Input)	Check point H2
	White(85) -Black	1.0 to 4.0 VDC (pulse) 1,080 pulse/min (more than 18 Hz)	

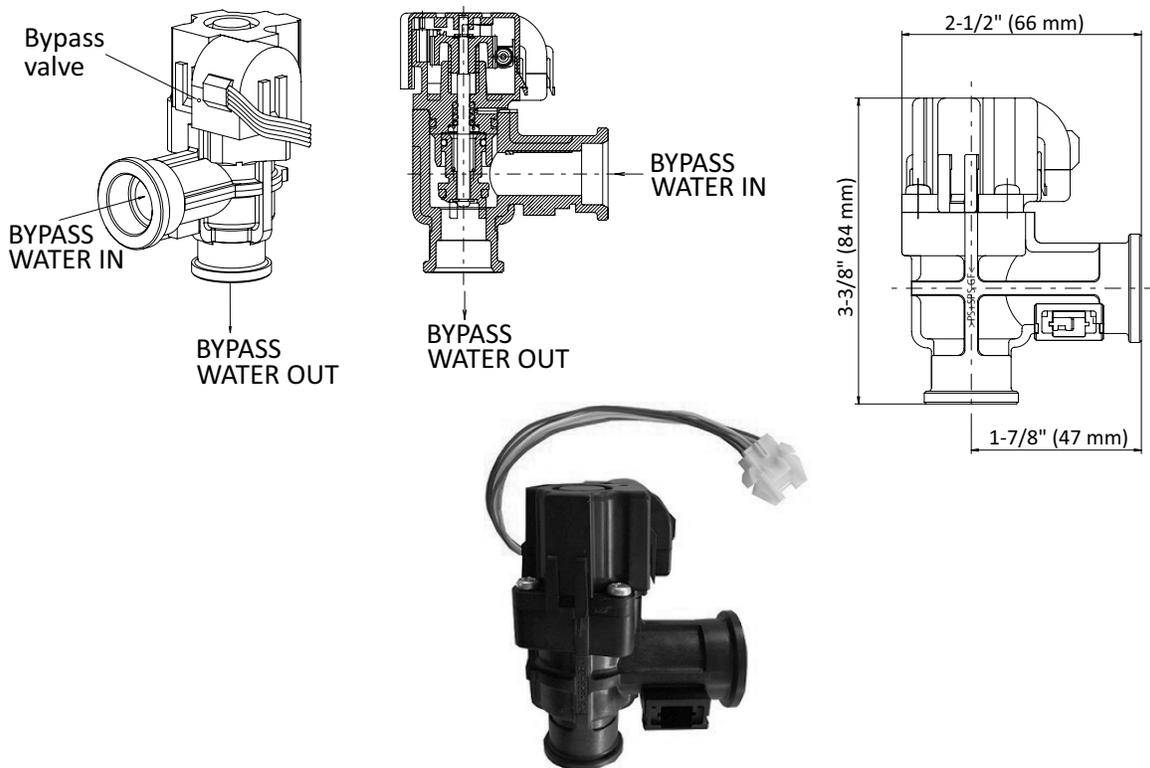
The flow sensor is assembled with the flow adjustment valve.



10-11. Bypass valve (540 (T-H3) models only)

Part #	<ul style="list-style-type: none"> • 319143-464 (EKD58) 540 (T-H3) models only 	Unit Part#	#403
Function	<ol style="list-style-type: none"> 1. Mixes hot water from the heat exchanger with cold water from the water inlet in order to modulate and control the water heater's outlet water temperature. 2. Keeps the water temperature in the heat exchanger stable, preventing low-temperature corrosion by reducing condensation buildup in heat exchanger. 		
Failure events	<ol style="list-style-type: none"> 1. Water leakage from valve. 2. The valve cannot modulate properly. 		
Effects on the water heater if bypass valve fails	<ol style="list-style-type: none"> 1. Water leakage from failed valve can damage other water heater components. 2. Temperature fluctuations in the hot water output. 		
Error codes when bypass valve fails	N/A		
Diagnostic	<ol style="list-style-type: none"> 1. Visual inspection: connection/breakage of wires. 2. Check voltages and resistance: proper range of values shown below. 		
Color / Number of wires	Brwon - Red	3.0 to 11 VDC and 50 to 85 Ω	Checkpoint J1

The physical appearance of the bypass valve is similar to that of the flow adjustment valve. However, their functions differ and cannot be substituted for each other



10-12. Thermistors

Part #	*See the table below	Unit Part#	#407 (Inlet) #408 (Outlet) #411 (Heat exchanger)
Function	Measures cold/hot water temperatures in the water heater.		
Failure events	Unable to properly measure water temperatures within the water heater.		
Effects on the water heater if thermistor fails	If the thermistors fail open or short, error code appears before starting operation. If resistance values are just off, The water heater will have temperature fluctuations in hot water.		
Error codes when thermistors fails	311 (Outlet)	321 (Inlet)	331 (Heat exchanger)
Diagnostic	1. Visual inspection: connection/breakage of wires and/or debris on thermistor. 2. Check voltages and resistance; proper range of values shown below.		
Color / Number of wires	Inlet Black (42) - Black	68 °F (20 °C) 9.0 to 13 kΩ 122 °F (50 °C) 3.3 to 4.4 kΩ	Check point *See the table below
	Heat exchanger Black (12) - Black	176 °F (80 °C) 1.4 to 1.8 kΩ (see table below for more resistance values)	
	Outlet Black (113) - Black		

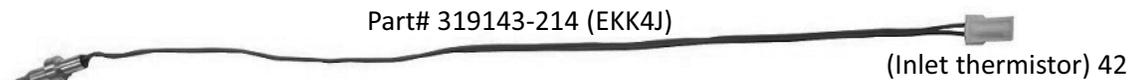
NOTE: Pictures are on the following page

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Part #		Description	Checkpoint	Model
319143-214	EKK4J	Inlet thermistor	E2	240 (T-H3J) / 340 (T-H3S)
319143-465	EK137	Inlet thermistor	E2	540 (T-H3)
319143-529	EK207	Outlet thermistor	E1	240 (T-H3J) / 340 (T-H3S)
319143-190	EKK1A	Outlet thermistor	E1	540 (T-H3)
319143-096	EKK2T	Heat exchanger thermistor	E3	540 (T-H3)

10-12. Thermistors

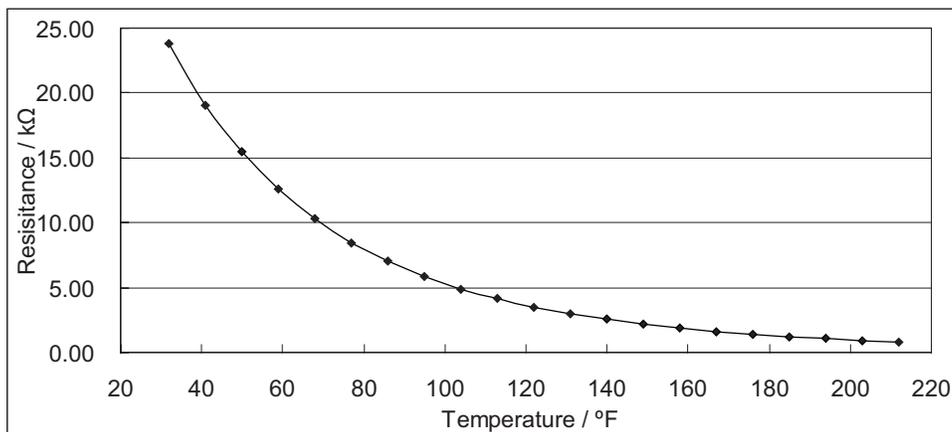
240 (T-H3J) and 340 (T-H3S) models



540 (T-H3) models



Resistance values of thermistors as a function of temperature

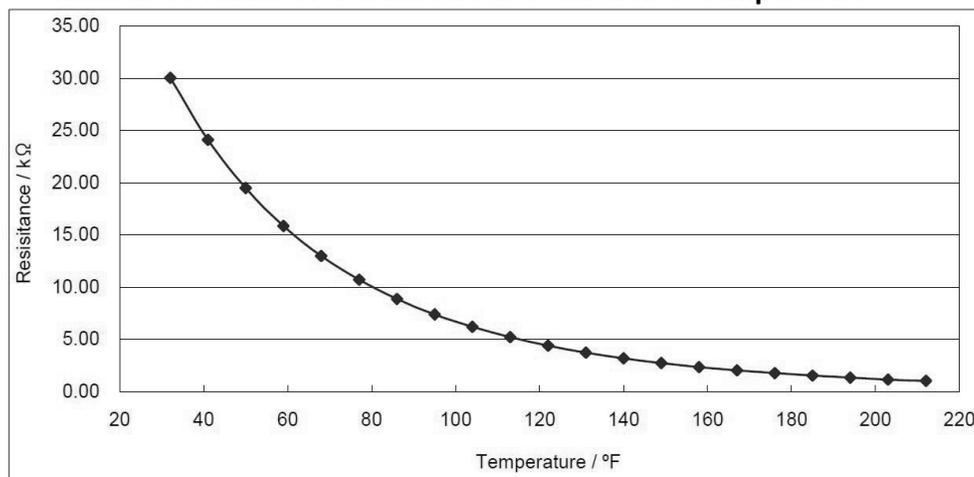


10-13. Exhaust thermistor

Part#	• 319143-131 (EKH6E)	Unit Part#	#718
Function	Measures the exhaust temperatures in the secondary heat exchanger.		
Failure events	Unable to measure exhaust temperature in the exhaust chamber properly.		
Effects on the water heater if exhaust thermistor fails	If the thermistors fail open or short, error code appears before starting operation. If resistance values are just off, the "341" error codes will display.		
Error codes when exhaust thermistor fails	341 (Direct Vent Indoor models only)		
Diagnostic	1. Visual inspection: connection/breakage of wires and/or debris on impeller. 2. Check voltages: proper range of values shown below.		
Color / Number of wires	White - White	68°F (20°C) 12.6 to 13.4 kΩ 122°F (50°C) 4.3 to 4.5 kΩ 176°F (80°C) 1.7 to 1.8 kΩ (see table below for more resistance values)	Check point K1



Resistance values of thermistors as a function of temperature



10-14. Hi-limit switch

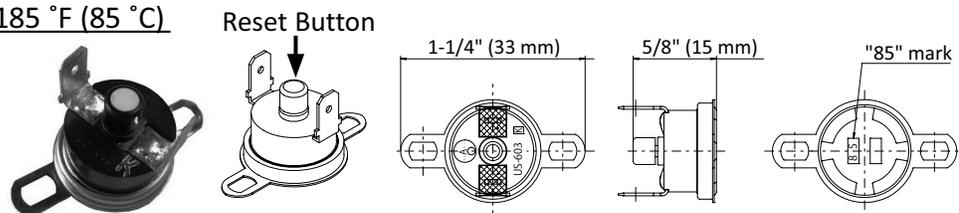
Part#	<ul style="list-style-type: none"> 319143-228 (EM212) 240 (T-H3J) /340 (T-H3S) models 319143-095 (EKN34) 540 (T-H3) models 	Unit Part#	#412
Function	<p>-Based on bi-metal thermal expansion. -Detects excessively high water temperature in pipes of the heat exchanger. -After detection, communication between the computer board and gas valves are severed, shutting down the water heater instantly. The "111" or "121" error codes will display.</p>		
Failure events	<p>1. Unable to detect excessively high water temperatures if switch fails "closed". 2. Continuous detection of excessively high water temperatures (regardless of what the actual water temperature is) if switch fails "open".</p>		
Effects on the water heater if hi-limit switch fails	<p>1. Unable to shut down the water heater if the water temperature from the heat exchanger exceeds 185 °F (85 °C) or 194 °F (90 °C). Note: The outlet and heat exchanger thermistors always act as backup hi-limit detectors to detect excessively high water temperatures in the heat exchanger. 2. The water heater is always shut down immediately after the ignition process, and either the "111" or "121" error code will display.</p>		
Error codes when hi-limit switch fails	111	121	
	<p>The water heaters don't have the "141" error code that was used in our previous models. This error code is now replaced by the "111" and the "121" error codes.</p>		
Diagnostic	<p>1. Visual inspection: connection/breakage of wires. Possibility also includes scale deposits inside the heat exchanger. 2. Check voltages and resistance: proper range of values shown below.</p>		
Color / Number of wires	Blue-Blue	Less than 1.0 Ω	Checkpoint C1

When detecting temperature of the hi-limit switch exceeds the activation temperature either 185 °F (85 °C) or 194 °F (90 °C), the reset button trips and switch goes to OFF mode.

Deactivation: to reset switch back to ON mode, press the reset button

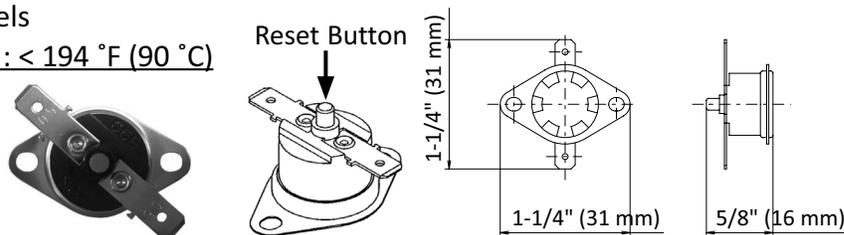
240 (T-H3J) / 340 (T-H3S) models

Activation temp : < 185 °F (85 °C)



540 (T-H3) models

Activation temp : < 194 °F (90 °C)



10-14. Hi-limit switch

After the hi-limit switch was working, refer to the following procedure.

1. Turn off the controller.
2. Open a hot water tap and lower the temperature of the heat exchanger.
3. Press the button on the hi-limit switch.

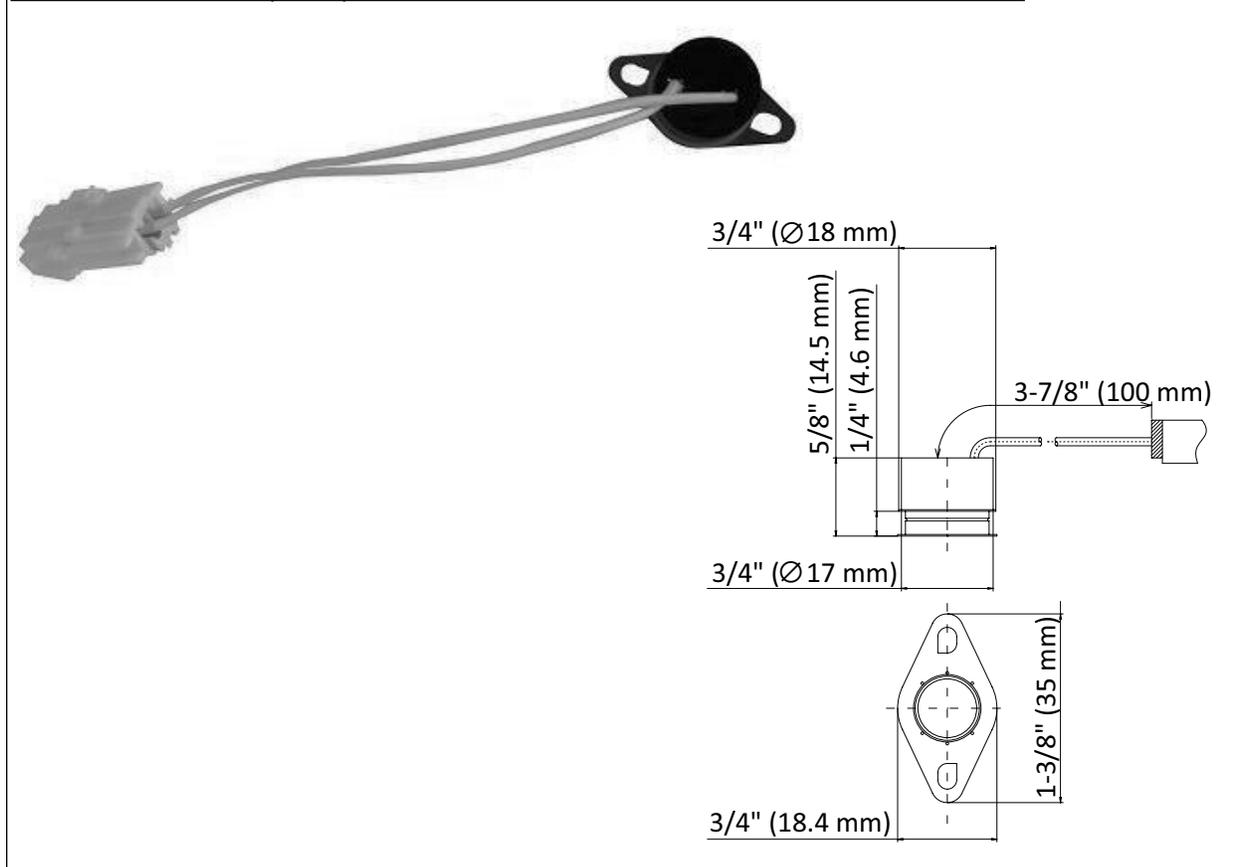


Before pressing the button on the hi-limit switch.

10-15. Hi-limit switch for exhaust

Part#	• 319143-104 (EKH6G)	Unit Part#	#472
Function	-Based on bi-metal thermal expansion. -Detects excess temperature (more than 151°F or 66°C) of exhaust gas in the exhaust chamber.		
Failure events	1. Unable to detect excess temperature of gas if switch fails "closed". 2. Continuous detection of excess temperatures (regardless of what the actual temperature is) if switch fails "open".		
Effects on the water heater if hi-limit switch for exhaust fails	1. Unable to shut down the water heater if the exhaust gas temperature in the exhaust chamber exceeds 151°F (66°C). 2. The water heater is always shut down immediately after the ignition process, and the "941" error code will display.		
Error codes when hi-limit switch for exhaust fails	941 (Direct Vent Indoor models only)		
Diagnostic	1. Visual inspection: connection/breakage of wires. 2. Check voltages and resistance: proper range of values shown below.		
Color / Number of wires	White - White Less than 1.0 Ω	Checkpoint	K2

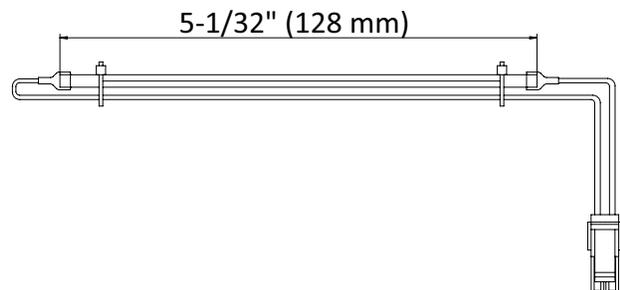
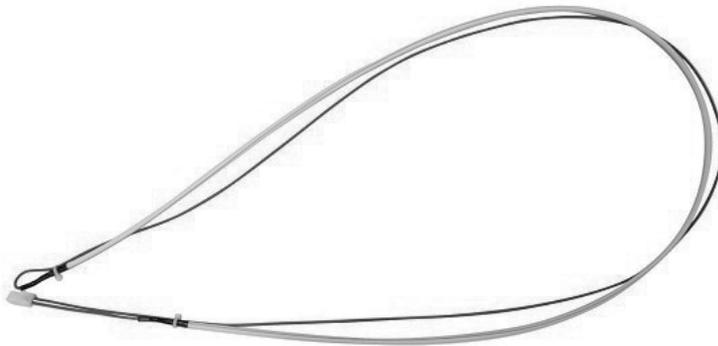
When temperatures exceed 151 °F (66 °C), the reset button trips and switch goes to OFF mode.
ON mode : < 151 °F (66 °C) OFF mode: automatic restoration back to ON mode



10-16. Overheat cut off fuse

Part#	• 319143-149 (EK333)	Unit Part#	#413
Function	-The overheat cutoff fuse contains solder with a melting point of 430 °F (221 °C). -Detects excessive temperatures within the water heater, especially around the heat exchanger and combustion chamber. Upon detection, communication between the computer board and gas valves will sever, shutting down the water heater instantly. The "111" or "121" error code will display.		
Failure events	1. Unable to detect the excessively high temperatures within the water heater.		
Effects on the water heater if the overheat cutoff fuse fails	1. Flames from burner may penetrate a ruptured/damaged heat exchanger. 2. Gas valves will not operate.		
Error codes when the overheat cutoff fuse fails	111		121
Diagnostic	1. Visual inspection: connection/breakage of wires. 2. Check voltages and resistance: proper range of values shown below.		
Color / Number of wires	Blue-Blue	Less than 1.0 Ω	Checkpoint C2

Solder will melt at temperature exceeding 430 °F (± 9 °F) or 221 °C (± 5 °C)



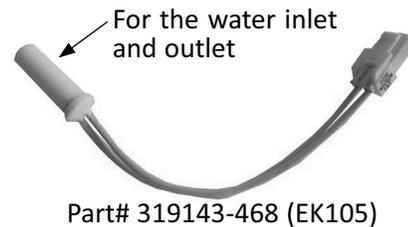
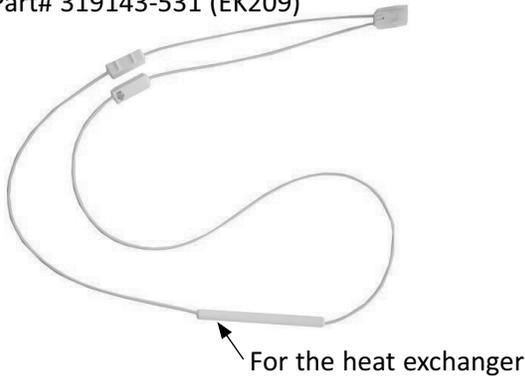
The O.H.C.F. has a red line on itself.

10-17. Freeze protection heaters

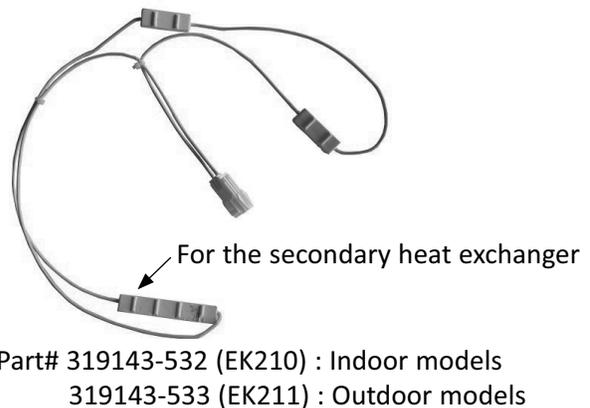
Part#	<ul style="list-style-type: none"> • 319143-531 (EK209) • 319143-532 (EK210) : Indoor • 319143-533 (EK211) : Outdoor • 319143-468 (EK105) • 319143-535 (EK217) 	Unit Part#	<p>#414</p> <p>#415</p> <p>#417</p> <p>#464</p>
Function	Prevents the heat exchanger, water valves, and water pipes within the water heater from freezing. The heaters are but one of the freeze protection devices in the water heater.		
Failure events	Open circuit failure: Ceramic heaters do not receive the voltage needed to heat up.		
Effects on the water heater if heater fails	Ceramic heaters do not activate, allowing water contained in the heat exchanger to freeze up, possibly causing the heat exchanger to burst.		
Error codes when heater fails	N/A		
Diagnostic	<ol style="list-style-type: none"> 1. Visual inspection: connection/breakage of wires and the condition of the heaters. 2. Check: whether those are in the normal range as shown in the following table. 		
Color / Number of wires	Black - Black	108 to 132 VAC (during freeze protection operation)	Checkpoint B1

The water heater has two types of the heaters in it. The one is for protecting of the heat exchanger and water pipes, the other one is for protecting of the water inlet and water outlet.

Part# 319143-531 (EK209)



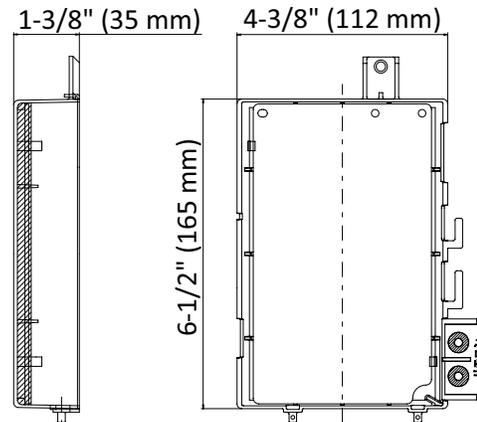
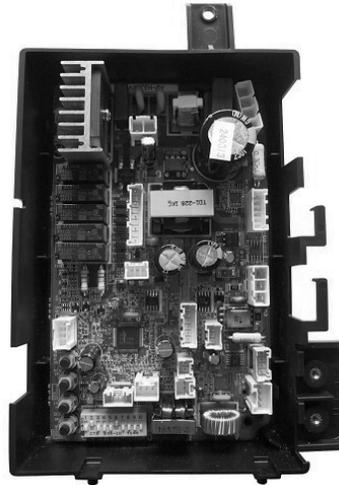
Flat heater



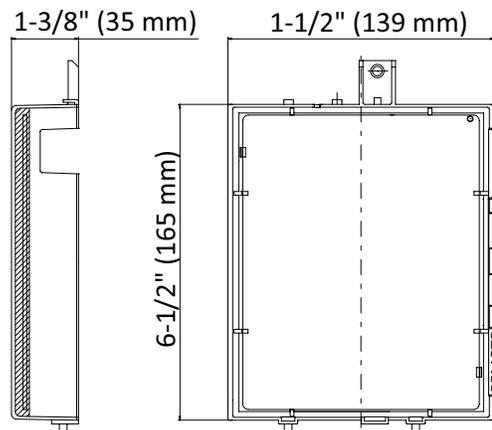
10-18. Computer board

Part#	<ul style="list-style-type: none"> • 319143-543 (EK186): 240 (T-H3J) models • 319143-544 (EK175): 340 (T-H3S) models • 319143-545 (EK176): 540 (T-H3) models 	Unit Part#	#701
Function	Controls the functions of most of the parts in the water heater.		
Failure events	Malfunctioning computer		
Effects on the water heater if the computer board fails	-A component(s) may not operate within the water heater. In most cases of computer board failure, the whole the water heater does not operate at all. -Error codes will display.		
Error codes when the computer board fails	701	721	741 761
Diagnostic	Visual inspection: connection/breakage of wires and/or burn marks on the computer board.		
Color / Number of wires	N/A	Checkpoint	N/A

**240 (T-H3J) models
340 (T-H3S) models**

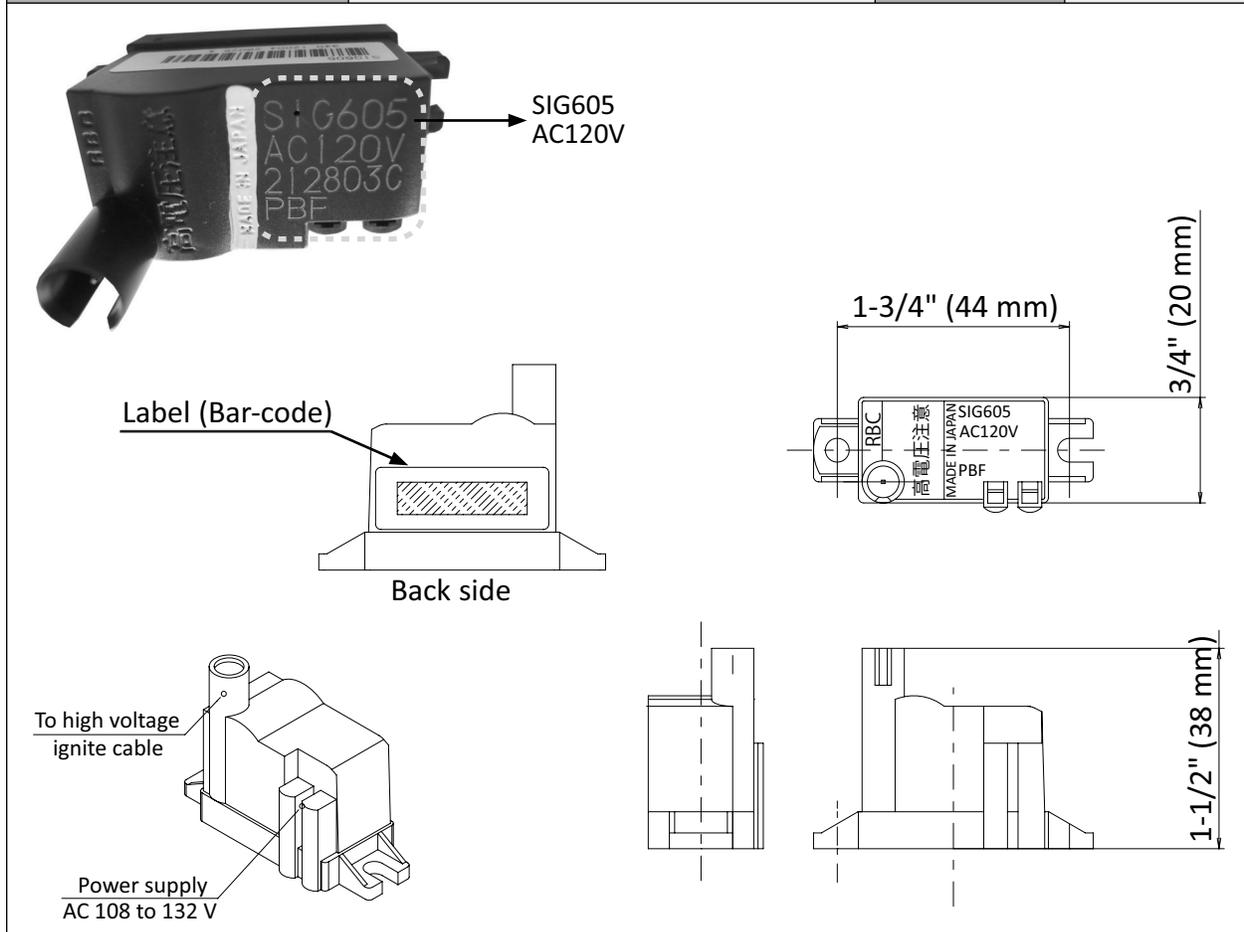


540 (T-H3) models



10-19. Igniter

Part #	• 319143-479 (EK153)	Unit Part#	#711
Function	-To ignite the gas/air mixtures when the water heater is ready to burn gas on its burner surface. -The output voltage of the igniter is more than 14 kVDC.		
Failure events	1. Unable to ignite during the ignition process. 2. Makes attempts to ignite at all times.		
Effects on the water heater if the igniter fails	1. The water heater cannot ignite during the ignition process and the "111" or "121" error codes will display. 2. No effects on the water heater, however, the durability of the igniter wears down.		
Error codes when igniter fails	111		121
Diagnostic	1. Visual inspection: connection/breakage of wires and/or an observed weak spark. 2. Check voltages: proper range of values shown below.		
Color / Number of wires	Purple(7)-Purple(7)	108 to 132 VAC	Checkpoint B



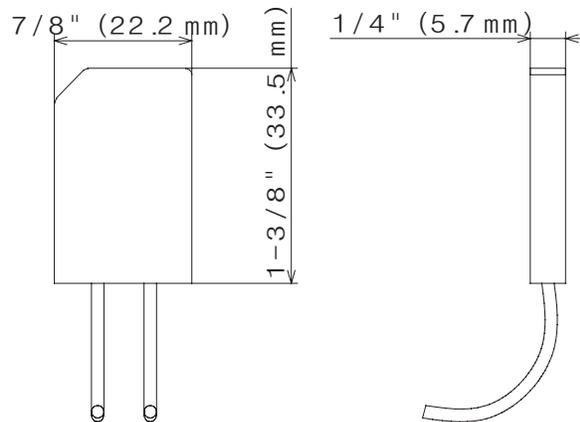
10-20. Freeze protection thermostat

Part#	<ul style="list-style-type: none"> • 319143-496 (EK184): Indoor • 319143-497 (EK185): Outdoor 	Unit Part#	#713
Function	Temperature detecting device which prevents the pipes within the water heater from freezing. When this device detects temperatures below 36.5 °F (2.5 °C) inside the water r heater, power is supplied to the electric heaters to prevent the water heater from freezing.		
Failure events	<ol style="list-style-type: none"> 1. ON-failure (Always senses freezing temperatures, regardless of actual temperature). 2. OFF-failure (Never senses freezing temperatures). 		
Effects on the water heater if freeze protection thermostat fails	<ol style="list-style-type: none"> 1. The freeze protection heaters will always be ON, causing heat damage to components inside the water heater. 2. The freeze protection heaters will never be able to turn on, even under freezing temperatures, causing freeze damage to the water heater. 		
Error codes when the freeze protection thermostat fails	N/A		
Diagnostic	<ol style="list-style-type: none"> 1. Visual inspection: connection/breakage of wires and/or the body has been broken. 2. Check resistance and voltage: proper range of values shown below. 		
Color / Number of wires	Black - Black (itself)	ON mode: 108 VAC - 132 VAC and less than 1 Ω OFF mode: less than 1 VAC and more than 1 MΩ	Checkpoint B1

Activation and deactivation temperature of the water heater’s freeze protection system

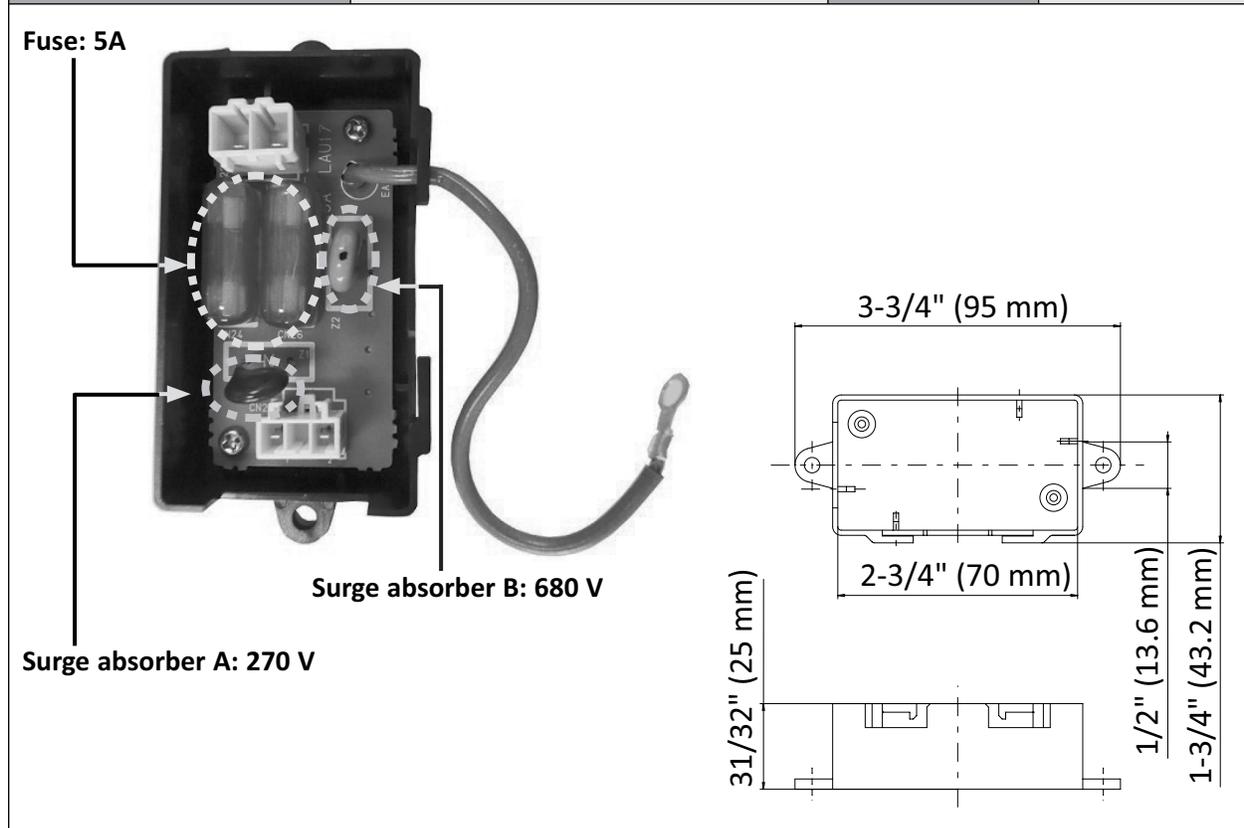
ON mode: 36.5 °F (+ 6.3 °F - 2.7 °F) 2.5 °C (+ 3.5 °C - 1.0 °C)

OFF mode: above 46.4 °F above 8 °C



10-21. Surge box

Part#	• 319143-522 (EK163)	Unit Part#	#121
Function	Protects the unit from high voltage and/or high electric current caused by lightning. There are 2 types of surge absorbers in the water heater. Surge absorber A is activated by voltage higher than 220 V, the other one is activated by voltage higher than 680 V.		
Failure events	1. Open-failure of the absorber and/or fuse. 2. Short-failure of the absorber.		
Effects on the water heater if the surge box fails	1. Unable to protect the computer board if high voltage gets applied to the unit. The computer board can short out, stopping all operations. 2. The unit cannot operate because the absorber shorted out, causing the fuse to break open.		
Error codes when the surge box fails	N/A		
Diagnostic	1. Visual inspection: burn marks on components and/or connection/breakage of wires. 2. Check resistance and voltage: proper range of values shown below.		
Color / Number of wires	White-Black	108 to 132 VAC	Checkpoint A1, A2



11. Fault Analysis & Specifications

Remarks:

1. Proper range of values of voltage & resistance shown below.
2. Please refer to the wiring diagram for checkpoint positions.
3. Remove power to the water heater when checking for continuity, disconnections, resistance values, etc.

Natural of Fault	Diagnosis	Check point
<ul style="list-style-type: none"> • No display on the controller, even when remote is turned on. 	1 Check the power supply [1] Check the power supply from Power ON-OFF switch to the PCB (Refer to section 12-2) [2] Check the power supply line to the water heater	
	2 Fault of Power ON-OFF switch Normal: 120 VAC between (white-black) Normal: 120 VAC between (white-black)	A A1
	3 Blown fuse at surge box (5A)	A2
	4 Fault of PCB [1] No voltage at the controller Normal: 11 to 25 VDC between (white-black)	F L
	5 Disconnection/short-circuit/grounding of the controller wires Normal: 11 to 25 VDC between (white-black)	
	6 Fault of PCB of the controller [1] Check for normal voltage at terminal	
<ul style="list-style-type: none"> • It takes long time to get hot water at the fixtures 	1 The time it takes to deliver hot water from the water heater to fixtures depends on the length of piping between them. The longer the distance or the bigger the pipes, the longer it will take to get hot water. 2 If you need hot water to fixtures quicker, you may want to consider a hot water recirculation system.	
<ul style="list-style-type: none"> • The water is not hot enough 	1 Check cross plumbing between cold water lines and hot water lines. 2 Check whether the gas supply pressure is enough. 3 Check whether the temperature setting is too low.	
<ul style="list-style-type: none"> • The water is too hot 	1 Check whether the temperature setting is too high.	
<ul style="list-style-type: none"> • The hot water is not available when a fixture is opened 	1 Make sure the unit has a 120 VAC / 60 Hz power supply. 2 If the remote controller is used, check whether the power button is turned on. 3 Check that the filter on the cold water inlet is clean. 4 Check whether the hot water fixture is sufficiently open to draw at least 0.5 GM through the water heater. 5 Check whether or not the unit is frozen. 6 Check if there is enough gas in the tank. (for propane units)	

Natural of Fault	Diagnosis	Check point
<ul style="list-style-type: none"> • The hot water turns cold and stays cold 	<ol style="list-style-type: none"> 1 Check whether the flow rate is high enough to keep the water heater running. 2 Check if there is a recirculation system installed and check also if the recirculation line has enough check valves. 3 Check that the filter on the cold water inlet is clean. 4 Check that the fixtures are free from debris and obstructions. 	
<ul style="list-style-type: none"> • The fan motor is still spinning after operation has stopped 	<ol style="list-style-type: none"> 1 This is normal operation. After operation has stopped, the fan motor keeps its running 15 to 70 seconds in order to re-ignite quickly, as well as purge all the exhaust gas out of the flue. 	
<ul style="list-style-type: none"> • Abnormal sound from water heater 	<ol style="list-style-type: none"> 1 Check the gas type of the water heater. 2 Check how long the water heater has been installed and in use. 3 Check the installation place. 4 Check the altitude/elevation of area of where the water heater installed. 5 Check the vent length, when the water heater has been installed indoors. 6 Check if there is any blockage in the intake air and/or exhaust. 7 Check if there is dust and lint in burner and heat exchanger, when the water heater has been installed in laundry room. 8 Check if there is grease and dirt in burner and fan motor, when the water heater has been installed in restaurant. 9 Check the manifold pressure in the water heater. 	

Natural of Fault	Diagnosis	Check point
<ul style="list-style-type: none"> • Fluctuation of hot water temperature 	<ol style="list-style-type: none"> 1 Check whether the filter in cold water inlet is cleaned. 2 Check whether the gas supply pressure is adequate. 3 Check for cross connections between cold water lines and hot water lines. 	
	<ol style="list-style-type: none"> 4 Fault of PCB in the water heater <ol style="list-style-type: none"> [1] No voltage to gas solenoid valve (SV₁). Normal: 93 to 120 VDC between COM (blue) & #9 (green) (during operation) [2] No voltage to gas solenoid valve (SV₃). Normal: 93 to 120 VDC between COM (blue) & #73 (red) (during operation) 	C
	<ol style="list-style-type: none"> 5 Gas solenoid valve (SV₁) fault <ol style="list-style-type: none"> [1] Disconnected wiring to gas solenoid valve (SV₁) Normal: 1.35 to 1.65 kΩ between COM (blue) & #9 (green) [2] Disconnected wiring to gas solenoid valve (SV₃) Normal: 2.07 to 2.53 kΩ between COM (blue) & #73 (red) 	C

Natural of Fault	Diagnosis	Check point
<ul style="list-style-type: none"> • Fluctuation of hot water temperature 	6 Fault of PCB in the water heater No voltage flow adjustment valve Normal: 7.0 to 16 VDC between (red-black)	J
	7 Flow adjustment valve fault Normal: 0.09 to 0.2 kΩ between (red-black)	J

Error Code	Malfunction description	Cancellation method
031	Incorrect DIPswitch setting fault	Turn off the power or water supply
	Diagnosis	Check point
	Check the DIPswitch settings on PCB	

Error Code	Malfunction description	Cancellation method
101	Warning for the "991" error code (Refer to section 12-3)	On the PCB, press the INC and DEC buttons simultaneously for 3 sec. Then turn the power off.
	Diagnosis	Check point
	1 Check the gas type of the water heater. 2 Check how long the water heater has been installed and in use. 3 Check the installation location. 4 Check the altitude/elevation of area of where the water heater installed. 5 Check the vent length. 6 Check if there is any blockage in the intake air and/or exhaust. 7 Check if there is dust and lint in burner and heat exchanger, when the water heater has been installed in laundry room. 8 Check if there is grease and dirt in burner and fan motor, when the water heater has been installed in restaurant. 9 Check the manifold pressure in the water heater.	

Error Code	Malfunction description	Cancellation method
<p style="text-align: center; font-weight: bold; font-size: 1.2em;">111</p> <p>Error code is shown after three failed attempts at ignition</p>	Ignition failure	Turn off the power or water supply
	Diagnosis	Check point
	1 Check gas supply and inlet gas pressure (Refer to section 1)	
	2 Check the igniter (Refer to section 10-19) Visual inspection: connection/breakage of wires and/or observed weak spark. [1] Cracks/soot on igniter rod [2] Improper gap between burner & igniter rod Normal gap: 0.16" (4mm) [3] PCB fault Normal: 108 to 132 VAC at #7 (purple-purple) (during ignition)	B
	3 PCB fault [1] No voltage to main gas solenoid valve (MV) Normal: 93 to 120 VDC between COM (blue) & #3 (light blue) (during operation) [2] No voltage to gas solenoid valve (SV ₂) Normal: 93 to 120 VDC between COM (blue) & #53 (orange) (during operation) [3] No voltage to gas proportional valve (VG ₀) Normal: 1.0 to 15 VDC between white & red (during operation)	C
	4 Gas solenoid valve fault [1] Main gas solenoid valve (MV) fault Normal: 1.35 to 1.65 kΩ between COM (blue) & #3 (light blue) [2] Gas solenoid valve (SV ₂) fault Normal: 1.35 to 1.65 kΩ between COM (blue) & #53 (orange) [3] Gas proportional valve (VG ₀) fault Normal: 1.0 to 15 VDC between white & red (during operation)	H1
	5 Disconnected/damaged O.H.C.F. (Refer to section 10-16) Visual inspection: connection/breakage of wires. Normal: 1.0 Ω or less between blue & blue	C
	6 Disconnected/damaged hi-limit switch. (Refer to section 10-14) Visual inspection: connection/breakage of wires. Normal: 1.0 Ω or less between blue & blue	C2
	7 Inspect flame rod [1] Check for any soot on the rod. [2] Check the connection of ground wire; make sure there is firm contact to the ground of the water heater. (in this case, the wire is contacted to the manifold surface.) [3] PCB fault During operation: more than 1 μA through the flame rod wire (orange) [4] Flame rod fault During operation: more than 1 μA through the flame rod wire (orange)	C1
	8 Check if hi-limit switch is properly functioning.	I

Error Code	Malfunction description	Cancellation method	
121 Error code is shown after three failed attempts at ignition	Loss of flame	Turn off the power or water supply	
	Diagnosis		Check point
	1 Check gas supply and pressure (Refer to section 1)		
	2 PCB fault		C
	[1] No voltage to gas main solenoid valve (MV) Normal: 93 to 120 VDC between COM (blue) & #3 (light blue) (during operation)		
	[2] No voltage to gas solenoid valve (SV ₂) Normal: 93 to 120 VDC between COM (blue) & #53 (orange) (during operation)		
	[3] No voltage to gas proportional valve (VG ₀) Normal: 1.0 to 15 VDC between white & red (during operation)		H1
	3 Gas solenoid fault		C
[1] Main gas solenoid valve (MV) fault Normal: 1.35 to 1.65 kΩ between COM (blue) & #3 (light blue)			
[2] Gas solenoid valve (SV ₂) fault Normal: 1.35 to 1.65 kΩ between COM (blue) & #53 (orange)			
[3] Gas proportional valve (VG ₀) fault Normal: 1.0 to 15 VDC between white & red		H1	
4 Check for soot on the flame rod		I	
[1] Clean the flame rod [2] PCB fault During operation: more than 1 μA through the flame rod wire (orange)			
5 Disconnected/damaged O.H.C.F. (Refer to section 10-16) Visual inspection: connection/breakage of wires. Normal: 1.0 Ω or less between blue & blue		C2	
6 Check if hi-limit switch is properly functioning.			
7 Disconnected/damaged hi-limit switch. (Refer to section 10-14) Visual inspection: connection/breakage of wires. Normal: 1.0 Ω or less between blue & blue		C1	

Error Code	Malfunction description	Cancellation method
311	Disconnected/short-circuited outlet thermistor (Only 240 (T-H3J) / 340 (T-H3S) models) Disconnected/short-circuited heat exchanger thermistor (Only 540 (T-H3) models)	Turn off the power or water supply
	Diagnosis	
1 Outlet thermistor / Heat exchanger fault (Refer to section 10-12) Visual inspection: connection/breakage of wires and/or debris on thermistor. Check voltage/resistance between black & black (#113). Refer to Section 8 (A) for proper range of values.		E1

Error Code	Malfunction description	Cancellation method
321	Disconnected/short-circuited inlet thermistor	Turn off the power or water supply
	Diagnosis	Check point
	1 Inlet thermistor fault (Refer to section 10-12) Visual inspection: connection/breakage of wires and/or debris on thermistor. Check voltage/resistance between black & black (#42). Refer to Section 8 (A) for proper range of values.	E2

Error Code	Malfunction description	Cancellation method
331	Disconnected/short-circuited outlet thermistor (Only 540 (T-H3) models)	Turn off the power or water supply
	Diagnosis	Check point
	1 Heat exchanger thermistor fault (Refer to section 10-12) Visual inspection: connection/breakage of wires and/or debris on thermistor. Check voltage/resistance between black & black (#12). Refer to Section 8 (A) for proper range of values.	E3

Error Code	Malfunction description	Cancellation method
341	Disconnected/short-circuited exhaust thermistor (Only Direct Vent Indoor models only)	Turn off the power or water supply
	Diagnosis	Check point
	1 Exhaust thermistor fault (Refer to section 10-13) Visual inspection: connection/breakage of wires and/or debris on thermistor. Check voltage/resistance between white & white. Refer to Section 8 (B) for proper range of values.	K1

Error Code	Malfunction description	Cancellation method
391	Disconnected AFR rod	Turn off the power or water supply
	Diagnosis	Check point
	1 AFR rod fault (Refer to section 10-6) Visual inspection: connection/breakage of wires, soot on it.	I

Error Code	Malfunction description	Cancellation method
441	Flow sensor failure (Only Easy-link system)	Turn off the power or water supply
	Diagnosis	Check point
	1 Flow sensor fault (Refer to section 10-10) Visual inspection: connection/breakage of wires and/or debris on impeller. Check voltage/resistance between (red & black) or (white & black)	H2

Error Code	Malfunction description	Cancellation method
510	Fault of driving circuit for main gas solenoid valve (MV) (The computer checks the condition of the main gas valve immediately after every operation)	Turn off the power supply
	Diagnosis	Check point
	1 PCB and/or main gas valve fault (Refer to section 10-4 & 10-18) Visual inspection of gas valves: connection/breakage of wires. Normal: 93 to 120 VDC between COM (blue) & #3 (light blue) (during operation) Visual inspection of PCB: connection/breakage of wires and/or burn marks on the computer board. 2 Main gas valve fault	C

Error Code	Malfunction description	Cancellation method
551	Fault of driving circuit for any of the gas solenoid valves (SV ₁ , SV ₂ and/or SV ₃) (The computer checks the condition of the solenoid valves 6 hours after every operation)	Turn off the power supply
	Diagnosis	Check point
	1 PCB and/or gas valve fault (Refer to section 10-4 & 10-18) Visual inspection of gas valves: connection/breakage of wires. Normal: 93 to 120 VDC between COM (blue) & #9 (green) (during operation) Normal: 93 to 120 VDC between COM (blue) & #53 (orange) (during operation) Normal: 93 to 120 VDC between COM (blue) & #73 (red) (during operation) Visual inspection of PCB: connection/breakage of wires and/or burn marks on the computer board. 2 Gas solenoid valve fault (SV ₁ , SV ₂ and/or SV ₃)	C

Error Code	Malfunction description	Cancellation method	
611	Fan motor fault	Turn off the power or water supply	
	Diagnosis		Check point
	1 PCB and fan motor fault (Refer to section 10-3 & 10-18) Visual inspection of fan motor: connection/breakage of wires or dust buildup (causing electrical shortage) Normal: 132 to 192 VDC between red & blue (during operation) Normal: 13 to 17 VDC between yellow & blue (during operation) Normal: 2.0 to 6.5 VDC between orange & blue (during operation) Verify fan motor speed of the water heater using the "diagnostics mode" of the controller. (Refer to section 12-1) Visual inspection of PCB: connection/breakage of wires and/or burn marks on the computer board.		G

Error Code	Malfunction description	Cancellation method	
651	Flow adjustment valve fault (Only Easy-link system)	Turn off the power or water supply	
	Diagnosis		Check point
	1 PCB and flow adjustment valve fault (Refer to section 10-9 & 10-18) Visual inspection of flow adjustment valve: connection/breakage of wires, motor drive locked due to scale buildup, and/or water leakage. Normal: 7.0 to 16 VDC between (black-red) Visual inspection PCB: connection/breakage of wires and/or burn marks on the computer board.		J

Error Code	Malfunction description	Cancellation method	
661	Bypass valve fault (Only 540 (T-H3) models)	Turn off the power or water supply	
	Diagnosis		Check point
	1 PCB and bypass valve fault (Refer to section 10-11 & 10-18) Visual inspection of bypass valve: connection/breakage of wires, motor drive locked due to scale buildup, and/or water leakage. Normal: 3.0 to 11 VDC between (brown-red) Visual inspection PCB: connection/breakage of wires and/or burn marks on the computer board.		J1

Error Code	Malfunction description	Cancellation method
701 711	1 PCB fault	(701 error code) Turn off the power or water supply
	[1] Fault of preparation for the outlet thermistor operation.	
	[2] Fault of driving circuit for Gas Proportional Valve(VG ₀)	(711 error code) Turn off the power supply
Diagnosis		Check point
1 Check the PCB and/or gas proportional valve (Refer to section 10-4 & 10-18) Visual inspection PCB: connection/breakage of wires and/or burn marks on the computer board. Visual inspection gas proportional valve: connection/breakage of wires of the gas proportional valve. Normal: 20 to 40 Ω between (white) & (red)		H1

Error Code	Malfunction description	Cancellation method
721	False flame detection	Turn off the power or water supply
	Diagnosis	
	1 False flame detection (5 sec.) 2 Check for damp of flame rod.	I

Error Code	Malfunction description	Cancellation method
741	Miscommunication between water heater and temperature remote controller	Restoring proper cable connections between the water heater and the Remote controller. When the computer detects proper connections between the water heater and the remote controller, "741" error code will cease to display.
	Diagnosis	
	1 Temperature remote controller or PCB fault Normal: 11 to 25 VDC between (white-black) 2 Check for signs of power surges.	F

Error Code	Malfunction description	Cancellation method
751	Miscommunication between water heater and temperature controller (Direct Vent Indoor models only)	When the computer detects proper connections between the water heater and the temperature controller, "751" error code will cease to display.
	Diagnosis	
	1 Temperature controller or PCB fault Normal: 11 to 25 VDC between (white-black) 2 Check for signs of power surges.	Check point L

Error Code	Malfunction description	Cancellation method
761	Miscommunication between Parent and Child units for Easy-Link systems	Restoring proper cable connections among all the water heaters. When the computer detects proper connections among all the water heaters, "761" error code will cease to display.
	Diagnosis	
	1 Inspect cable connections between Parent and Child units. Normal: 15 VDC between (black-white) (during Easy-link operation) 2 Check for signs of power surges.	Check point D1 and D2

Error Code	Malfunction description	Cancellation method
941	Abnormal exhaust temperature (Direct Vent Indoor models only)	Turn off the power or water supply
	Diagnosis	Check point
	1 Check how long the water heater has been installed and in use. 2 Check the vent length. 3 Check if there is any blockage in the intake air and/or exhaust. 4 Check if there is dust and lint in burner and heat exchanger, when the water heater has been installed in laundry room. 5 Check the manifold pressure in the water heater. 6 Check if the set temperature is higher than 140°F (60°C) and the system is recirculation. Recirculation system with high temperature settings (above 140°F) can lead to this error code.	K1 K2

Error Code	Malfunction description	Cancellation method
991	Imperfect combustion (Refer to section 12-3)	Turn off the power or water supply If not possible, press and hold the INC and DEC buttons on the computer board simultaneously for more than 3 sec.
	Diagnosis	Check point
	1 Check the gas type of the water heater. 2 Check how long the water heater has been installed and in use. 3 Check the installation place. 4 Check the altitude/elevation of area of where the water heater installed. 5 Check the vent length. 6 Check if there is any blockage in the intake air and/or exhaust. 7 Check if there is dust and lint in burner and heat exchanger, when the water heater has been installed in laundry room. 8 Check if there is grease and dirt in burner and fan motor, when the water heater has been installed in restaurant. 9 Check the manifold pressure in the water heater.	

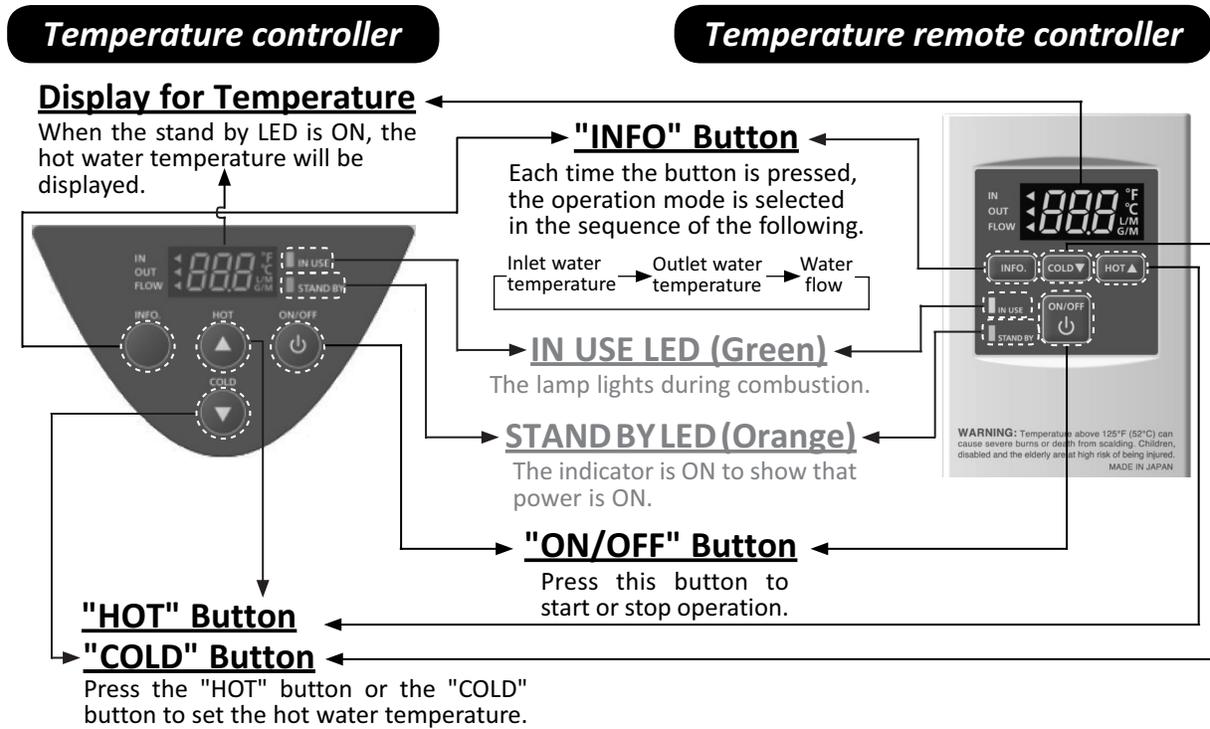
12. Controls and settings

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12-1. Diagnosis using the temperature controller and temperature remote controller

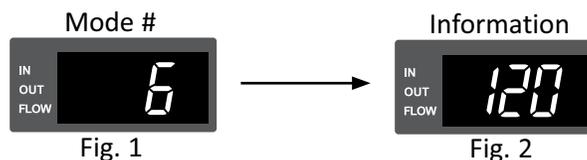
TEMPERATURE CONTROLLER and TEMPERATURE REMOTE CONTROLLER

The illustration below shows an example of the controllers. The exact display may differ from examples.



< Individual unit >

1. Press the "HOT" button and the "COLD" button simultaneously for at least 5 seconds to enter "Diagnostic mode".
2. Scroll up or down to the needed information (mode #) of the water heater by pressing the "HOT" or "COLD" buttons (Fig.1 shows mode #6 being selected.)
When selecting information, please refer to the table on p. 61-62 for the proper mode #.
3. Press the "INFO" button to select the mode #, and the information to which the mode # correlates to will display on the controller. (Fig.2)
4. When the "ON/OFF" button is pressed or 30 minutes have elapsed without pressing any buttons, the display will return to normal.



For example, the figures above show how to arrive at the outlet temperature information.

< For multiple units in an Easy-Link system >

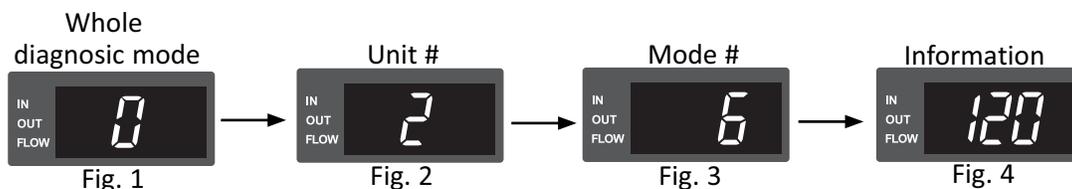
1. Press and hold the "HOT" and "COLD" buttons simultaneously for at least 5 seconds to enter "Diagnostics Mode".
2. "0" will be displayed on the controller. (See Fig. 1)
3. Scroll to the desired 540 (T-H3) unit # in the easy-link system by pressing the "HOT" or the "COLD" buttons to scroll up or down. (Fig. 2 shows that unit #2 is being selecting)

NOTE: The definition of the unit #'s:

"0" will yield information about the Easy-link system as a whole, and "1" will yield information about the parent unit, "2", "3", & "4" will yield information about each of the individual 540 (T-H3) models installed in the Easy-link system.

In an Easy-link system of 540 (T-H3) models, a maximum of four units of the water heaters can be linked together.

4. Press the "INFO" button to select the desired unit #.
5. When the desired unit # is selected and fixed, scroll up or down to the needed information (mode #) of the unit by pressing the "HOT" or "COLD" buttons. (Fig.3 shows mode #6 is being selected.) **When selecting information, please refer to the table on p.61-62 for the proper mode #.**
6. Press the "INFO" button to select the mode #, and information to which the mode # correlates to will display on the controller. (Fig. 4)
7. When the "ON/OFF" button is pressed or 30 minutes have elapsed without pressing any buttons, the display will return to normal.



For example, the figures above show how to arrive at the outlet temperature information for Unit #2 in an Easy-Link System.

NOTICE

- Although the controller of the parent unit will display the set temperature at the Easy-Link system, the controller of the child unit will not display the set temperature.
- The controller means the temperature controller and the temperature remote controller.

Description of mode numbers in “Diagnostics Mode”

Mode #	Whole multi-unit system information (#0)		Unit information (#1 to #4)	
1	Total system flow rate	0 to 999 (GPM)	Total operation time	0 to 999 (x 100 hours)
2	BTU requirement for the multi-system	0 to 999 (xkBTU/h)	ON/OFF cycles	0 to 999 (x 1,000 cycles)
3	Quantity of connected water heaters	1 to 4 (units)	Fan motor speed	0 to 999 (x 10 rpm)
4	Priority water heater unit	1 to 4 (unit #)	Inlet temperature	32 to 212 (°F). Over 212 °F = E5, Under 32 °F = E0
5	Quantity of operational water heaters	0 to 4 (units)	Heat exchanger temperature (540 (T-H3) models only)	
6	Set temperature	100 to 185 °F	Outlet temperature	
7	Operation time during current rotation	0 to 720 (minutes). After 720, the next rotation occurs	Air-Fuel ratio rod current	0 to 999 (µA)
8	ON/OFF cycles during current rotation	0 to 100 (cycles). After 100, the next rotation occurs	Flow rate	0 to 999 (x 0.1 GPM)
9	N/A		Energization time of unit	0 to 999 (x 100 hours)
10			Integrating flow of unit	0 to 999 (x 10,000 gallons)
11			Error code history: displays most recent error code	
12	Inlet temperature of the priority unit	32 to 212 (°F). Over 212 °F = E5, Under 32 °F = E0	Error code history: displays 2nd most recent error code	
13	Outlet temperature of the priority unit		Error code history: displays 3rd most recent error code	
14	N/A		Clears memory in error code history*	
15			Integrating output of unit	0 to 999 MBTU/h
16			Air-fuel ratio stage	0 to 16, normal condition=6
17			Exhaust temperature (Direct Vent Indoor models only)	32 to 212 (°F). Over 212 °F = E5, Under 32 °F = E0
18			N/A	

Mode #	Whole multi-unit system information (#0)	Unit information (#1 to #4)	
19	N/A	Bypass valve position**	0 to 999 (x 10 steps) closed position = 0
20		Ratio of hot water and cold water**	0 to 999 (%)
21		N/A	
22		N/A	
23		N/A	
24		N/A	
25		EEPROM Initialization Initializes current of gas proportional valve and fan motor speed*	
26		Current value of proportional valve	0 to 999 (mA)
27		The number of combustion stages (The water heater has 4 stages for combustion.)	"1" means 1st stage "2" means 2nd stage "3" means 3rd stage "4" means 4th stage "0" means No burning
28		N/A	
29		Estimated output from computer board	0 to 999 (kBTU/h)
30		Actual output of unit	0 to 999 (kBTU/h)
31		N/A	
32		N/A	

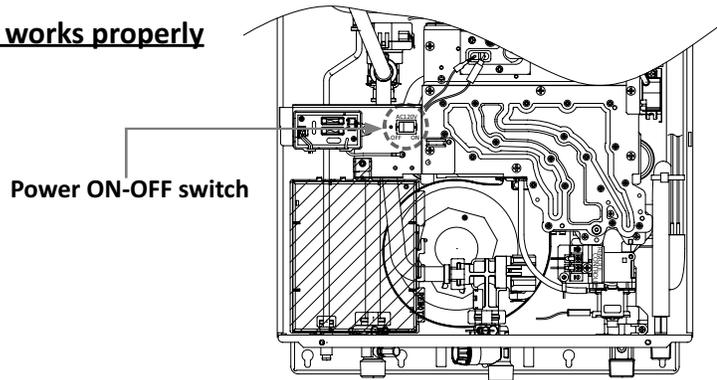
***EEPROM Initialization of water heater's computer:** Press the "INFO" button on the controller while in mode# 14 and mode# 25 for at least 3 seconds to completely clear the memory in the error code history.

**540 (T-H3) models only

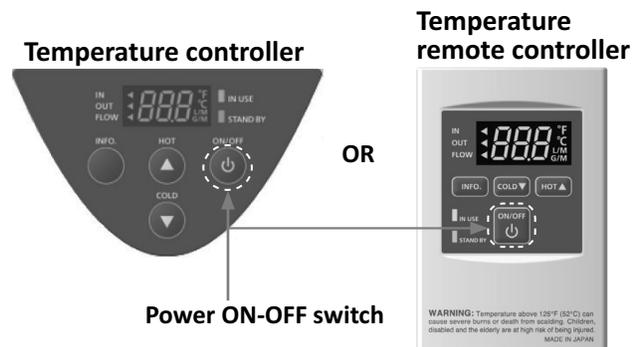
12-2. Verifying functionality of computer board

A. How to check if the computer board works properly

1. Check the power ON-OFF switch of the water heater.
The factory setting is ON position.

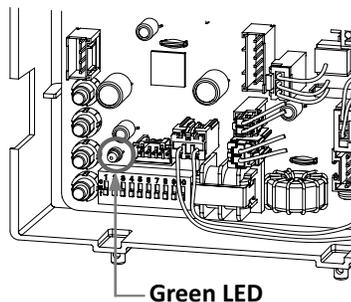


2. Turn on the ON/OFF button of either the temperature controller or the temperature remote controller.

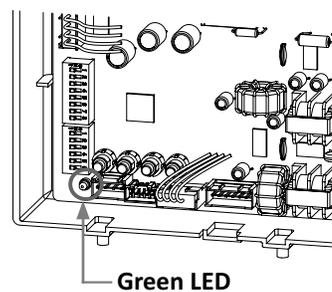


3. If the computer board works properly, the green LED on the computer board will light up.

240 (T-H3J) / 340 (T-H3S) models computer board



540 (T-H3) models computer board



B. Data backup function of the temperature remote controller

The temperature remote controller has a backup function which allow the data was stored in the computer, can be transferred to the temperature remote controller. When the computer board is replaced, the stored data is transferred automatically to a new computer board by the temperature remote controller.



Do not exchange both the controller and the computer board simultaneously.

12-3. Displaying error code history, Clearing error code history memory and Display patterns for error codes

Displaying error code history

Check the mode #11 to 13 of "Diagnostic Mode" of the controller. (Refer to section 12-1)



Temperature controller

Clearing error code history memory

Check the mode #14 of "Diagnostic Mode" of the controller. (Refer to section 12-1)



Temperature remote controller

Display patterns for error codes

The green LED will blink in the patterns shown below when the water heater has an error code. When the water heater does not have an error code and is operating under normal conditions, the green LED will remain solidly lit during operation and will remain completely OFF during stand-by. **For details on the error code, refer to p.47 - 57.**

Error code	Green LED
031, 701, 711	
311, 321, 331, 341, 391, 441	
111, 121	
611, 651, 661	
101, 941, 991	
510, 551, 721	

0.5 sec. ON, 0.5 sec. OFF 3 sec.

Green LED	Error Indication on the controller	Green LED	Error Indication on the controller
Blinking one time	031	Blinking three times	111 121
	701		611
	711		651
Blinking two times	311	Blinking four times	661
	321		101 941
	331	Blinking five times	991
	341		510
	391		551
	441	Blinking six times	721

12-4. Clearing the “101” and “991” error code

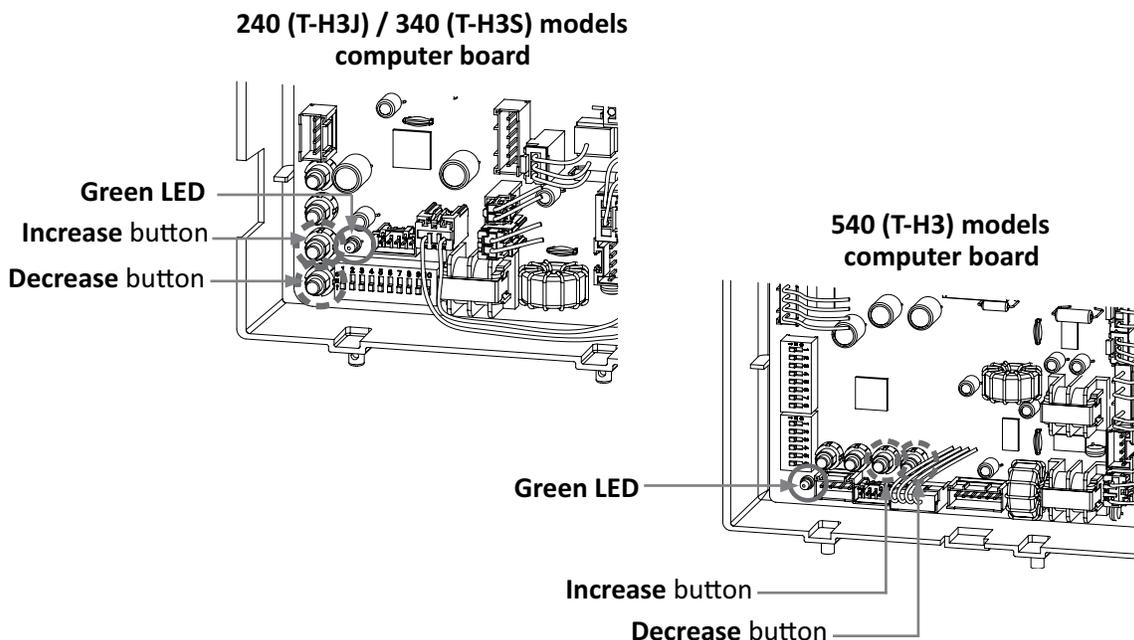
The “101” and “991” error codes signify imperfect (abnormal) combustion, caused by insufficient intake air and/or obstructions in the exhaust.

A. If the “101” and “991” error code occurs, please check the following:

1. What is the gas-type of the water heater: propane or natural gas?
2. How long has the water heater been installed and been in use?
3. Where is the water heater installed: indoor, outdoor, attic, etc?
4. What is the altitude/elevation of the area of installation?
5. Are there any obstructions in the intake air and/or exhaust?
 - Damper sticking.
 - Vent Flaps installed on the Terminator.
 - Snow build up around Terminator.
 - Installed in a closet. (No Ventilation or lack of combustion air)
6. If installed in laundry room, check the burner and heat exchanger. Dust and lint may deposit in burner and heat exchanger.
7. If installed in restaurant, check the burner and fan motor. Grease and dirt may deposit in burner and fan motor.
8. Check if the manifold pressure of the water heater is too high.

B. How to clear the “101” and “991” error code (after resolving the main root cause of the error):

Turn off the controller. On the computer board, press and hold the “Increase” and “Decrease” buttons simultaneously for at least 3 seconds until the red light turns on. Turn off the 120 VAC by Power ON-OFF switch and turn back on. The “101” and “991” error code should then be cleared.



12-5. AFR rod function

<Function>

The AFR rod checks flame conditions during combustion. When the AFR rod detects unexpected flame conditions, the computer board of the water heater adjusts the fan motor speed to ensure that air and fuel are always at a proper mixture ratio, minimizing emissions.

< AFR normal range of values >

240 (T-H3J) models

Installation type		Direct vent		Outdoor	
Gas type		Propane	Natural gas	Propane	Natural gas
Combustion mode	MAX	12.0 to 35.0	23.6 to 58.0	6.0 to 41.0	17.1 to 55.0
	MIN	5.0 to 20.0	3.5 to 11.0	3.0 to 15.0	3.8 to 19.0

340 (T-H3J) models

Installation type		Direct vent		Outdoor	
Gas type		Propane	Natural gas	Propane	Natural gas
Combustion mode	MAX	19.0 to 52.0	24.6 to 65.0	7.0 to 47.0	21.4 to 56.0
	MIN	5.0 to 20.0	3.5 to 11.0	3.0 to 15.0	3.8 to 19.0

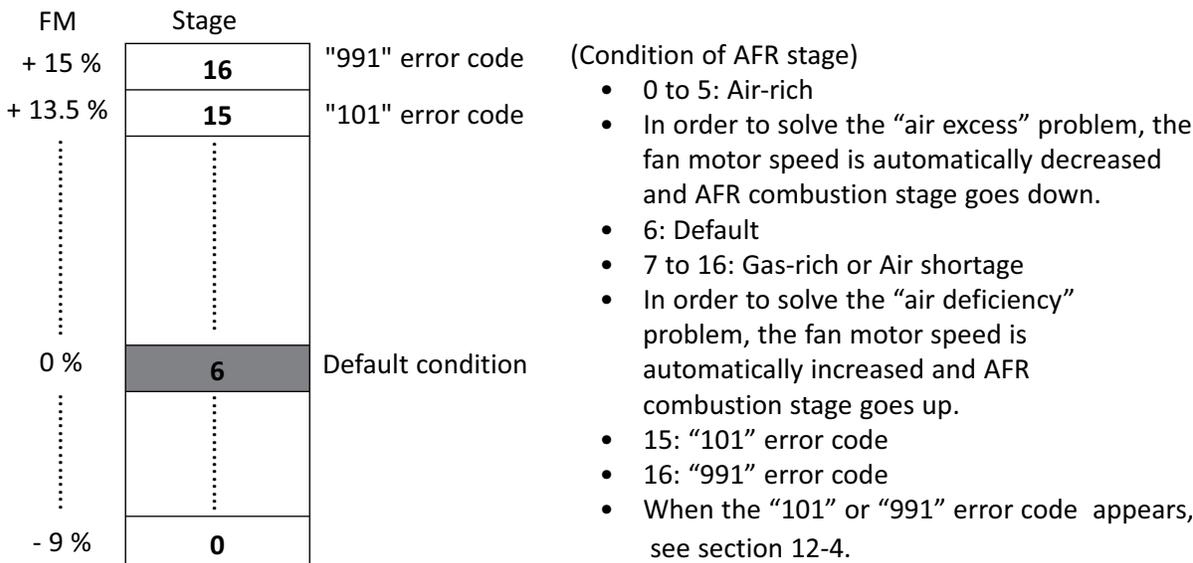
540 (T-H3) models

Installation type		Direct vent		Outdoor	
Gas type		Propane	Natural gas	Propane	Natural gas
Combustion mode	MAX	20.0 to 57.0	26.2 to 78.0	7.0 to 48.0	22.3 to 60.0
	MIN	5.0 to 20.0	3.5 to 11.0	3.0 to 15.0	3.8 to 19.0

- If the detected AFR value is higher than the normal value, the FM speed is increased.
- If the AFR value is lower than the normal value, the FM speed is decreased.
- **These values are read with the front cover close.**
- Measure the values after the water heater for ten minutes.

*The AFR stage can be confirmed in "Diagnostic Mode". (Section 12-1)

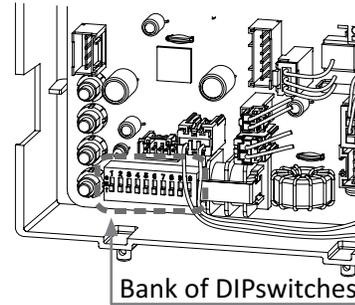
<The relationship between the AFR stage and the "101" and "991" error codes>



12-6. DIPswitch settings

The 240 (T-H3J) /340 (T-H3S) Indoor shares the computer board with the 240 (T-H3J) /340 (T-H3S) Outdoor. The DIPswitches have certain special functions as shown on the following table and generally should not need adjustment. Carefully verify the functions of each DIPswitch before changing any settings.

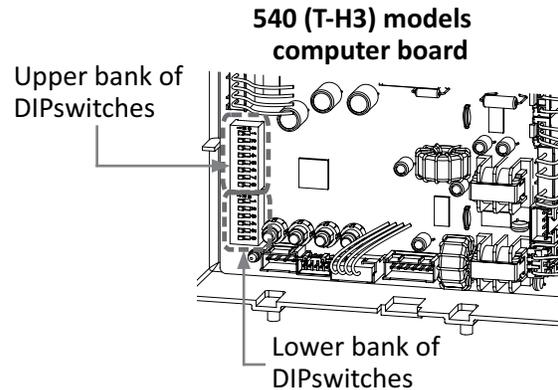
**240 (T-H3J) and 340 (T-H3S) models
Computer board**



240 (T-H3J) / 340 (T-H3S) models

No.	Functions	ON position	OFF position																																																																																
1	Gas type	Propane	Disable																																																																																
2		Natural gas	Disable																																																																																
3	FM+, FM- and Input- (FM speed is increased automatically. See section 12-13)	<table border="1"> <thead> <tr> <th colspan="10">DEFAULT</th> </tr> <tr> <th>ON</th> <th>1</th><th>2</th><th>3</th><th>4</th><th>5</th><th>6</th><th>7</th><th>8</th><th>9</th><th>10</th> </tr> </thead> <tbody> <tr> <td></td> <td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td> </tr> <tr> <th>OFF</th> <td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td> </tr> <tr> <td colspan="11" style="text-align: center;"> No.3: OFF NO.4: OFF No.5: OFF </td> </tr> </tbody> </table>		DEFAULT										ON	1	2	3	4	5	6	7	8	9	10		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	OFF	<input type="checkbox"/>	No.3: OFF NO.4: OFF No.5: OFF																																													
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6	Installation settings	<table border="1"> <thead> <tr> <th colspan="4">Vent settings (Direct vent Indoor models only)</th> </tr> <tr> <th>3" ventings</th> <th>5 to 20 ft (DEFAULT)</th> <th>21 to 40 ft</th> <th>41 to 70 ft</th> </tr> </thead> <tbody> <tr> <td>4" ventings</td> <td>5 to 50 ft (DEFAULT)</td> <td>51 to 100 ft</td> <td>N/A</td> </tr> <tr> <td></td> <td>ON <input type="checkbox"/> <input type="checkbox"/></td> <td>ON <input type="checkbox"/> <input type="checkbox"/></td> <td>ON <input type="checkbox"/> <input type="checkbox"/></td> </tr> <tr> <td></td> <td>OFF <input type="checkbox"/> <input type="checkbox"/></td> <td>OFF <input type="checkbox"/> <input type="checkbox"/></td> <td>OFF <input type="checkbox"/> <input type="checkbox"/></td> </tr> <tr> <td></td> <td>No. 6 : ON No. 7 : OFF</td> <td>No. 6 : OFF No. 7 : OFF</td> <td>No. 6 : ON No. 7 : ON</td> </tr> </tbody> </table>		Vent settings (Direct vent Indoor models only)				3" ventings	5 to 20 ft (DEFAULT)	21 to 40 ft	41 to 70 ft	4" ventings	5 to 50 ft (DEFAULT)	51 to 100 ft	N/A		ON <input type="checkbox"/>	ON <input type="checkbox"/>	ON <input type="checkbox"/>		OFF <input type="checkbox"/>	OFF <input type="checkbox"/>	OFF <input type="checkbox"/>		No. 6 : ON No. 7 : OFF	No. 6 : OFF No. 7 : OFF	No. 6 : ON No. 7 : ON	<table border="1"> <thead> <tr> <th colspan="10">Outdoor models</th> </tr> <tr> <th>ON</th> <th>1</th><th>2</th><th>3</th><th>4</th><th>5</th><th>6</th><th>7</th><th>8</th><th>9</th><th>10</th> </tr> </thead> <tbody> <tr> <td></td> <td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td> </tr> <tr> <th>OFF</th> <td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td> </tr> <tr> <td colspan="11" style="text-align: center;"> No. 6 : OFF No. 7 : ON </td> </tr> </tbody> </table>		Outdoor models										ON	1	2	3	4	5	6	7	8	9	10		<input type="checkbox"/>	OFF	<input type="checkbox"/>	No. 6 : OFF No. 7 : ON																												
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9	Output temperature settings (Default 120 °F)	140 °F (60 °C)	120 °F (49 °C) (Default)																																																																																
10	Deactivation of the exhaust temperature control (This switch is for a specialized purposes only)	Enable	Disable (Default)																																																																																

The 540 Indoor (T-H3-DV) shares the computer board with the 540 Outdoor (T-H3-OS). There are two banks of DIPswitches (upper and lower bank) on the computer board. The upper bank has certain special functions as shown on the following table and generally should not need adjustment. Carefully verify the functions of each DIPswitch before changing any settings.



540 (T-H3) models

The upper bank of DIPswitches

No.	Functions	ON position	OFF position																
1	Gas type	Propane	Disable																
2		Natural gas	Disable																
3	Installation settings	Set DIPswitches shown in the table above depending on the vent length.																	
4		Set DIPswitches shown in the table below.																	
<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th colspan="4">Vent settings (Direct vent Indoor models only)</th> </tr> <tr> <th>3" ventings</th> <th>5 to 20 ft (DEFAULT)</th> <th>21 to 40 ft</th> <th>41 to 70 ft</th> </tr> </thead> <tbody> <tr> <td>4" ventings</td> <td>5 to 50 ft (DEFAULT)</td> <td>51 to 100 ft</td> <td>N/A</td> </tr> <tr> <td></td> <td> ON: OFF: No. 3 : ON No. 4 : OFF </td> <td> ON: OFF: No. 3 : OFF No. 4 : OFF </td> <td> ON: OFF: No. 3 : ON No. 4 : ON </td> </tr> </tbody> </table>				Vent settings (Direct vent Indoor models only)				3" ventings	5 to 20 ft (DEFAULT)	21 to 40 ft	41 to 70 ft	4" ventings	5 to 50 ft (DEFAULT)	51 to 100 ft	N/A		ON: OFF: No. 3 : ON No. 4 : OFF	ON: OFF: No. 3 : OFF No. 4 : OFF	ON: OFF: No. 3 : ON No. 4 : ON
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	ON: OFF: No. 3 : ON No. 4 : OFF	ON: OFF: No. 3 : OFF No. 4 : OFF	ON: OFF: No. 3 : ON No. 4 : ON																
5	N/A	N/A	N/A (Default)																
6	Deactivation of the exhaust temperature control (This switch is for a specialized purposes only)	Enable	Disable (Default)																
7	Allow adjustments of fan motor speed (Changing the FM speed is similar to changing the manifold pressure. See section 12-15)	Enable	Disable (Default)																
8	Deactivation of the freeze protection firing system	Enable	Disable (Default)																

The lower bank of DIPswitches

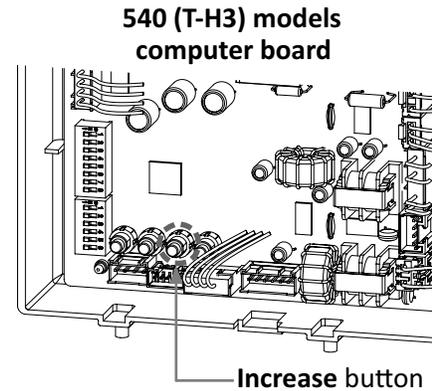
No.	Functions	ON position	OFF position														
1	Parent/Child setting for Easy-Link systems	Parent	Child (Default)														
2 3 4	FM+, FM- and Input- (FM speed is increased automatically. See section 12-13)		<div style="border: 1px solid black; padding: 5px; width: fit-content; margin: auto;"> <p style="text-align: center; margin: 0;">DEFAULT</p> <table style="margin: 0 auto; border-collapse: collapse;"> <tr> <td style="padding: 2px 5px;">ON</td> <td style="border: 1px solid black; width: 15px; height: 15px; text-align: center;">1</td> <td style="border: 1px solid black; width: 15px; height: 15px; text-align: center;">2</td> <td style="border: 1px solid black; width: 15px; height: 15px; text-align: center;">3</td> <td style="border: 1px solid black; width: 15px; height: 15px; text-align: center;">4</td> <td style="border: 1px solid black; width: 15px; height: 15px; text-align: center;">5</td> <td style="border: 1px solid black; width: 15px; height: 15px; text-align: center;">6</td> </tr> <tr> <td style="padding: 2px 5px;">OFF</td> <td style="border: 1px solid black; width: 15px; height: 15px; background-color: black;"></td> <td style="border: 1px solid black; width: 15px; height: 15px; background-color: black;"></td> <td style="border: 1px solid black; width: 15px; height: 15px; background-color: black;"></td> <td style="border: 1px solid black; width: 15px; height: 15px;"></td> <td style="border: 1px solid black; width: 15px; height: 15px;"></td> <td style="border: 1px solid black; width: 15px; height: 15px;"></td> </tr> </table> <p style="margin: 5px 0 0 20px;">No.2: OFF NO.3: OFF No.4: OFF</p> </div>	ON	1	2	3	4	5	6	OFF						
ON	1	2	3	4	5	6											
OFF																	
5	Output temperature settings (Default 120 °F)	140 °F (60 °C)	120 °F (49 °C) (Default)														
6	Easy-link connections with previous models (See section 12-12)	Enable	Disable (Default)														

12-7. Assigning unit numbers in the Easy-link system Only 540 (T-H3) models

A. How to display the unit number

Press the “Increase” button on the computer board of **child unit**. The controller of the child unit will then display the assigned number for that 540 (T-H3) unit for 10 sec.

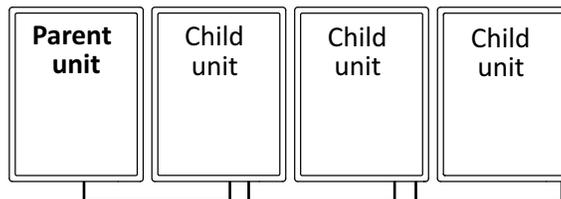
NOTE: In a single-unit installation, the numbering system is disabled.



B. How to reset and reconfigure the numbering of units

Unit #'s can be reset and reassigned manually:

	Operation	Screen on the controller
1.	Press and hold the “Increase” button on the computer board of the parent unit for at least 5 seconds.	
2.	The green LED on the computer board of the parent unit will be blinking for 10 seconds.	
3.	The controller of the child unit will display “000” to signify for 10 sec that the computer memory has been erased of its previously assigned unit #.	
4.	Press and hold the "Increase" button on each child unit in the new order of your choosing. The new unit numbers will be assigned in this order.	



- Each 540 (T-H3) models in an Easy-link system is assigned a random unit #, except for the Parent unit, which is always assigned as unit #1.
- When more than four units of the 540 (T-H3) models are connected in an Easy-link system, only the first four units will work as a system. The remaining units will not operate.

12-8. (A) ON/OFF conditions: Overview

The following table shows the ON/OFF conditions of the water heater.

ON / OFF Conditions	
Conditions needed to turn ON.	The BTU requirement is more than 29,800 BTU/h OR Inlet water temperature is lower 5.4 °F than the set temperature and BTU requirement is more than 14,880 BTU/h AND The water flow rate is more than 0.5 GPM OR The water flow rate is more than 0.8 GPM (Only 135 °F (57 °C))
Conditions needed to turn OFF.	The BTU requirement is lower than 11,900 BTU/h AND *Inlet temperature is higher than the temperature that is -18 °F below the set temperature. OR Inlet temperature is higher than the set temperature OR Heat exchanger temperature is over 194 °F OR The water flow rate is less than 0.4 GPM OR The water flow rate is less than 0.5 GPM (Only 135 °F (57 °C))

*Only if the set temperature is below 115 °F (46 °C).

12-8. (B) ON/OFF conditions: BTU requirements

A. Calculating the ON/OFF conditions of the water heater

"Condition needed to turn the water heater ON"

$$(T_{\text{set}} - T_{\text{in}}) \times \text{GPM} \times 500 > 14,880$$

"Condition needed to turn the water heater OFF"

$$(T_{\text{set}} - T_{\text{in}}) \times \text{GPM} \times 500 < 11,900 \text{ or } T_{\text{in}} = T_{\text{set}}$$

Where: T_{set} = Set temperature and T_{in} = Inlet temperature

B. Calculation example

Set temperature: $T_{\text{set}} = 120^{\circ}\text{F}$ Flow rate = 2.5 GPM

"Condition needed to turn the water heater ON"

$$(120 - T_{\text{in}}) \times 2.5 \times 500 > 14,880 \quad T_{\text{in}} < 108.1^{\circ}\text{F}$$

"Condition needed to turn the water heater OFF"

$$(120 - T_{\text{in}}) \times 2.5 \times 500 < 11,900 \quad T_{\text{in}} > 110.5^{\circ}\text{F}$$

The output temperature at that moment will be 120°F

C. ON/OFF table

Set temperature (°F)		Flow rate (GPM)							
		0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0
100	ON	40.5	70.2	80.2	85.1	88.1	90.1	91.5	92.6
	OFF	52.4	76.2	84.1	88.1	90.5	92.1	93.2	94.0
110	ON	50.5	80.2	90.2	95.1	98.1	100.1	101.5	102.6
	OFF	62.4	86.2	94.1	98.1	100.5	102.1	103.2	104.0
120	ON	60.5	90.2	100.2	105.1	108.1	110.1	111.5	112.6
	OFF	72.4	96.2	104.1	108.1	110.5	112.1	113.2	114.0
130	ON	70.5	100.2	110.2	115.1	118.1	120.1	121.5	122.6
	OFF	82.4	106.2	114.1	118.1	120.5	122.1	123.2	124.0
140	ON	80.5	110.2	120.2	125.1	128.1	130.1	131.5	132.6
	OFF	92.4	116.2	124.1	128.1	130.5	132.1	133.2	134.0
150	ON	90.5	120.2	130.2	135.1	138.1	140.1	141.5	142.6
	OFF	102.4	126.2	134.1	138.1	140.5	142.1	143.2	144.0
160	ON	100.5	130.2	140.2	145.1	148.1	150.1	151.5	152.6
	OFF	112.4	136.2	144.1	148.1	150.5	152.1	153.2	154.0
175	ON	115.5	145.2	155.2	160.1	163.1	165.1	166.5	167.6
	OFF	127.4	151.2	159.1	163.1	165.5	167.1	168.2	169.0
185	ON	125.5	155.2	165.2	170.1	173.1	175.1	176.5	177.6
	OFF	137.4	161.2	169.1	173.1	175.5	177.1	178.2	179.0

12-9. Multi-unit system ON/OFF conditions

Only 540 (T-H3) models

In an Easy-Link system, the amount of 540 (T-H3) models called on to activate depends on the **FLOW RATE** and the **SET TEMPERATURE**.

1. Condition required to activate an additional 540 (T-H3) models:

Flow rate required to activate additional 540 (T-H3) models = A × n

Where **n** = number of currently activated 540 (T-H3) models

and **A** is dependent on the set temperature. See table below:

Set temperature		Factor "A"	
°F	°C	GPM	L / min
100 - 120	38 - 49	3.4	13
125 - 130	52 - 54	3.2	12
135 - 140	57 - 60	2.9	11
145	63	2.6	10
150 - 185	66 - 85	2.4	9

2. Condition required to reduce the number of activated 540 (T-H3) models:

A. In the case of reducing down from two units of 540 (T-H3) models to one unit of 540 (T-H3) models:

Flow rate = A / 1.7

B. All other cases: Flow rate = A × (n - 2)

3. Example: Set temperature = 120 °F in a four unit system and priority unit is No. 1

**To activate additional
540 (T-H3) models**

Unit No.	Factor "A"	
	GPM	L / min
No.1 ON	0.5	1.9
No.2 ON	3.4	13
No.3 ON	6.8	26
No.4 ON	10.2	39

**To reduce number of activated
540 (T-H3) models**

Unit No.	Factor "A"	
	GPM	L / min
No.4 ON	6.8	26
No.3 ON	3.4	13
No.2 ON	2.0	7.6
No.1 ON	0.37	1.5

12-10. Operation time for unit rotation **Only 540 (T-H3) models**

The unit that turns on first is whichever unit the 540 (T-H3) models decides is the primary unit. The priority unit will rotate when it reaches 100 ON/OFF cycles or after 12 hours of operation.

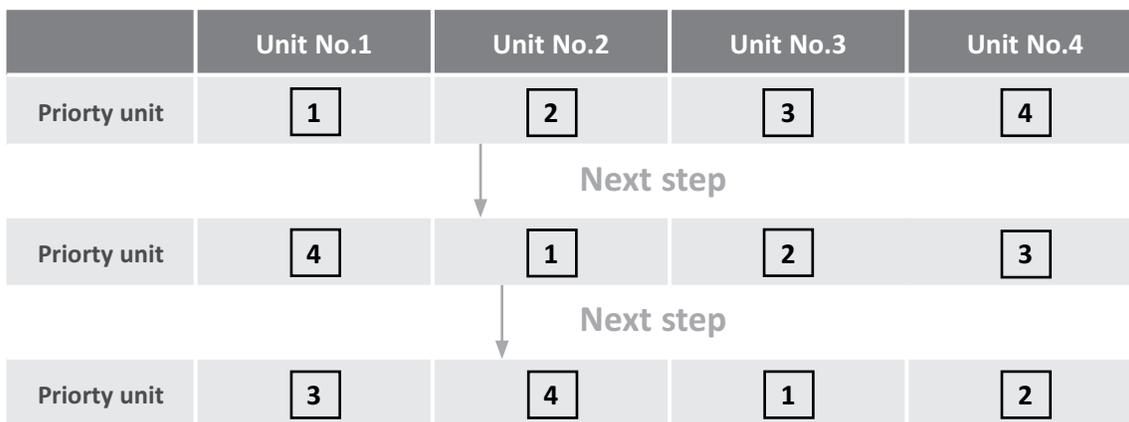
NOTE: The priority unit is the unit that turns on first when there is a hot water demand.

When there is a black out and/or cut off for over 50 minutes, priority unit will switch back to Unit #1.

Example: Four units of 540 (T-H3) models Rotation

A rotation occurs when:

ON/OFF cycles (×100 times) or Hours of operation (12 hours)



12-11. Individual unit operation in easy-link system while parent unit is under abnormal conditions (Individual operation mode)
Only 540 (T-H3) models

In an easy-link system, if a parent unit undergoes abnormal conditions, the 540 (T-H3) models can operate as individual units. If this happens, the minimum flow rate of the system changes from 0.5 GPM to 0.5 GPM multiplied by the number of the 540 (T-H3) models. Refer to the following example:

Ex: Minimum flow rate of a four unit easy-link system.

Under normal conditions: 0.5GPM

When the parent unit fails: $0.5 \times 4 = 2.0$ GPM

- Minimum flow rate of the easy-link system depends on the number of the units installed in the easy-link system.
- The set temperature of each unit individual is the set temperature before the failed communication happened between child unit and parent unit.

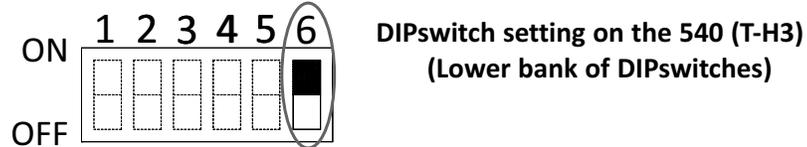
12-12. Easy-Link connections with previous models

The 540 (T-H3) can be connected with the previous models ; 520 (T-H2).

A. DIPswitch setting on the computer board of the 540 (T-H3)



If a Easy-link system contains a 520 (T-H2), change DIPswitch No.6 on the lower bank all of the 540 (T-H3) computer board to the "ON" position.



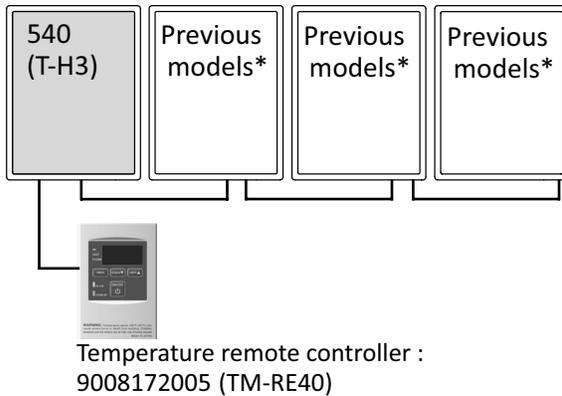
The dark square is the direction the DIPswitch should be set to.

B. Basic diagram of connections between the Easy-Link system units

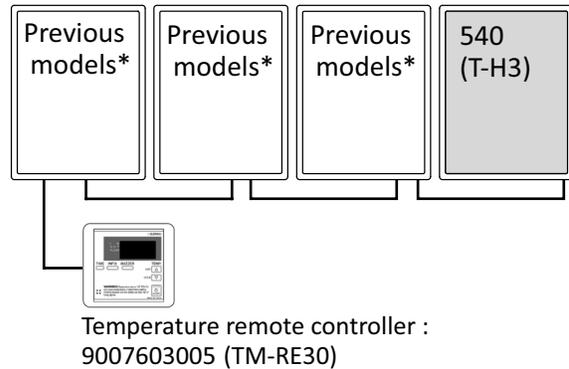
*The previous models indicates a 520 (T-H2).

Example of correct connections

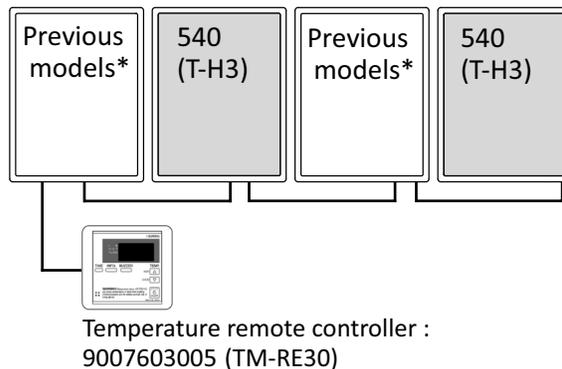
Case 1



Case 2



Case 3



C-1. Temperature settings

When the 540 (T-H3) is connected with any 520 (T-H2) as part of an Easy-Link system, the available set temperatures will default to what is available on a 520 (T-H2) (from 100 °F to 175 °F/185 °F as shown below).



CAUTION

- Although 540 (T-H3) can be connected with the temperature remote controller 9008172005 (TM-RE40), it cannot be connected with the temperature remote controller 9007603005 (TM-RE30).
- Although 520 (T-H2) can be connected with the temperature remote controller 9007603005 (TM-RE30), these cannot be connected with the temperature remote controller 9008172005 (TM-RE40).

Temperatures available under the Normal Temperature Mode*

°F	100	105	110	115	120	125	130	135	140	145	150	155	160	165	170	175
°C	38	40	43	45	50	52	55	57	60	63	65	68	70	75	77	80

*Factory setting (Default): 120 °F

Temperatures available under the High Temperature Mode*

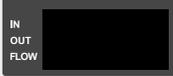
°F	110	115	120	125	130	135	140	145	150	155	160	165	170	175	180	185
°C	43	45	50	52	55	57	60	63	65	68	70	75	77	80	82	85

*Factory setting (Default): 120 °F

See next page for details.

HIGH TEMPERATURE MODE

 **CAUTION** The following procedure apply only to case 1 of B. (Refer to P.76)

	Operation	Screen
1.	Turn on the 120 VAC power supply to the unit.	
2.	Press the "ON/OFF" button on the remote in order to turn the controller off.	
3.	Press the "INFO" button for at least 3 seconds.	
4.	If the "HI" display on its screen, you can set the high temperature mode. If the "Lo" display on its screen, you can set the default mode.	 or 
5.	After 5 seconds, the display will return to normal.	
6.	Press the "ON/OFF" button on the remote in order to turn the controller on.	
7.	Press the "HOT" button or the "COLD" button to set the temperature setting of the unit.	
	(Increasing temperature, example 140 °F to 145 °F) Press the "HOT" button to set 140 °F. Simultaneously press and hold the "HOT" and "INFO" buttons for at least 3 seconds. It shows the 145 °F on its display. The display will be blinking for 10 seconds and set.	 
8.	You can set the temperature from 100 °F (37 °C) to 185 °F (85 °C).	

D. Diagnostic mode with previous models

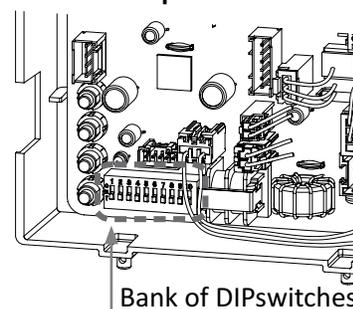
When the 540 (T-H3) is connected with 520 (T-H2) as part of an Easy-Link system, you can normally see the "Diagnostics Mode". However, if the 540 (T-H3) is connected with T-H2, it have to be careful. Because the "Diagnostics Mode" for 520 (T-H2) is different from 540 (T-H3).

12-13. High-Altitude Region Support Functions

<Using these functions>

The high-altitude region support functions have four operation levels, with the appropriate level being set up by the installer until the abnormal sound problem is solved. The desired level can be specified at the bank of DIPswitches (No.3 , No.4 and No.5) on the computer board. See the table below.

240 (T-H3J) and 340 (T-H3S) models
Computer board



Indoor models of 240 (T-H3J) / 340 (T-H3S) : Propane

Level	Elevation	Output reduction	Fan motor speed change	DIPswitch settings		
				No.3	No.4	No.5
0	0 (DEFAULT)	N/A	N/A	OFF	OFF	OFF
1	Up to 2,500 ft	N/A	3 %	OFF	ON	OFF
2	Up to 5,000 ft	-8 %	5 %	ON	ON	OFF
		-11 %	7 %	OFF	OFF	ON
3	Up to 7,500 ft	-14 %	9 %	ON	OFF	ON
		-18 %	12 %	OFF	ON	ON
4	Up to 10,100 ft	-22 %	15 %	ON	ON	ON
Special function		N/A	-7%	ON	OFF	OFF

Indoor models of 240 (T-H3J) / 340 (T-H3S) : Natural gas

Level	Elevation	Output reduction	Fan motor speed change	DIPswitch settings		
				No.3	No.4	No.5
0	0 (DEFAULT)	N/A	N/A	OFF	OFF	OFF
1	Up to 2,500 ft	N/A	6%	OFF	ON	OFF
2	Up to 5,000 ft	-6 %	10 %	ON	ON	OFF
		-9 %	14 %	OFF	OFF	ON
3	Up to 7,500 ft	-12 %	18 %	ON	OFF	ON
		-15 %	22 %	OFF	ON	ON
4	Up to 10,100 ft	-18 %	26 %	ON	ON	ON
Special function		N/A	-7 %	ON	OFF	OFF

Outdoor models of 240 (T-H3J) / 340 (T-H3S) : Propane

Level	Elevation	Output reduction	Fan motor speed change	DIPswitch settings		
				No.3	No.4	No.5
0	0 (DEFAULT)	N/A	N/A	OFF	OFF	OFF
1	Up to 2,000 ft	N/A	3 %	OFF	ON	OFF
2	Up to 4,000 ft	-11 %	7 %	OFF	OFF	ON
3	Up to 6,000 ft	-14 %	9 %	ON	OFF	ON
4*	Consult our Technical Services Department					
	Special function	N/A	-7 %	ON	OFF	OFF

*If the abnormal sound problem persists even with a "Level 3" setting, please contact our Technical Service Department for advice. Note that there are many high risks associated with manually changing manifold pressure.

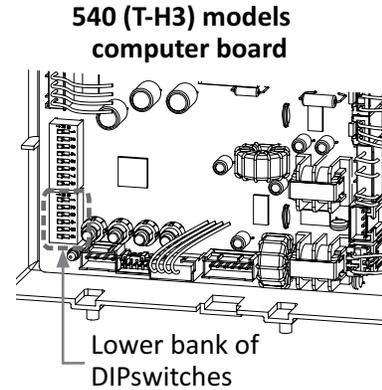
Outdoor models of 240 (T-H3J) / 340 (T-H3S) : Natural gas

Level	Elevation	Output reduction	Fan motor speed change	DIPswitch settings		
				No.3	No.4	No.5
0	0 (DEFAULT)	N/A	N/A	OFF	OFF	OFF
1	Up to 2,000 ft	N/A	6 %	OFF	ON	OFF
2	Up to 4,000 ft	-9 %	14 %	OFF	OFF	ON
3	Up to 6,000 ft	-12 %	18 %	ON	OFF	ON
4*	Consult our Technical Services Department					
	Special function	N/A	-7 %	ON	OFF	OFF

*If the abnormal sound problem persists even with a "Level 3" setting, please contact our Technical Service Department for advice. Note that there are many high risks associated with manually changing manifold pressure.

<Using these functions>

The desired level can be specified at the Lower bank of DIPswitches (No.2, No.3 and No.4) on the computer board.
See the table below.



Indoor models of 540 (T-H3) : Propane

Level	Elevation	Output reduction	Fan motor speed change	DIPswitch settings		
				No.2	No.3	No.4
0	0 (DEFAULT)	N/A	N/A	OFF	OFF	OFF
1	Up to 2,500 ft	N/A	3 %	OFF	ON	OFF
2	Up to 5,000 ft	-8 %	5 %	ON	ON	OFF
		-11 %	7 %	OFF	OFF	ON
3	Up to 7,500 ft	-14 %	9 %	ON	OFF	ON
		-18 %	12 %	OFF	ON	ON
4	Up to 10,100 ft	-22 %	15 %	ON	ON	ON
Special function		N/A	-7%	ON	OFF	OFF

Indoor models of 540 (T-H3) : Natural gas

Level	Elevation	Output reduction	Fan motor speed change	DIPswitch settings		
				No.2	No.3	No.4
0	0 (DEFAULT)	N/A	N/A	OFF	OFF	OFF
1	Up to 2,500 ft	N/A	6%	OFF	ON	OFF
2	Up to 5,000 ft	-6 %	10 %	ON	ON	OFF
		-9 %	14 %	OFF	OFF	ON
3	Up to 7,500 ft	-12 %	18 %	ON	OFF	ON
		-15 %	22 %	OFF	ON	ON
4	Up to 10,100 ft	-18 %	26 %	ON	ON	ON
Special function		N/A	-7 %	ON	OFF	OFF

Outdoor models of 540 (T-H3) : Propane

Level	Elevation	Output reduction	Fan motor speed change	DIPswitch settings		
				No.2	No.3	No.4
0	0 (DEFAULT)	N/A	N/A	OFF	OFF	OFF
1	Up to 2,000 ft	N/A	3 %	OFF	ON	OFF
2	Up to 4,000 ft	-11 %	7 %	OFF	OFF	ON
3	Up to 6,000 ft	-14 %	9 %	ON	OFF	ON
4*	Consult our Technical Services Department					
	Special function	N/A	-7 %	ON	OFF	OFF

*If the abnormal sound problem persists even with a "Level 3" setting, please contact our Technical Service Department for advice. Note that there are many high risks associated with manually changing manifold pressure.

Outdoor models of 540 (T-H3) : Natural gas

Level	Elevation	Output reduction	Fan motor speed change	DIPswitch settings		
				No.2	No.3	No.4
0	0 (DEFAULT)	N/A	N/A	OFF	OFF	OFF
1	Up to 2,000 ft	N/A	6 %	OFF	ON	OFF
2	Up to 4,000 ft	-9 %	14 %	OFF	OFF	ON
3	Up to 6,000 ft	-12 %	18 %	ON	OFF	ON
4*	Consult our Technical Services Department					
	Special function	N/A	-7 %	ON	OFF	OFF

*If the abnormal sound problem persists even with a "Level 3" setting, please contact our Technical Service Department for advice. Note that there are many high risks associated with manually changing manifold pressure.

12-14. Adjusting manifold gas pressure

The manifold gas pressure on the water heater can be adjusted by following the procedures below.



Adjusting the manifold pressure can cause unexpected combustion conditions during operation, which can cause a health hazard, damage the water heater, and/or shorten its lifespan. Therefore, changing the manifold pressure is not recommended unless there are very strong reasons to do so (e.g. high elevation installations), and with the consultation of the Technical Services Department.

Adjusting maximum manifold pressure

1. Ensure that water heater is not in operation.
2. Remove the screw off the manifold port of the water heater. (Fig. 1)
3. Connect a manometer to the manifold port using a tube (Fig. 2). Ensure that this connection is secure enough to prevent gas leak.
4. Run water through the water heater to activate its operation. If presence of a gas leak is detected, immediately shut off the water heater and inspect the tube/manifold connection; otherwise, proceed onto the next step.
5. Press and hold down the **“MAX”** button on the computer board. While holding down the **“MAX”** button, press either the **“Increase”** or **“Decrease”** button to increase or decrease the manifold gas pressure, respectively (Fig. 3). Refer to the manometer to verify that pressure has been set to desired value.
6. After gas pressure has been set, deactivate the water heater, remove the manometer tube, and replace the port screw.

Adjusting minimum manifold pressure

1. Ensure that water heater is not in operation.
2. Remove the screw off the manifold port of the water heater. (Fig. 1)
3. Connect a manometer to the manifold port using a tube (Fig. 2). Ensure that this connection is secure enough to prevent gas leak.
4. Run water through the water heater to activate its operation. If presence of a gas leak is detected, immediately shut off the water heater and inspect the tube/manifold connection; otherwise, proceed onto the next step.
5. Press and hold down the **“MIN”** button on the computer board. While holding down the **“MIN”** button, press either the **“Increase”** or **“Decrease”** button to increase or decrease the manifold gas pressure, respectively (Fig. 3). Refer to the manometer to verify that pressure has been set to desired value.
6. After gas pressure has been set, deactivate the water heater, remove the manometer tube, and replace the port screw.

Fig. 1

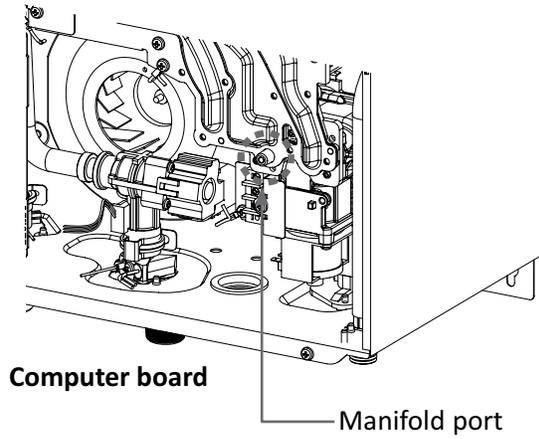


Fig. 2

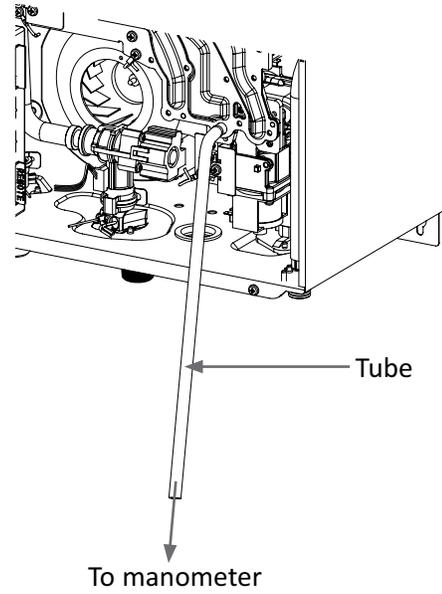
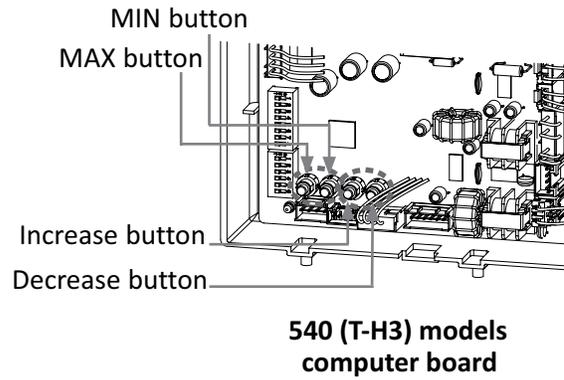
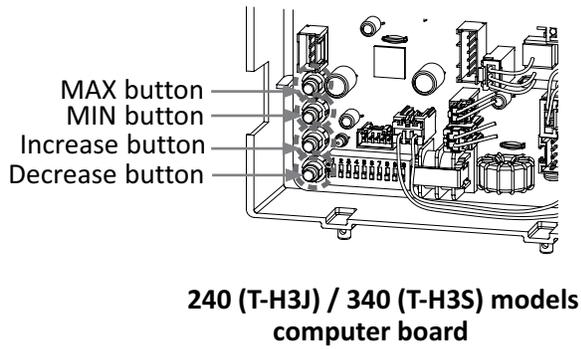


Fig. 3



12-15. Manually adjusting the fan motor speed Only 540 (T-H3) models

While the FM+ DIPswitch will automatically increase the fan speed by 6%, the fan motor speed on the 540 (T-H3) models can also be manually adjusted. In order to perform manual adjustments to the speed, a controller is required.



Manually adjusting the fan motor speed of the 540 (T-H3) models will change the amount of intake air for combustion, which can cause excess CO emission from the exhaust chamber if the fan motor speed is set incorrectly. Therefore, this procedure should never be performed unless the Technical Services Department has given consent and authorization.

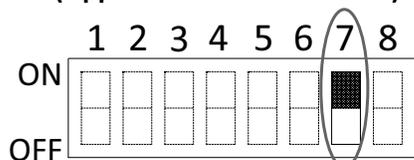
Adjusting maximum fan motor speed

1. While water heater is in operation, set DIPswitch No.7 on the upper bank of the 540 (T-H3) computer board to the "ON" position. (Fig. 1)
2. On the controller, display mode #3 (fan motor speed) by entering the "Diagnostics mode" (Refer to Section 12-1).
3. Press and hold down the "MAX" button on the computer board. While holding down the "MAX" button, press either the "Increase" or "Decrease" button to increase or decrease the fan motor speed, respectively (Fig. 2). Refer to the controller display to verify that speed has been set to desired value.
4. After fan speed has been set, set DIPswitch No.7 on the upper bank of the 540 (T-H3) computer board back to the "OFF" position.

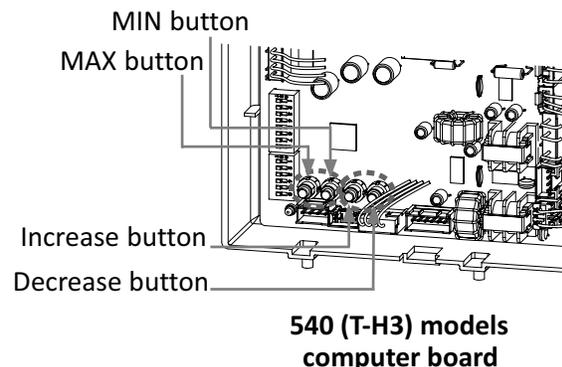
Adjusting minimum fan motor speed

1. While water heater is in operation, set DIPswitch No.7 on the upper bank of the 540 (T-H3) computer board to the "ON" position. (Fig. 1)
2. On the controller, display mode #3 (fan motor speed) by entering the "Diagnostics mode" (Refer to Section 12-1).
3. Press and hold down the "MIN" button on the computer board. While holding down the "MIN" button, press either the "Increase" or "Decrease" button to increase or decrease the fan motor speed, respectively (Fig. 2). Refer to the controller display to verify that speed has been set to desired value.
4. After fan speed has been set, set DIPswitch No.7 on the upper bank of the 540 (T-H3) computer board back to the "OFF" position.

DIPswitch setting on the 540 (T-H3) models
(Upper bank of DIPswitches)



The dark square is the direction the DIPswitch should be set to.



540 (T-H3) models
computer board

12-16. Freeze protection system

The 240 (T-H3J) models, 340 (T-H3S) models and 540 Outdoor (T-H3-OS) models freeze protection system is comprised of the ceramic heating blocks. The ceramic heating blocks will heat up whatever portion of the heat exchanger the blocks are strapped to.

There are two features to the 540 (T-H3) model's freeze protection system: the automatic firing system and the ceramic heating blocks. The automatic firing system allows the 540 (T-H3) models to briefly fire on for about 3 seconds and the ceramic heating blocks will heat up whatever portion of the heat exchanger the blocks are strapped to. The firing system mainly focuses on providing freeze protection around the heat exchanger drum. The two heating blocks focus on protecting the inlet and outlet piping inside the 540 (T-H3) models, as well as the front drum pipe. The conditions to activate either feature are different from each other. However, the two features are not mutually exclusive, because they focus on different areas of the 540 (T-H3) models. As long as each particular feature's activation requirements are met, it is possible for both features to operate at the same time.

Automatic firing system : Only 540 Direct Vent Indoor (T-H3-DV)

Activation conditions will depend on whether or it is an indoor / direct-vent installation. There is the DIPswitch No.8 (the upper bank) on the computer board to the "OFF" position. Gas and electrical power are required for this feature to operate.

After 5 minutes have elapsed since the 540 Direct Vent Indoor (T-H3-DV) previous firing operation, the computer will continually check the temperatures of the inlet and heat exchanger thermistors (the heat exchanger thermistor is the one that checks the temperature of the water immediately leaving the heat exchanger, not the water leaving the 540 Direct Vent Indoor (T-H3-DV), which is mixed with water from the bypass valve). The automatic firing system will not activate at all unless these 5 minutes have elapsed.

When the computer checks for these temperatures, the freeze protection firing system will activate if:

$$T_{ex} < 32 \text{ }^{\circ}\text{F}$$

where T_{ex} is the temperature of exhaust thermistor.

To sum it up in a chart:

Case	5 minutes have elapsed since prior operation?	Exhaust thermistor temperature	Will automatic firing be activated?
1	No	Any	No
2	Yes	Above 32 °F	No
3	Yes	32 °F and below	Yes

Ceramic heating blocks

The two heating blocks focus on protecting the inlet and outlet piping inside the water heater, as well as the front drum pipe.

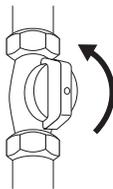
The blocks will only activate based on what the freeze protection thermostat senses. The thermostat is located on the intake port for Direct Vent Indoor models, close in vicinity to the inlet and outlet pipes for Outdoor models. Electrical power is required for this feature to operate.

The heating blocks will activate if the thermostat senses a surrounding temperature **below 36.5 °F**.

Once they are on, the heating blocks will only deactivate if surrounding temperatures reach **above 46.4 °F**.

12-17. Draining and cleaning the inlet water filter

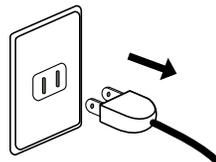
1. Close the manual gas shut off valve.



2. Turn off power to the water heater, wait a few seconds. And then turn on again.



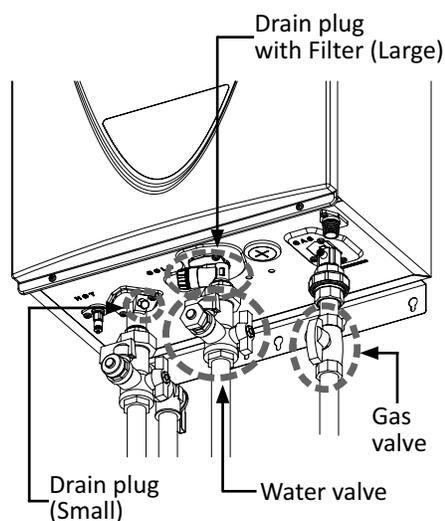
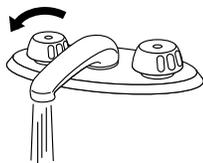
3. Wait 30 seconds for water valves starts to completely open.
Then turn off power to the water heater, yet again.



4. Close the water shut-off valve.



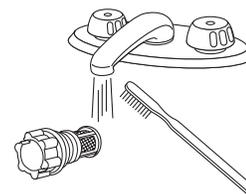
5. Open all hot water taps in the house. When the all water flow has ceased, close all hot water taps.



6. Have a bucket or pan to catch the water from the drain plugs of the water heater. **Unscrew** the drain plugs to drain all the water out of the water heater.

7. Wait a few minutes to ensure all water has completely drained from unit.

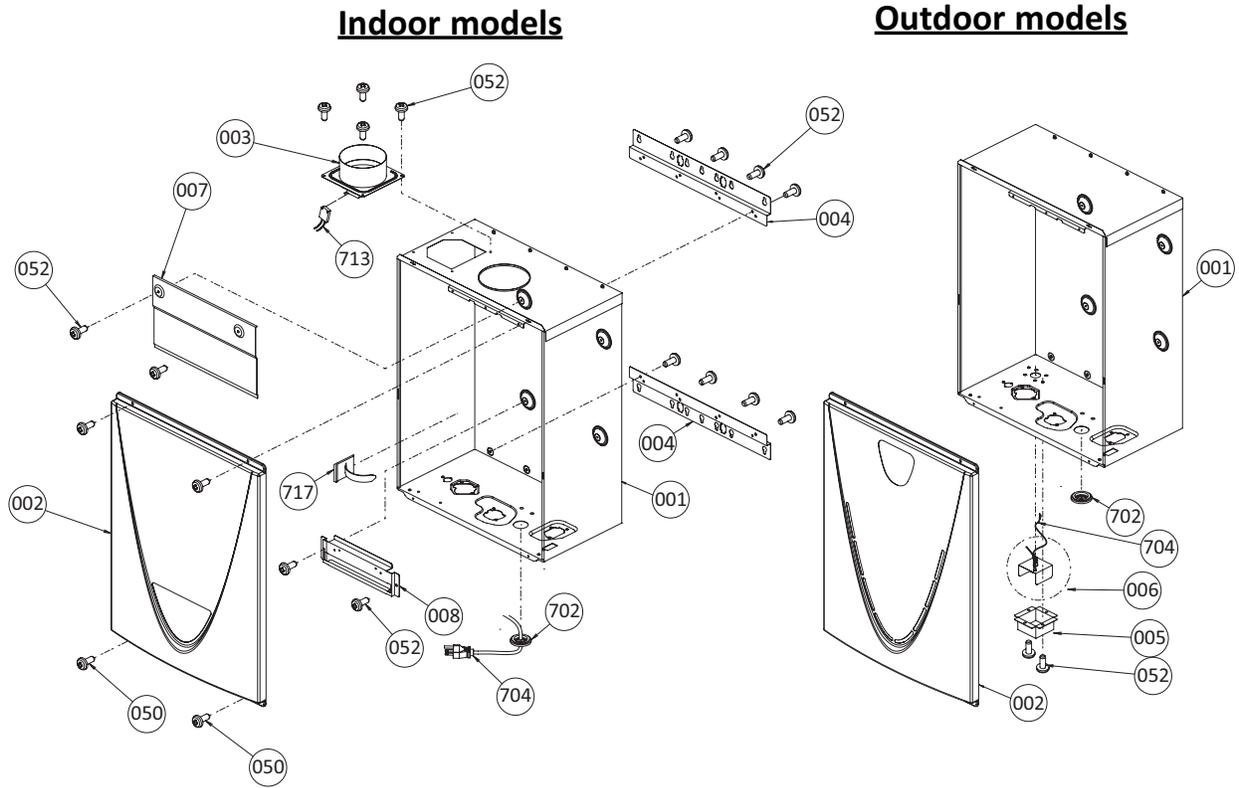
8. **Clean the filter:** Inspect the water filter located within the cold inlet. With a tiny brush, clean the water filter of any debris which may have accumulated and reinsert the filter back into the cold water inlet.



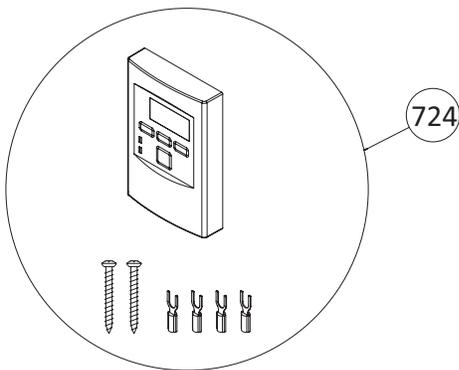
9. Securely screw the drain plugs back into place. **Hand-tighten only.**

13. Components diagram

Case assembly

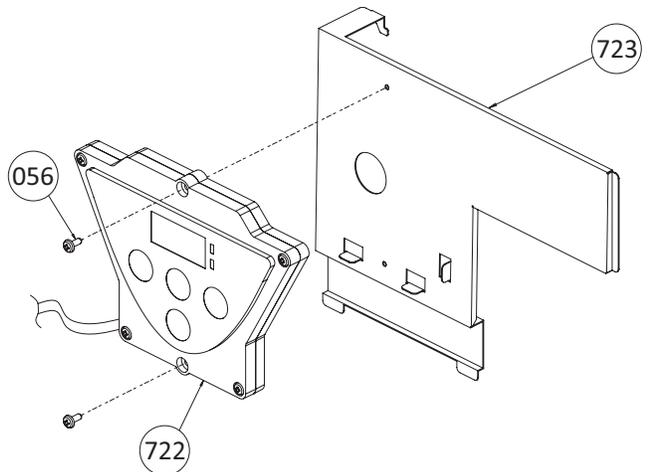


Temperature remote controller



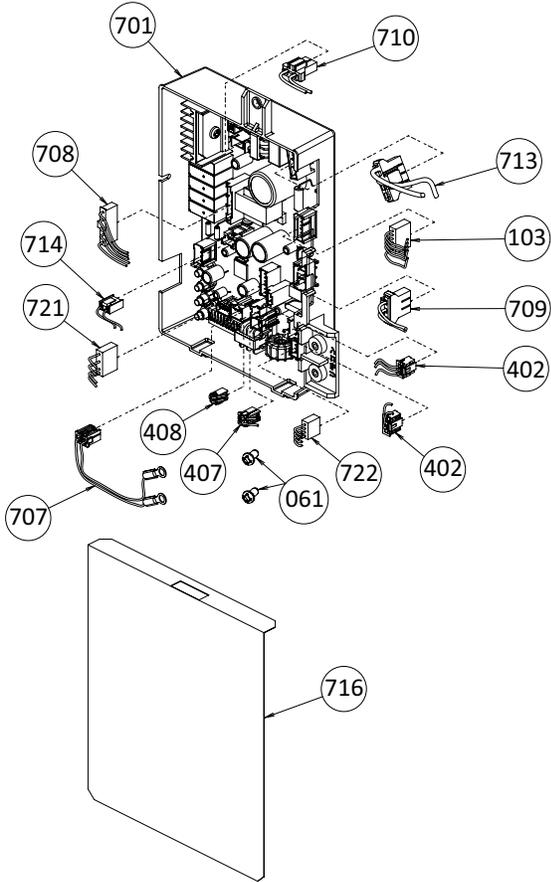
Temperature controller

Indoor models

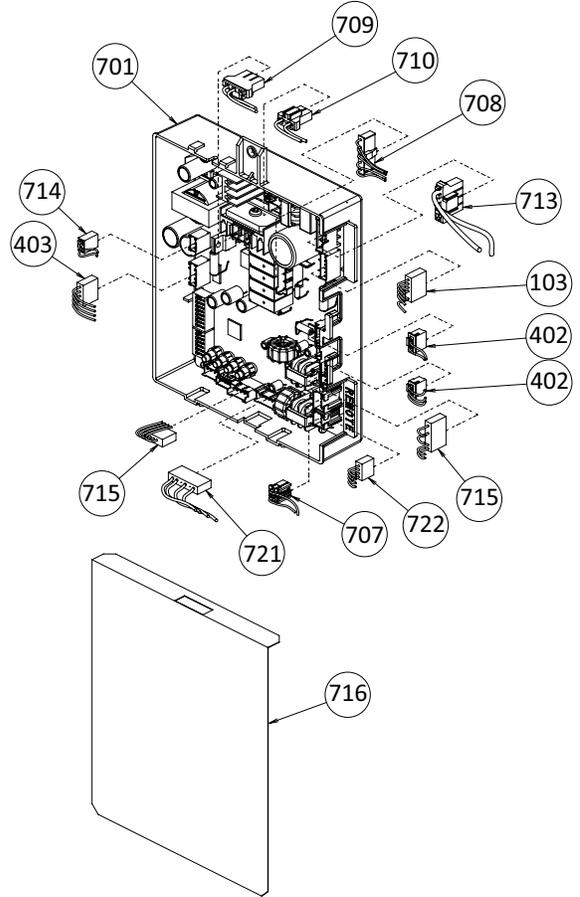


Computer board assembly

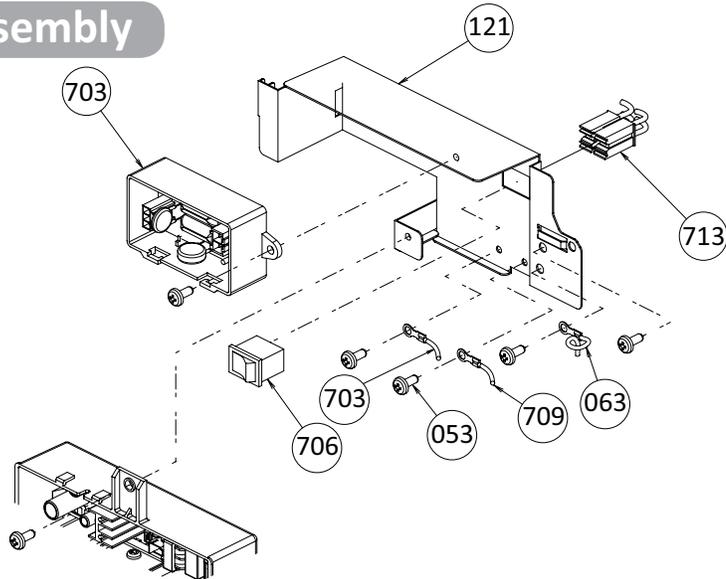
240 (T-H3J) and 340 (T-H3S) models



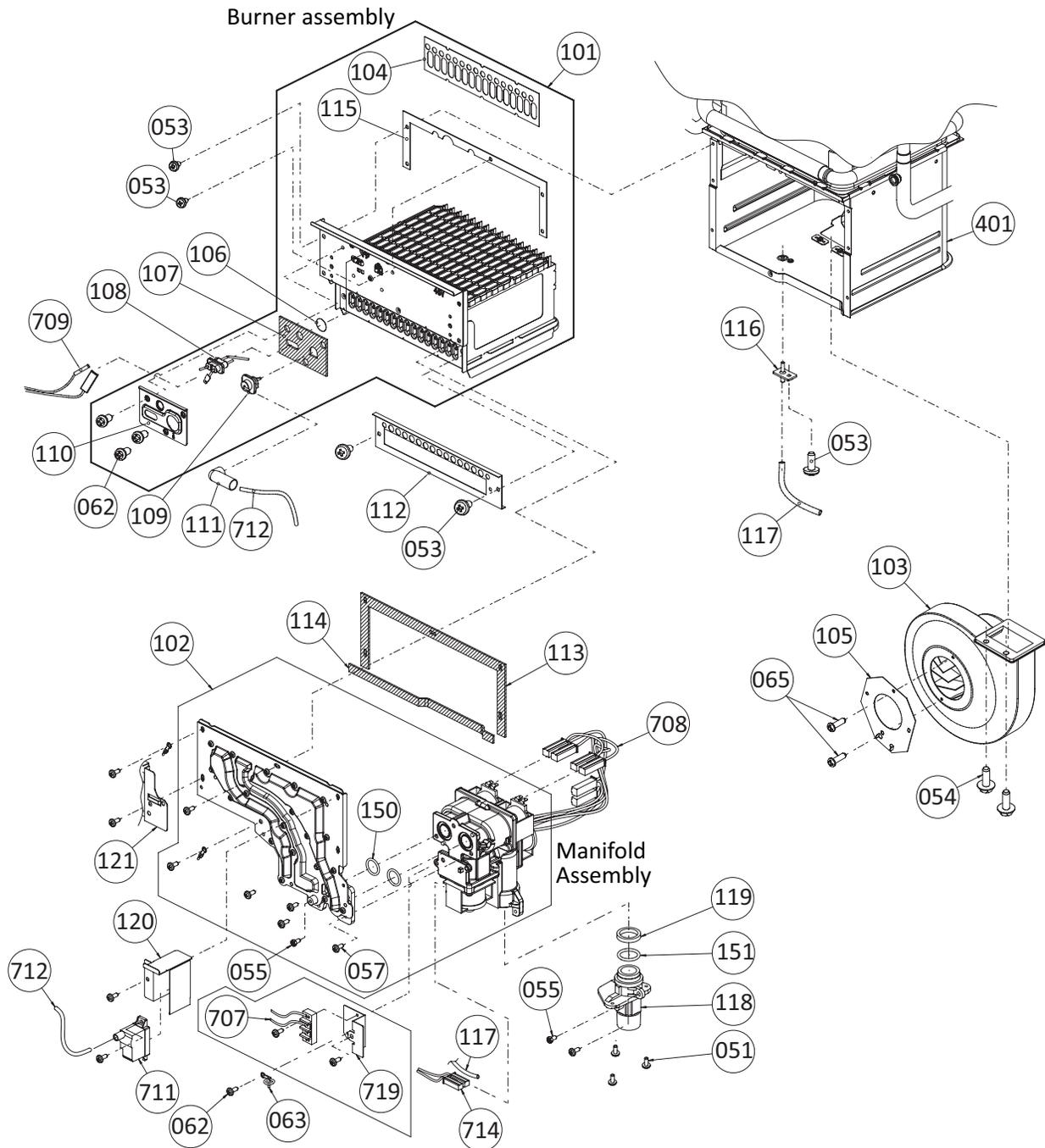
540 (T-H3) models



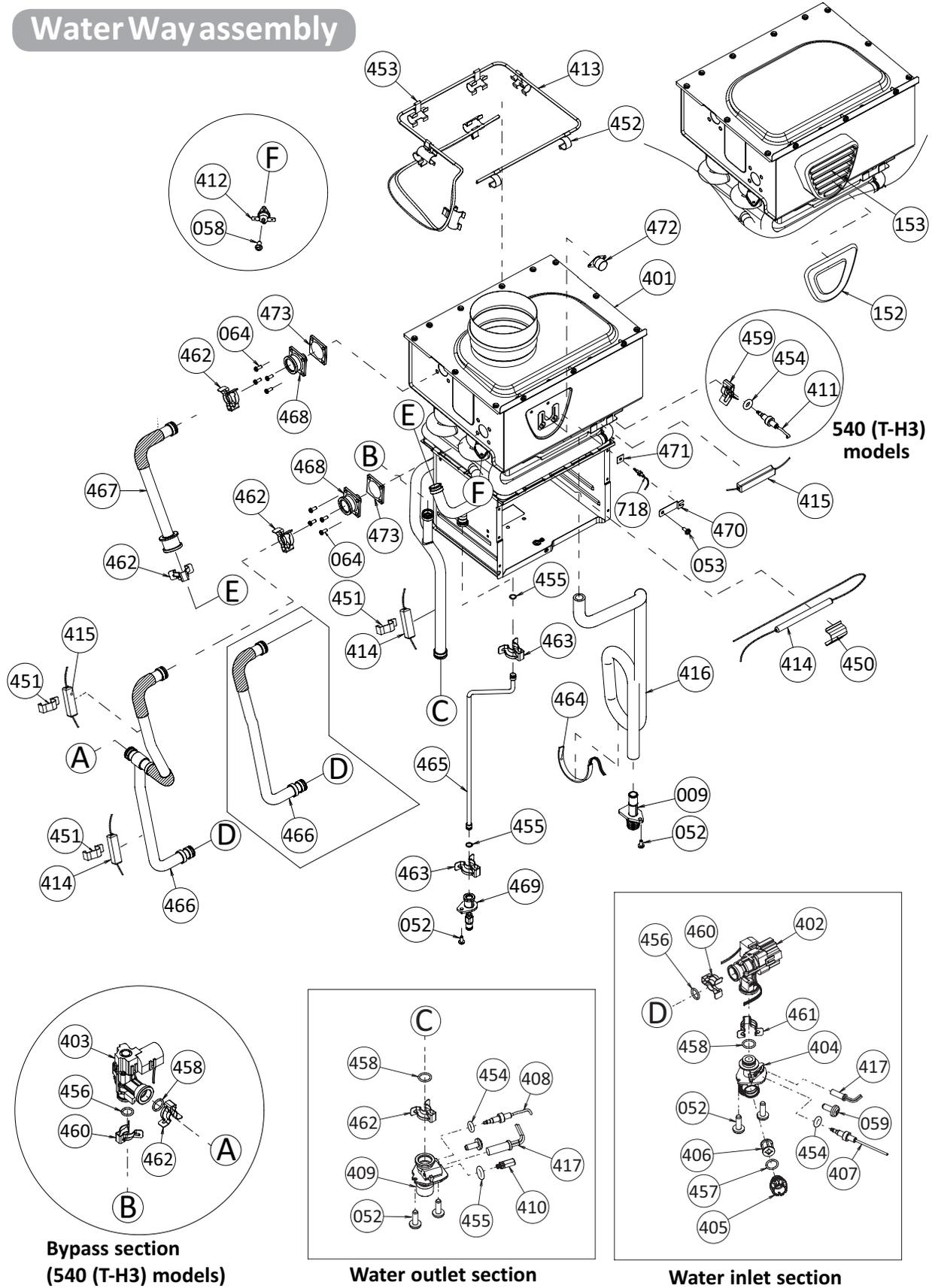
Surge box assembly



Burner assembly



Water Way assembly



14. Parts list

Item #	Part #		Description	Common parts for other models	
	240, 340 and 540 models	T-H3J, T-H3S and T-H3 models		240, 340 and 540 models	T-H3J, T-H3S and T-H3 models
001	N/A	EK159	Case assembly for Indoor models		
	N/A	EK164	Case assembly for Outdoor models		
002	319143-505	EK187	Front cover for 240 and 340 Indoor (T-H3J-DV and T-H3S-DV)		
	319143-506	EK188	Front cover for 240 and 340 Outdoor (T-H3J-DV and T-H3S-OS)		
	319143-507	EK158	Front cover for 540 Indoor (T-H3-DV)		
	319143-508	EK174	Front cover 540 Outdoor (T-H3-OS)		
003	319143-509	EK170	Intake air port assembly		
004	N/A	EK162	Bracket		
005	319143-510	EK190	Junction box		
006	319143-511	EK171	Power supply code assembly		
007	319143-512	EK161	Back guard panel		
008	319143-513	EK160	Chamber fixing plate		
009	319143-018	EKH23	Condensate drain port	520, 320	T-H2-DV/OS, T-H2S-DV/OS
050	319143-025	EW000	Screw M4×12 (W/Washer)		
051	319143-325	EW001	Screw M4×10 (W/Washer)		
052	319143-026	EW002	Screw M4×10 (Coated)		
053	319143-060	EW003	Screw M4x10		
054	319143-326	EW004	Hex head screw M4×12 (W/Washer)		
055	319143-063	EW005	Hex head screw M4x8		
056	N/A	EW018	Pan screw M4x20		
057	319143-201	EKK31	Tap tight screw M4x12 FEZN		
058	319143-087	EW00A	Screw M3x6		
059	319143-328	EW009	Screw M4x6		
060	319143-438	EKK37	Screw M4x12		
061	N/A	EK191	Screw M3x6		
062	319143-059	EW00D	Screw M4x8		
063	319143-048	EM167	Wire clamp 60	910, 710, 520, 320, 110, 310, 510, 110U, 310U, 510U	T-K3, T-K3-Pro, T-K3-SP/OS, T-M50, T-M32, T-H2-DV/OS, T-H2S-DV/OS, T-KJr2-IN/OS, T-K4-IN/OS, T-D2-IN/OS, T-KJr2U-IN/OS, T-K4U-IN/OS, T-D2U-IN/OS
064	N/A	EK230	Screw M4x10		
065	319143-330	EW00B	Screw M3x6 SUS3		

Item #	Part #		Description	Common parts for other models	
	240, 340 and 540 models	T-H3J, T-H3S and T-H3 models		240, 340 and 540 models	T-H3J, T-H3S and T-H3 models
101	319143-514	EK192	Burner assembly		
102	319143-515	EK181	Manifold with gas valve assembly LP		
	319143-516	EK182	Manifold with gas valve assembly NA		
103	319143-443	EK109	Fan motor for Indoor models	110U Indoor, 310U Indoor, 510U Indoor	T-KJr2U-IN, T-K4U-IN, T-D2U-IN
	319143-043	EKK25	Fan motor for Outdoor models	910, 710, 520, 320, 310, 510, 310 Indoor, 510 Indoor, 110U Outdoor, 310U Outdoor, 510U Outdoor	T-K3, T-K3-Pro, T-K3-SP, T-M50, T-M32, T-H2-DV/OS, T-H2S-DV/OS, T-K4-IN, T-D2-IN, T-KJr2U-OS, T-K4U-OS, T-D2U-OS
104	319143-031	EKK2X	Burner gasket	520, 320, 110, 310, 510	T-K3, T-K3-Pro, T-K3-SP/OS, T-H2-DV/OS, T-H2S-DV/OS, T-KJr2-IN/OS, T-K4-IN/OS, T-D2-IN/OS
105	319143-282	EM381	Fan damper for Indoor models	710	T-M32
106	319143-033	EKK2V	Burner window	910, 710, 520, 320, 110, 310, 510, 110U, 310U, 510U	T-K3, T-K3-Pro, T-K3-SP/OS, T-M50, T-M32, T-H2-DV/OS, T-H2S-DV/OS, T-KJr2-IN/OS, T-K4-IN/OS, T-D2-IN/OS, T-KJr2U-IN/OS, T-K4U-IN/OS, T-D2U-IN/OS
107	319143-034	EKK2W	Rod holder gasket	910, 710, 520, 320, 110, 310, 510	T-K3, T-K3-Pro, T-K3-SP/OS, T-M50, T-M32, T-H2-DV/OS, T-H2S-DV/OS, T-KJr2-IN/OS, T-K4-IN/OS, T-D2-IN/OS
108	319143-517	EK193	Flame rod		

Item #	Part #		Description	Common parts for other models	
	240, 340 and 540 models	T-H3J, T-H3S and T-H3models		240, 340 and 540 models	T-H3J, T-H3S and T-H3 models
109	319143-037	EKK0F	Igniter rod	910, 710, 520, 320, 310, 510	T-K3, T-K3-Pro, T-K3-SP/OS, T-M50, T-M32, T-H2-DV/OS, T-H2S-DV/OS, T-K4-IN/OS, T-D2-IN/OS
110	319143-036	EKK32	Rod holder	910, 710, 520, 320, 310, 510	T-K3, T-K3-Pro, T-K3-SP/OS, T-M50, T-M32, T-H2-DV/OS, T-H2S-DV/OS, T-K4-IN/OS, T-D2-IN/OS
111	319143-038	EKN61	Rod cap	910, 710, 520, 320, 110, 310, 510	T-K3, T-K3-Pro, T-K3-SP/OS, T-M50, T-M32, T-H2-DV/OS, T-H2S-DV/OS, T-KJr2-IN/OS, T-K4-IN/OS, T-D2-IN/OS
112	319143-518	EK183	Burner damper LP	110U, 310U, 510U	T-KJr2U-IN/OS, T-K4U-IN/OS, T-D2U-IN/OS
	319143-519	EK169	Burner damper NA		
113	319143-044	EKK2Y	Manifold gasket A	910, 520, 320, 110, 310, 510	T-K3, T-K3-Pro, T-K3-SP/OS, T-M50, T-H2-DV/OS, T-H2S-DV/OS, T-KJr2-IN/OS, T-K4-IN/OS, T-D2-IN/OS
114	319143-045	EKK2K	Manifold gasket B	520, 320, 910, 110, 310, 510, 110U, 310U, 510U	T-K3, T-K3-Pro, T-K3-SP/OS, T-M50, T-H2-DV/OS, T-H2S-DV/OS, T-KJr2-IN/OS, T-K4-IN/OS, T-D2-IN/OS, T-KJr2U-IN/OS, T-K4U-IN/OS, T-D2U-IN/OS

Item #	Part #		Description	Common parts for other models	
	240, 340 and 540 models	T-H3J, T-H3S and T-H3 models		240, 340 and 540 models	T-H3J, T-H3S and T-H3 models
115	319143-032	EKK0G	Burner holder gasket	910, 520, 320, 310, 510	T-K3, T-K3-Pro, T-K3-SP/OS, T-M50, T-H2-DV/OS, T-H2S-DV/OS, T-K4-IN/OS, T-D2-IN/OS
116	319143-042	EKK2D	Pressure port	910, 710, 520, 320, 310, 510, 110U, 310U, 510U	T-K3, T-K3-Pro, T-K3-SP, T-M50, T-M32, T-H2-DV/OS, T-H2S-DV/OS, T-K4-IN/OS, T-D2-IN/OS, TKJr2U-IN/OS, T-K4U-IN/OS, T-D2U-IN/OS
117	319143-520	EX019	Combustion chamber tube	910, 310, 510	T-M50, T-K4-OS, T-D2-OS
118	319143-455	EK117	Gas inlet	110U, 310U, 510U	TKJr2U-IN/OS, T-K4U-IN/OS, T-D2U-IN/OS
119	319143-342	EX00D	Gas inlet ring	710, 110U, 310U, 510U	T-M32, TKJr2U-IN/OS, T-K4U-IN/OS, T-D2U-IN/OS
120	319143-521	EK194	Igniter plate		
121	319143-522	EK163	Surge box plate		
150	319143-350	EZP18	O-ring P18 NBR (Black)	910, 110, 310, 510, 110U, 310U, 510U	T-K3, T-K3-Pro, T-K3-SP/OS, T-M50, T-KJr2-IN/OS, T-K4-IN/OS, T-D2-IN/OS, TKJr2U-IN/OS, T-K4U-IN/OS, T-D2U-IN/OS
151	319143-057	EK042	O-ring P20 NBR (Black)	910, 520, 320, 110, 310, 510, 110U, 310U, 510U	T-K3, T-K3-Pro, T-K3-SP/OS, T-M50, T-H2-DV/OS, T-H2S-DV/OS, T-KJr2-IN/OS, T-K4-IN/OS, T-D2-IN/OS, TKJr2U-IN/OS, T-K4U-IN/OS, T-D2U-IN/OS

Item #	Part #		Description	Common parts for other models	
	240, 340 and 540 models	T-H3J, T-H3S and T-H3 models		240, 340 and 540 models	T-H3J, T-H3S and T-H3 models
152	319143-523	EK157	Silicon ring for Outdoor models		
153	319143-524	EK177	Exhaust port for Outdoor models		
401	319143-525	EK198	Heat exchanger assembly for 240 and 340 Indoor (T-H3J-DV and T-H3S-DV)		
	319143-526	EK199	Heat exchanger assembly for 240 and 340 Outdoor (T-H3J-OS and T-H3S-OS)		
	319143-527	EK200	Heat exchanger assembly for 540 Indoor (T-H3-DV)		
	319143-528	EK206	Heat exchanger assembly for 540 Outdoor (T-H3-OS)		
402	319143-463	EK129	Flow adjustment valve / Flow sensor	110U, 310U, 510U	TKJr2U-IN/OS, T-K4U-IN/OS, T-D2U-IN/OS
403	319143-464	EKD58	Bypass valve for 540 (T-H3) models	510U	T-D2U-IN/OS
404	319143-193	EKK1U	Water inlet	110, 310, 510, 110U, 310U, 510U	T-K3, T-K3-Pro, T-K3-SP/OS, TKJr2-IN/OS, T-K4-IN/OS, T-D2-IN/OS, TKJr2U-IN/OS, T-K4U-IN/OS, T-D2U-IN/OS
405	319143-197	EKK2B	Inlet drain plug	110, 310, 510, 110U, 310U, 510U	T-K3, T-K3-Pro, T-K3-SP/OS, TKJr2-IN/OS, T-K4-IN/OS, T-D2-IN/OS, TKJr2U-IN/OS, T-K4U-IN/OS, T-D2U-IN/OS
406	319143-198	EKK2C	Inlet water filter	110, 310, 510, 110U, 310U, 510U	T-K3, T-K3-Pro, T-K3-SP/OS, TKJr2-IN/OS, T-K4-IN/OS, T-D2-IN/OS, TKJr2U-IN/OS, T-K4U-IN/OS, T-D2U-IN/OS
407	319143-214	EKK4J	Inlet thermistor for 240 (T-H3J) and 340 (T-H3S) models	110, 310, 110U, 310U	T-K3-SP/OS, TKJr2-IN/OS, T-K4-IN/OS, TKJr2U-IN/OS, T-K4U-IN/OS
	319143-465	EK137	Inlet thermistor for 540 (T-H3) models	510U	T-D2U-IN/OS
408	319143-529	EK207	Outlet thermistor for 240 (T-H3J) and 340 (T-H3S) models		
	319143-190	EKK1A	Outlet thermistor for 540 (T-H3) models	910, 510 510U	T-K3, T-K3-Pro, T-M50, T-D2-IN/OS, T-D2U-IN/OS

Item #	Part #		Description	Common parts for other models	
	240, 340 and 540 models	T-H3J, T-H3S and T-H3 models		240, 340 and 540 models	T-H3J, T-H3S and T-H3 models
409	319143-530	EK208	Water outlet		
410	319143-199	EKK2E	Outlet drain plug	910, 110, 310, 510, 110U, 310U, 510U	T-K3, T-K3-Pro, T-K3-SP/OS, T-M50, T-KJr2-IN/OS, T-K4-IN/OS, T-D2-IN/OS, T-KJr2U-IN/OS, T-K4U-IN/OS, T-D2U-IN/OS
411	319143-096	EKK2T	Heat exchanger thermistor for 540 (T-H3) models	910, 710, 520, 320, 510, 510U	T-K3, T-K3-Pro, T-M50, T-M32, T-H2-DV/OS, TH2S-DV/OS, T-D2-IN/OS, T-D2U-IN/OS
412	319143-228	EM212	Hi-Limit switch for 240 (T-H3J) and 340 (T-H3S) models	110, 310, 110U, 310U	T-KJr2-IN/OS, T-K4-IN/OS, T-KJr2U-IN/OS, T-K4U-IN/OS
	319143-095	EKN34	Hi-Limit switch for 540 (T-H3) models	910, 710, 520, 320, 510, 510U	T-K3, T-K3-Pro, T-K3-SP/OS, T-M50, T-M32, T-H2-DV/OS, TH2S-DV/OS, T-D2-IN/OS, T-D2U-IN/OS
413	319143-149	EK333	Overheat-cut-off fuse	910, 110, 310, 510, 110U, 310U, 510U	T-K3, T-K3-Pro, T-K3-SP/OS, T-M50, T-KJr2-IN/OS, T-K4-IN/OS, T-D2-IN/OS, T-KJr2U-IN/OS, T-K4U-IN/OS, T-D2U-IN/OS
414	319143-531	EK209	Pipe heater		
415	319143-532	EK210	Inlet heater for Indoor models		
	319143-533	EK211	Inlet heater for Outdoor models		
416	319143-534	EK231	Drain tube		
417	319143-468	EK105	Inlet heater	110U, 310U, 510U	T-KJr2U-IN/OS, T-K4U-IN/OS, T-D2U-IN/OS

Item #	Part #		Description	Common parts for other models	
	240, 340 and 540 models	T-H3J, T-H3S and T-H3 models		240, 340 and 540 models	T-H3J, T-H3S and T-H3 models
450	319143-088	EKK27	Pipe heater fixing plate	910, 710, 520, 320, 110, 310, 510, 110U, 310U, 510U	T-K3, T-K3-Pro, T-K3-SP/OS, T-M50, T-M32, T-H2-DV/OS, T-H2S-DV/OS, T-KJr2-IN/OS, T-K4-IN/OS, T-D2-IN/OS, TKJr2U-IN/OS, T-K4U-IN/OS, T-D2U-IN/OS
451	319143-125	EK031	Heater fixing plate 16	910, 710, 520, 320, 110, 310, 510, 110U, 310U, 510U	T-M50, T-M32, T-H2-DV/OS, T-H2S-DV/OS, T-KJr2-IN/OS, T-K4-IN/OS, T-D2-IN/OS, TKJr2U-IN/OS, T-K4U-IN/OS, T-D2U-IN/OS
452	319143-066	EKK26	Fuse fixing plate 18	910, 710, 520, 320, 110, 310, 510, 110U, 310U, 510U	T-K3, T-K3-Pro, T-K3-SP/OS, T-M50, T-M32, T-H2-DV/OS, T-H2S-DV/OS, T-KJr2-IN/OS, T-K4-IN/OS, T-D2-IN/OS, TKJr2U-IN/OS, T-K4U-IN/OS, T-D2U-IN/OS
453	319143-146	EK029	Fuse fixing plate 14	110, 310, 510, 110U, 310U, 510U	T-K3, T-K3-Pro, T-K3-SP/OS, T-KJr2-IN/OS, T-K4-IN/OS, T-D2-IN/OS, TKJr2U-IN/OS, T-K4U-IN/OS, T-D2U-IN/OS
454	319143-082	EZM04	O-ring P4 FKM	910, 710, 520, 320, 110, 310, 510, 110U, 310U, 510U	T-K3, T-K3-Pro, T-K3-SP/OS, T-M50, T-M32, T-H2-DV/OS, T-H2S-DV/OS, T-KJr2-IN/OS, T-K4-IN/OS, T-D2-IN/OS, TKJr2U-IN/OS, T-K4U-IN/OS, T-D2U-IN/OS

Item #	Part #		Description	Common parts for other models	
	240, 340 and 540 models	T-H3J, T-H3S and T-H3 models		240, 340 and 540 models	T-H3J, T-H3S and T-H3 models
455	319143-080	EZM06	O-ring P6 FKM	910, 710, 520, 320, 110, 310, 510, 110U, 310U, 510U	T-K3, T-K3-Pro, T-K3-SP/OS, T-M50, T-M32, T-H2-DV/OS, T-H2S-DV/OS, T-KJr2-IN/OS, T-K4-IN/OS, T-D2-IN/OS, TKJr2U-IN/OS, T-K4U-IN/OS, T-D2U-IN/OS
456	319143-100	EZM14	O-ring P14 FKM	520, 320, 110, 310, 510, 110U, 310U, 510U	T-K3, T-K3-Pro, T-K3-SP/OS, T-H2-DV/OS, T-H2S-DV/OS, T-KJr2-IN/OS, T-K4-IN/OS, T-D2-IN/OS, TKJr2U-IN/OS, T-K4U-IN/OS, T-D2U-IN/OS
457	319143-091	EZM15	O-ring P15 FKM	710, 520, 320, 110, 310, 510, 110U, 310U, 510U	T-K3, T-K3-Pro, T-K3-SP/OS, T-M32, T-H2-DV/OS, T-H2S-DV/OS, T-KJr2-IN/OS, T-K4-IN/OS, T-D2-IN/OS, TKJr2U-IN/OS, T-K4U-IN/OS, T-D2U-IN/OS
458	319143-083	EZM16	O-ring P16 FKM	910, 710, 520, 320, 110, 310, 510, 110U, 310U, 510U	T-K3, T-K3-Pro, T-K3-SP/OS, T-M50, T-M32, T-H2-DV/OS, T-H2S-DV/OS, T-KJr2-IN/OS, T-K4-IN/OS, T-D2-IN/OS, TKJr2U-IN/OS, T-K4U-IN/OS, T-D2U-IN/OS

Item #	Part #		Description	Common parts for other models	
	240, 340 and 540 models	T-H3J, T-H3S and T-H3 models		240, 340 and 540 models	T-H3J, T-H3S and T-H3 models
459	319143-097	EKH30	Fastener "4-11"	910, 710, 520, 320, 510, 510U	T-K3, T-K3-Pro, T-M50, T-M32, T-H2-DV/OS, TH2S-DV/OS, T-D2-IN/OS, T-D2U-IN/OS
460	319143-105	EKK24	Fastener "14-22"	520, 320, 110, 310, 510, 110U, 310U, 510U	T-K3, T-K3-Pro, T-K3-SP/OS, T-H2-DV/OS, TH2S-DV/OS, T-KJr2-IN/OS, T-K4-IN/OS, T-D2-IN/OS, TKJr2U-IN/OS, T-K4U-IN/OS, T-D2U-IN/OS
461	319143-226	EM192	Fastener "16A"	110, 310, 510, 110U, 310U, 510U	T-K3, T-K3-Pro, T-K3-SP/OS, T-KJr2-IN/OS, T-K4-IN/OS, T-D2-IN/OS, TKJr2U-IN/OS, T-K4U-IN/OS, T-D2U-IN/OS
462	319143-205	EKK39	Fastener "16-25A"	510, 510U	T-K3, T-K3-Pro, T-D2-IN/OS, T-D2U-IN/OS
463	319143-112	EX12K	Fastener "6-15"	520, 320	T-H2-DV/OS, T-H2S-DV/OS
464	319143-535	EK217	Flat heater		
465	319143-536	EK218	Drain pipe		
466	319143-537	EK219	Cold pipe for 240 (T-H3J) and 340 (T-H3S) models		
	319143-538	EK220	Cold pipe for 540 (T-H3) models		
467	319143-539	EK222	Stainless heat exchanger out pipe		
468	319143-540	EK226	Header connection		
469	319143-541	EK228	Drain port		
470	319143-106	EX13H	Thermistor fixing plate	520 Indoor, 320 Indoor	T-H2-DV, T-H2S-DV
471	319143-111	EK13L	Exhaust thermistor gasket	520, 320	T-H2-DV/OS, T-H2S-DV/OS
472	319143-104	EKH6G	Hi-limit switch for exhaust	520 Indoor, 320 Indoor	T-H2-DV, T-H2S-DV
473	319143-542	EK229	Gasket		

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Item #	Part #		Description	Common parts for other models	
	240, 340 and 540 models	T-H3J, T-H3S and T-H3 models		240, 340 and 540 models	T-H3J, T-H3S and T-H3 models
701	319143-543	EK186	Computer board for 240 (T-H3J) models		
	319143-544	EK175	Computer board for 340 (T-H3S) models		
	319143-545	EK176	Computer board for 540 (T-H3) models		
702	319143-334	EX00B	Rubber grommet	710, 910	T-M32, T-M50
703	320273-128	EK280	Surge box	110U, 310U, 510U	T-K3-SP/OS, T-KJr2U-IN/OS, T-K4U-IN/OS, T-D2U-IN/OS
704	319143-427	EK146	120 VAC wire for Indoor models	110 Indoor, 310 Indoor, 510 Indoor, 110U Indoor, 310U Indoor, 510U Indoor	T-KJr2-IN, T-K4-IN, T-D2-IN, T-KJr2U-IN, T-K4U-IN, T-D2U-IN
	319143-546	EK143	120 VAC wire for Outdoor models		
706	319143-141	EKK4V	120 VAC Power ON-OFF switch	520, 320, 110, 310, 510, 110U, 310U, 510U	T-K3-SP/OS, T-H2-DV/OS, T-H2S-DV/OS, T-KJr2-IN/OS, T-K4-IN/OS, T-D2-IN/OS, T-KJr2U-IN/OS, T-K4U-IN/OS, T-D2U-IN/OS
707	319143-490	EK189	Remote controller wire for 240 (T-H3J) and 340 (T-H3S) models		
	319143-491	EK165	Remote controller wire for 540 (T-H3) models		
708	319143-492	EK168	Gas valve wire		
709	319143-493	EK166	Flame rod wire		
710	319143-494	EK172	EH-IG wire		
711	319143-479	EK153	Igniter	110U, 310U, 510U	T-KJr2U-IN/OS, T-K4U-IN/OS, T-D2U-IN/OS
712	319143-495	EK195	High voltage igniter cable		
713	319143-496	EK184	Switch wire with thermostat for Indoor models		
	319143-497	EK185	Switch wire with thermostat for Outdoor models		
714	319143-498	EK167	Proportional gas valve wire		
715	319143-499	EK179	24V cables for 540 (T-H3) models		
716	319143-191	EKK1M	Computer board cover	910, 510, 110U, 310U, 510U	T-K3, T-K3-Pro, T-M50, T-D2-IN/OS, T-KJr2U-IN/OS, T-K4U-IN/OS, T-D2U-IN/OS

Item #	Part #		Description	Common parts for other models	
	240, 340 and 540 models	T-H3J, T-H3S and T-H3 models		240, 340 and 540 models	T-H3J, T-H3S and T-H3 models
717	319143-500	EX13C	Cable clamp for Indoor models		
718	319143-131	EKH6E	Exhaust thermistor assembly	520 Indoor, 320 Indoor	T-H2-DV, T-H2S-DV
719	319143-484	EK152	Remote fixing plate for 540 (T-H3) models	510U	T-D2U-IN/OS
721	319143-501	EK180	Exhaust Hi-limit switch wire		
722	319143-502	EK173	Temperature controller for Indoor models		
723	319143-503	EK178	Fixing plate		
724	319143-485	ER014	Temperature remote controller	110U, 310U, 510U	TKr2U-IN/OS, TK4U-IN/OS, T-D2U-IN/OS

15. Revisions

Version	Description of changes	Date
1.00	First edition	12/07/18