



# Marquis Installation Manual

## Model

TWH180 / TWH180LP  
Gas Condensing Water Heater



- Natural Gas (NG) - TWH180
- Liquid Propane Gas (LP) - TWH180LP

### WARNING

Read the Installation Manual carefully and be sure that your water heater has been properly assembled, installed and maintained. Failure to follow these instructions exactly could result in a fire or explosion, serious bodily injury and/or property damage.

This product must be installed and serviced by a licensed plumber, a licensed gas fitter, or a professional technician in accordance with all local codes.

Improper installation and/or operation by an unqualified person will void the warranty.

If the information in these instructions is not followed exactly, a fire or explosion may result, causing property damage, personal injury, or death.

- Do not store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other appliance.
- **WHAT TO DO IF YOU SMELL GAS**
  - Do not try to light any appliance.
  - Do not touch any electrical switch; do not use any phone in your building.
  - Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions.
  - If you cannot reach your gas supplier, call the fire department.
- Installation and service must be performed by a qualified installer, service agency or the gas supplier.

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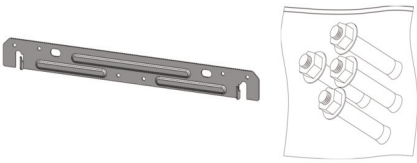

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# Product Accessories

Item	Description
<p>ACV-Triangle Tube Marquis Water Heater TWH180 / TWH180LP</p>	
<p>User's and Installation Manuals</p>	
<p>Condensate Hose</p>	
<p>Anchors and Wall mounting bracket</p>	
<p>Vent Termination Caps</p>	

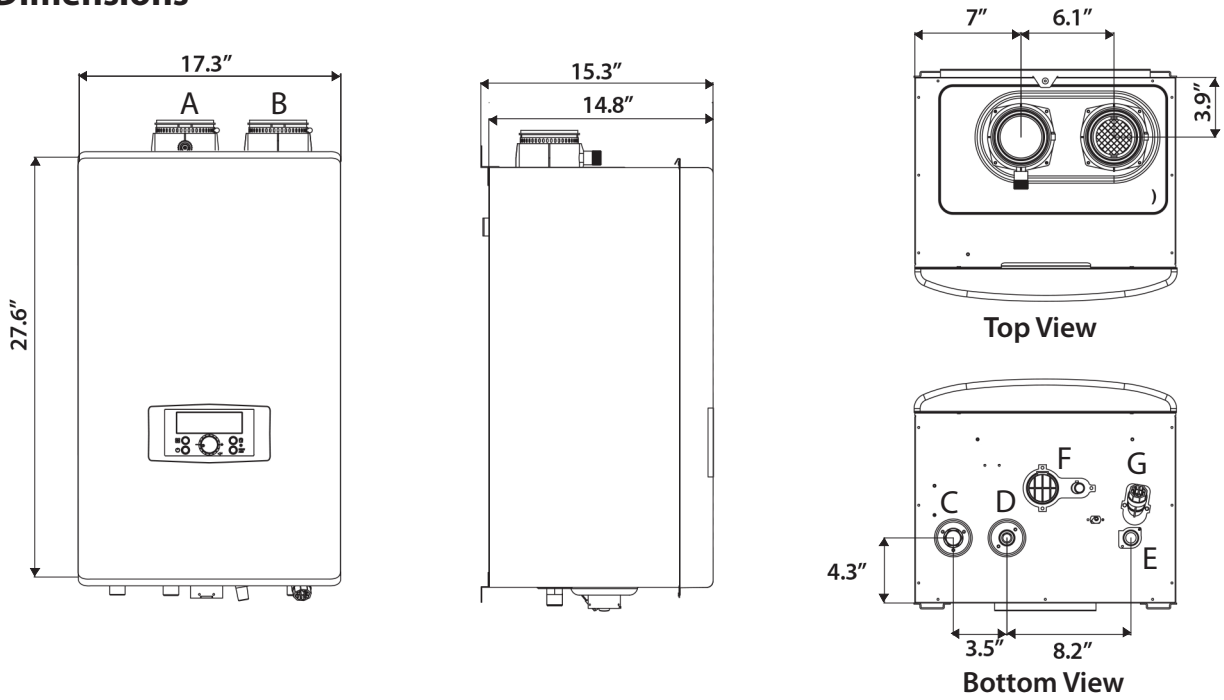
# Product Specifications

## Specifications

MODEL		TWH180	TWH180LP
Fuel		Natural Gas	Propane
Gas Input Rate	Max.	180,000 Btu/h	
	Min.	18,000 Btu/h	
Energy Factor		.95	
Hot Water Capacity	35°F Rise	9.8 GPM	
	45°F Rise	7.6 GPM	
	77°F Rise	4.4 GPM	
Installation		Indoor Wall Hung	
Flue System		Sealed Combustion Direct Vent	
Vent		2" (50 ft) /3" (100ft) Schedule 40 PVC, CPVC, PP	
Orifice Size (mm)		9.5	7.1
Gas Supply Pressure ("WC)		3.5" WC ~ 10.5" WC	8.0" WC ~ 13.0" WC
Manifold Pressure ("WC)	Min.	-0.13" WC	-0.08" WC
	Max.	-0.14" WC	-0.09" WC
Power Supply	Main Supply	120 V 60 Hz	
	Max power consumption	135 W	
Ignition System		Direct Electronic Ignition / Automatic Flame Sensing	
Burner System		Premixed Fuel Metal Fiber Burner	
Gas Valve System		Negative Pressure Gas Valve	
Minimum Flow Rate		0.5 GPM	
Internal Pipe Material		SS 304	
Weight		88 lbs	
Heat Exchanger Water Capacity		Less than 2 Gallons	
Water Pressure	Max.	150 psi	
	Min.	15 psi	
Connection Sizes	Water Inlet/Outlet	3/4" NPT	
	Gas Inlet	3/4" NPT	
Materials	Casing	Cold Rolled Carbon Steel	
	Heat Exchanger	Primary Heat Exchanger: SS 304 Secondary Heat Exchanger: SS 304	
Safety Devices		Overheat High Limit Switch, Gas Leak Detector Sensor, Exhaust Temperature High Limit Switch, Water Temperature High Limit Switch, Frost Protection Ceramic Heater	

# Product Specifications

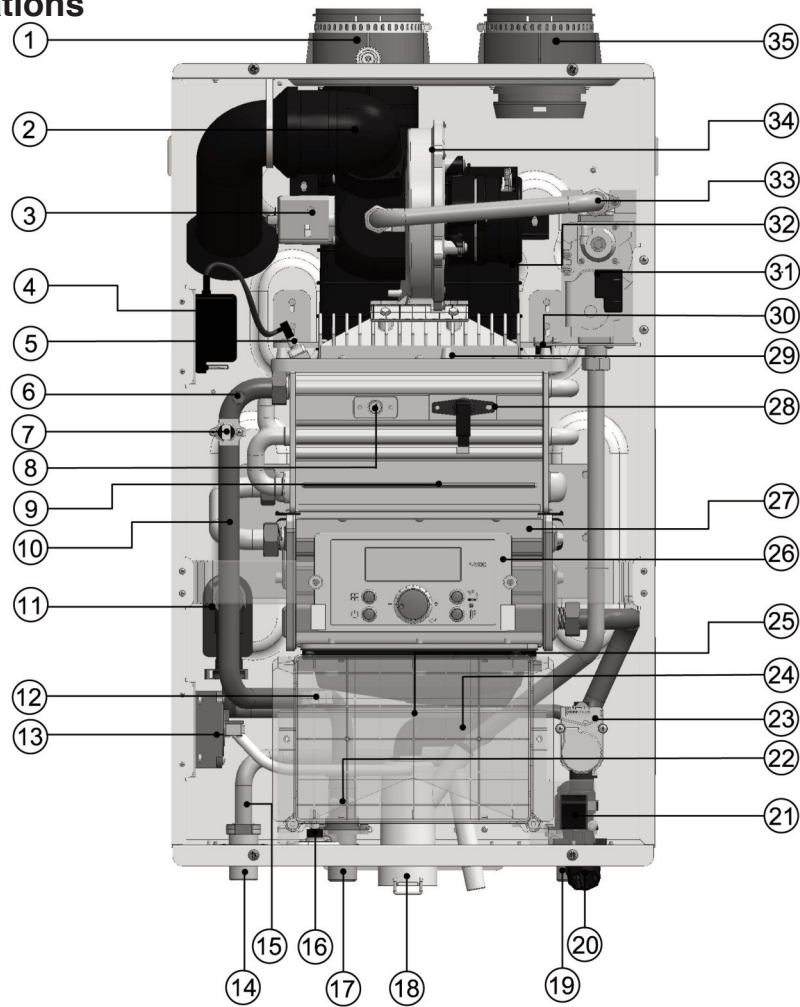
## Dimensions



Item	Description	Diameter
A	Exhaust Outlet Adapter	3"
B	Air Intake Adapter	3"
C	Gas Inlet	3/4"
D	Hot Water Outlet	3/4"
E	Cold Water Inlet	3/4"
F	Condensate Drain	1/2"
G	Cold Water Stainer	

# Product Specifications

## Component Locations



Item	Description	Item	Description
1	Exhaust Outlet Adapter	19	Cold Water Inlet
2	Air Intake Pipe	20	Cold Water Inlet Strainer
3	AGM (Air Gas Mixer)	21	Manual Power Switch
4	Ignition Transformer	22	DHW NTC
5	Igniter	23	Water Adjustment Valve
6	OP NTC	24	Condensate Trap Hose
7	H/L Overheat Switch	25	Main Controller
8	Sight Glass	26	Display Panel
9	Primary Heat Exchanger	27	Secondary Heat Exchanger
10	Hot Water Outlet Pipe	28	Flame Detection Sensor
11	Mixing Valve	29	Burner Case
12	Ceramic Heater	30	Burner Overheat Switch
13	Air Pressure Switch	31	Gas Valve
14	Gas Inlet	32	Exhaust Duct
15	Gas Inlet Pipe	33	Gas Inlet Pipe
16	Freeze Protector	34	BLDC Fan
17	DHW Outlet	35	Air Intake Adapter
18	Condensate Trap		

## Product & Safety Information

### WARNING

To avoid product damage, personal injury, or even possible death, carefully read, understand, and follow all the instructions in the Installation and Operation manual before installation, operation and servicing the Water Heater.

ACV-Triangle Tube cannot anticipate every circumstance that might involve a potential hazard. Therefore, all possible incidents are not included in our warnings. Proper installation, operation, and service are your responsibility.

You must make sure that the operation and settings of the Water Heater are safe for you and for others.

### Definitions

This manual provides Safety Symbols. When the user fails to adhere to the following requirements, it may cause death, serious damage, or great property loss.

### DANGER

Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

### WARNING

Indicates a potentially hazardous situation which, if ignored, can result in death, serious injury or substantial property damage.

### CAUTION

Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. It is also used to alert against unsafe practices and hazards involving only property damage.

### WARNING

#### FOR YOUR SAFETY READ BEFORE OPERATING

If you do not follow these instructions exactly, a fire or explosion could result causing property damage, personal injury or loss of life.

- A. This appliance does not have a pilot. It is equipped with an ignition device which automatically lights the burner. Do not try to light the burner by hand.
- B. **BEFORE OPERATING** smell all around the appliance area for gas. Be sure to smell next to the floor because some gas is heavier than air and will settle on the floor.

#### WHAT TO DO IF YOU SMELL GAS

- Do not try to light any appliance.
  - Do not touch any electric switch; do not use any phone in your building.
  - Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions.
  - If you cannot reach your gas supplier, call the fire department.
- C. Use only your hand to push in or turn the gas control knob. Never use tools. If the knob will not push in or turn by hand, don't try to repair it, call a qualified service technician. Force or attempted repair may result in a fire or explosion.
  - D. Do not use this appliance if any part has been under water. Immediately call a qualified service technician to inspect the appliance and to replace any part of the control system or gas control which has been under water.

This appliance must be installed in accordance with local codes if any; if not, follow ANSI Z223.1/ NFPA 54 or CAN/CSA B149.1, Natural Gas and Propane Installation Code, as applicable.



## Product & Safety Information



### DANGER

- **Vapors from flammable liquids can explode and catch on fire. These will cause death or severe burns.**
- **Do not use or store flammable products such as gasoline, solvents or adhesives in the same room or area near the appliance.**

#### Keep flammable products

- **Far away from water heater**
- **In approved containers**
- **Tightly closed**
- **Out of children's reach**

#### Vapors

- **Cannot be seen**
- **Are heavier than air**
- **Spread on the floor**
- **Can spread from other rooms to the main burner by air currents**

**Do not install the appliance where flammable products will be stored.**

**Read and follow water heater warnings and instructions thoroughly. If owner's manual is missing, contact the retailer or manufacturer.**

- The Marquis Water Heater must be installed by a qualified plumber, a licensed gas fitter, and/or a professional service technician.
- Improper installation and/or operation may cause a potentially hazardous situation, such as serious injury or death. Also, it will void the warranty.
  - The National Fuel Gas Code NFPA 54 / ANSI Z223.1
  - National Electric Code ANSI/NEPA 70
  - All applicable local, state, national and provincial codes, regulations and laws.

- Proper care is your responsibility. Carefully read and understand the Operating Information in this manual before operating the Marquis Water Heater.
- Be aware of the location of the gas shut-off valve and operation method.
- Close the gas shut-off valve immediately if the appliance is subjected to fire, overheating, flood, physical damage, or any other damaging condition that might affect the operation of the unit. Water Heater must be checked by a qualified technician before resuming operation.
- DO NOT use this Water Heater if any part has been submerged under water. Immediately call a qualified technician for inspecting the Water Heater and replacing any part of the control system and gas control which has been under water.
- Do not power up the unit until the gas and water supply valves are fully opened. Make sure that the fresh air intake port and exhaust gas port are opened and functional.
- DO NOT attempt to install, repair, or service this Water Heater by yourself.
- Do not change any part of the Water heater. Contact a qualified technician if the Water Heater needs repair or maintenance.
- DO NOT use spray paint, hair spray, or any other flammable spray near Water Heater or near the exterior fresh air inlet port. DO NOT place any items in or around the exterior exhaust gas outlet port and/or fresh air inlet port. These could restrict or block the flow in or out of the vent system.

### CAUTION

**While repairing control, all wires are labeled. You must connect the wires in accordance with the instruction. Wiring errors can cause improper and dangerous operation.**

- Verify proper operation after servicing.
- This water heater consists of the gas ignition system components which are protected from water (dripping, spraying, rain, etc.) during operation and service (circulator replacement, condensate trap, control replacement, etc.).
- After installing the water heater, safety device must be tested. (Please refer to the 'FMEA').

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## Product & Safety Information

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- \* This water heater is equipped with a blocked vent shutoff system.

If the error code '41' occurs, follow the instructions below.

- Turn off the manual gas valve.
- Make sure that there is no foreign object in the vent passage or rodent screen.
- If you do not find any problem, do the following.
- Turn off the error state by pressing the power button on display panel.
- If the error occurs again, call your service technician or gas supplier.

## Unit Installation



Installations must comply with:

- All the local, state, provincial, and national codes, laws, regulations and ordinances.
- National Fuel Gas Code, ANSI Z223.1 – The latest version.
- National Electrical Code.
- National Standard of Canada CAN/CSA-B149.1-05

Check before operating the Water Heater

- Always check the connected components which are near the water heater. The components are below.

Water piping / Venting adapter / Gas supply piping / Electrical power / Condensate drain hose.

- Confirm area around Water Heater. Remove any combustible materials, gasoline and other flammable liquids. Failure to keep Water Heater area clear and free of combustible materials, gasoline and other flammable liquids and vapors can result in severe personal injury, death or substantial property damage.
- The Water Heater which has gas control system components must be protected from any possible danger during operation and service.
- If this Water Heater replaces an existing appliance, check and correct system problems, for example: System leaks causing oxygen corrosion or heat exchanger cracks from hard water deposits.

- If the water heater was installed in a narrow space or corner, please ensure that there is sufficient space for service and maintenance access. For regular maintenance, there should not be any problem accessing gas and water lines.
- The water heater must be installed on a wall that can bear its weight.

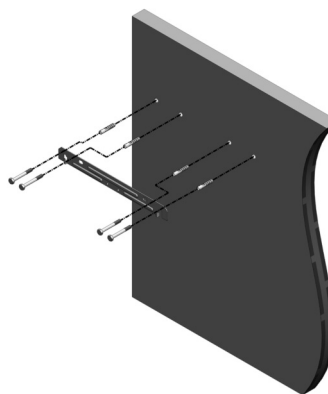


### CLEARANCES FOR SERVICE ACCESS

- The water heater must be installed on a wall that can bear its weight.
- The Water heater can be installed on any suitable internal wall (suitable sound proofing may be required when installing onto a stud wall).
- For specific details of Water heater, go to Manual page 3.

Method of positioning the water heater on a wall

- Please refer to the template before installing the water heater.
- Attach the template exactly to the location where you want to install the appliance.
- Drill 4 1/2" holes at the position of template bracket which is appropriate place for installing the water heater.



### Minimum Clearances

Required from Non-Combustibles/Combustibles		Recommended Service Clearance
Top of Appliance	9 Inch (228.6 mm)	• 40 Inch (1016 mm) or more (Front of Appliance)
Back of Appliance	5/8 inch (15.9 mm)	
Front of Appliance	6 Inch (152.4 mm)	
Side of Appliance	3 Inch (76.2 mm)	• 8 Inch (203 mm) or more (Side of Appliance)
Bottom of Appliance	12 Inch (304.8 mm)	

## Vent / Combustion Air Installation

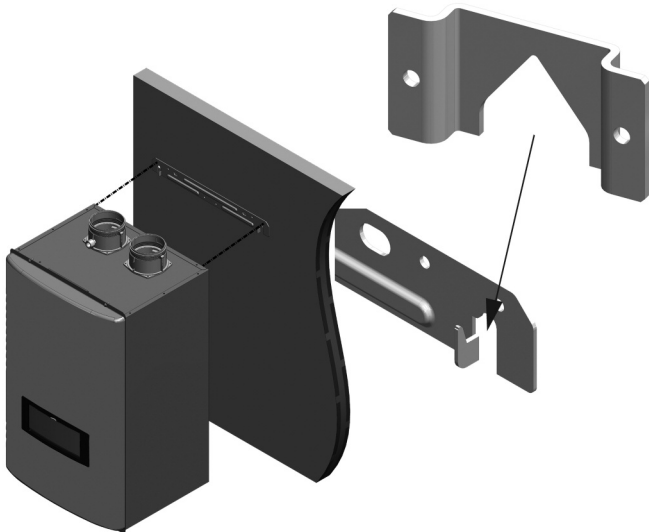
- After four anchors are inserted in the holes, mount the wall bracket.
- Affix the wall bracket securely to the wall. Make sure that it is level and it can support the weight of the water heater.
- Align the grooves on the back of the water heater with the tongues on the mounting bracket and hang the water heater on the bracket.
- If overheating occurs or the gas supply fails to shut off, turn off the manual gas valve.
- This installation must conform with below section
  - “Air for Combustion and Ventilation” of the National Fuel Gas Code, ANSI Z223.1/NFPA 54, or Sections 8.2, 8.3 or 8.4 of Natural Gas and Propane Installation Code, CAN/CSA B149.1, or applicable provisions of the local building codes.

### Vent pipe installation

- You must follow the test procedure below when installing the heater.

At the time of removal of an existing water heater, the following steps shall be followed with each appliance remaining connected to the common venting system placed in operation, while the other appliances remaining connected to the common venting system are not in operation.

- (a) Seal any unused openings in the common venting system.
- (b) Visually inspect the venting system for proper size and horizontal pitch and determine there is no blockage or restriction, leakage, corrosion and other deficiencies which could cause an unsafe condition.
- (c) Close all building doors and windows and all doors between the space in which the appliances remaining connected to the common venting system are located and other spaces of the building. Turn on clothes dryers and any appliance not connected to the common venting system. Turn on any exhaust fans, such as range hoods and bathroom exhausts, so they will operate at maximum speed. Do not operate a summer exhaust fan. Close fireplace dampers.
- (d) The inspection should begin in operation mode. Follow the lighting instructions. Adjust thermostat so appliance will operate continuously.
- (e) Test for leakage at the draft hood relief opening after 5 minutes of main burner operation. Use the flame of a match or candle, or smoke from a cigarette, cigar, or pipe.
- (f) Any improper operation of the common venting system should be corrected so the installation conforms with the National Fuel Gas Code, ANSI Z223.1/NFPA 54, and/or the Natural Gas and Propane Installation Code, CAN/CSA B149.1. If resizing any portion of the common



### CAUTION

**Ensure water heater is the proper Natural Gas/Propane model for the application. Propane-ready water heaters have suffix "LP" after the model number.**

- Adequate drainage
  - The appliance should be installed not to damage the adjacent area.  
If such locations cannot be avoided, it is recommended that a suitable drain pan, be installed under the appliance.
- Connecting the Water Supply
  - To conserve water and energy, insulate all water piping especially the hot and recirculation water lines. Never cover the drain or pressure relief valve.  
Having a backflow preventer in the cold water supply line means it will prevent thermal expansion backflow.

## Vent / Combustion Air Installation

venting system, the common venting system should be resized to the minimum size as determined using the appropriate tables in Chapter 13 of the National Fuel Gas Code, ANSI Z223.1/NFPA 54, and/or the Natural Gas and Propane Installation Code, CAN/CSA B149.1.

### WARNING

- **Failure to vent this Water Heater in accordance with these instructions could cause leakage of products combustion. This will result in severe property damage, personal injury or death.**
- **Do not interchange vent systems or materials.**
- **The use of thermal insulation covering pipe and fittings is prohibited.**
- **Do not apply an electric damper, draft hood or vent damper with this Water Heater.**
- **Do not locate vent termination where exposed to prevailing winds. Moisture and ice may fall on surface around vent termination. To prevent deterioration, surface must be in good repair (sealed, painted, etc.).**

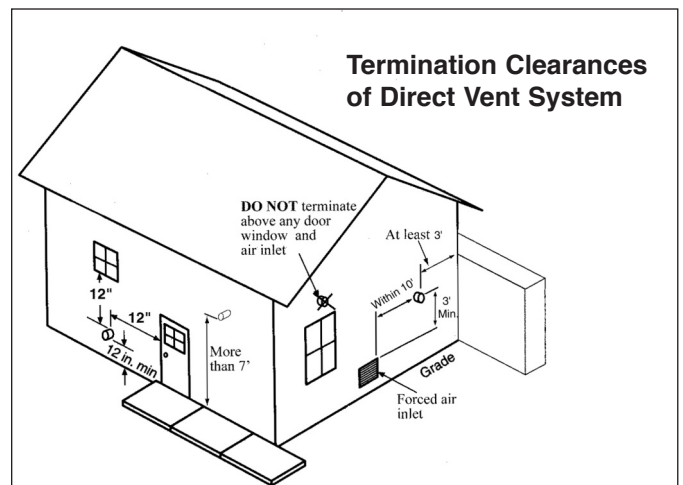
### Direct Vent Guidelines

1. Vent system installation must be in accordance with Local codes or, in the absence of local codes, the National Fuel Gas Code, ANSI Z223.1 / NFPA 54 and/or CSA B149.1, Natural Gas and Propane Installation Code.
2. Do not install venting system components on the exterior of building except as specifically required by these instructions
  - Vent terminals must be at least 1 foot from any door, window, or gravity inlet into the building.
  - Maintain the correct clearance and orientation between the vent and air intake terminals.
  - The vent and air intake terminals must be at the same height and their center lines must be spaced apart 12" minimum.
  - The bottom of the vent and air intake terminal must be at least 12" above the normal snow line. In no case should they be less than 12" above grade level.
  - Do not install the vent terminal directly over windows or doors.

- Air intake terminal must not terminate in areas that might contain combustion air contaminants, such as near swimming pools.
- For sidewall venting, the minimum horizontal distance between any adjacent water heater vent terminations is twelve (12) inches. It is better to be far more than 12 inches for avoiding frost damage to building surfaces where vent terminations are placed.
- The minimum horizontal distance between any adjacent water heater roof vent is one (1) foot.

The direct vent termination must also maintain the following clearances; as shown below.

- a. At least 3 feet [0.9 m] from adjacent walls
- b. At least 3 feet [0.9 m] below roof over hangs
- c. At least 7 feet [2.1 m] above any public walkways
- d. At least 3 feet [0.9 m] above any forced air intake within 10 feet [3 m] (does not apply to the combustion air inlet of a direct vent appliance).
- e. No closer than 12" [30.5 cm] below or horizontally from any door or window or gravity air inlet.
- f. Must be at least 4 feet [1.2 m] (6 feet [1.8 m] Canada) from any electric meters, gas meters-regulators, relief valves or other equipment. Never terminate the vent above or below any of these items within 4 feet [1.2 m] (6 feet [1.8 m] Canada) horizontally.
- g. A minimum 12 inches [30.5 cm] horizontal spacing from other fan assisted appliance vents such as clothes dryer vent, kitchen exhaust vent etc. Never terminate the vent above or below any fan assisted vent within 12 inches [30.5 cm] horizontally.



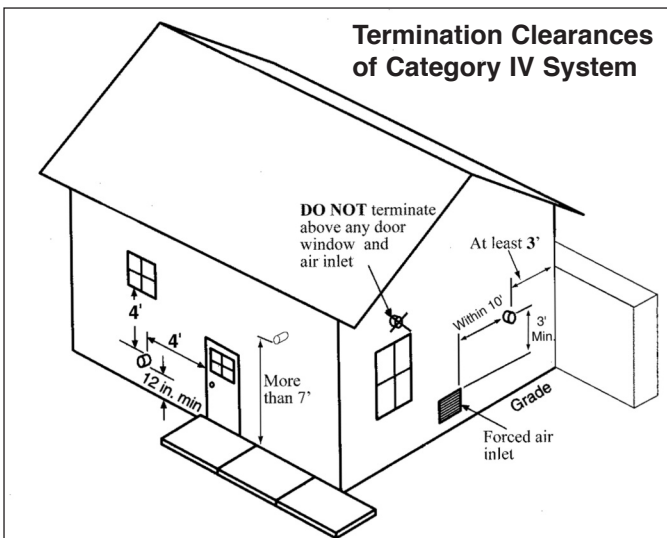
# Vent / Combustion Air Installation

## Category IV Vent Guidelines

1. Vent system installation must be in accordance with Local codes or, in the absence of local codes, the National Fuel Gas Code, ANSI Z223.1 / NFPA 54 and/or CSA B149.1, Natural Gas and Propane Installation Code.
2. Do not install venting system components on the exterior of building except as specifically required by these instructions
  - Vent terminals must be at least 4 feet from any door, window, or gravity inlet into the building.
  - The bottom of the vent terminal must be at least 12" above the normal snow line. In no case should it be less than 12" above grade level.
  - Do not install the vent terminal directly over windows or doors.
  - For sidewall venting, the minimum horizontal distance between any adjacent water heater vent terminations is twelve (12) inches. It is better to be far more than 12 inches for avoiding frost damage to building surfaces where vent terminations are placed.

The Category IV vent termination must also maintain the following clearances; as shown below.

- a. At least 3 feet [0.9 m] from adjacent walls
- b. At least 3 feet [0.9 m] below roof over hangs
- c. At least 7 feet [2.1 m] above any public walkways
- d. At least 3 feet [0.9 m] above any forced air intake within 10 feet [3 m].
- e. No closer than 4 feet [1.2 m] below or horizontally from any door or window or gravity air inlet.



## Maximum Allowable Vent Lengths (PVC, CPVC, PP)

TWH180/ TWH180LP	Maximum Length	Maximum Elbows
<b>2" Combustion Air / Vent Pipe</b>	50' (15 M)	4
<b>3" Combustion Air / Vent Pipe</b>	100' (30 M)	6

### Note:

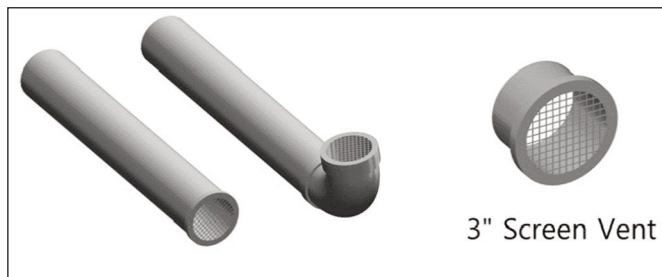
Reduce maximum allowable length:

- 5 feet (1.5 M) for each additional 3-inch 90 degree elbow
- 2.5 feet (0.75 M) for each additional 3-inch 45 degree elbow
- 8 feet (2.4 M) for each additional 2-inch 90 degree elbow
- 4 feet (1.2 M) for each additional 2-inch 45 degree elbow
- The thickness of the wall vents installed: Min 4" ~ Max 20"

## Vent Termination

### 1. Bird Screen Installation

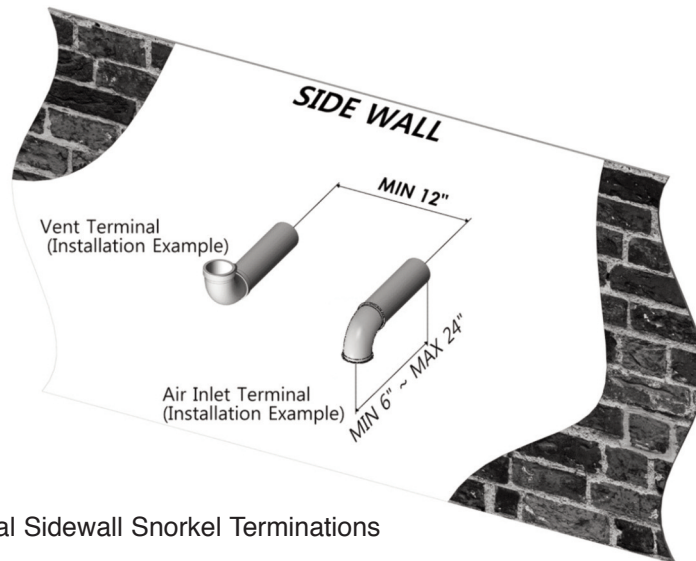
- Install Bird Screen at Vent Terminal
- After connecting vent/air inlet terminal, it is required to install screen for the terminal to prevent blockage, which might cause damage to the unit.



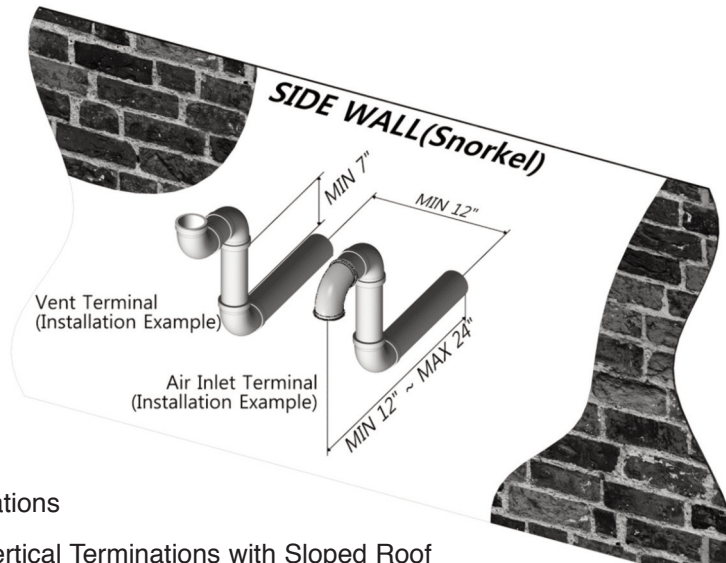
# Vent / Combustion Air Installation

## 2. Horizontal Vent Terminations

- Direct Vent - Sidewall Terminations

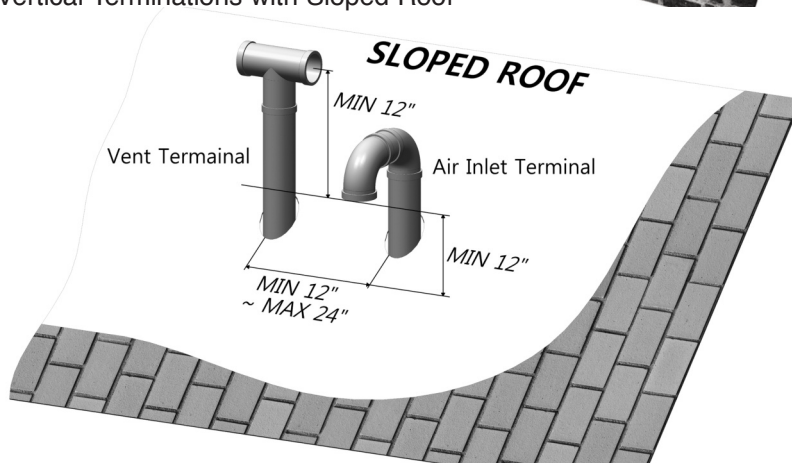


- Direct Vent - Optional Sidewall Snorkel Terminations



## 3. Vertical Vent Terminations

- Direct Vent - Vertical Terminations with Sloped Roof



## Vent / Combustion Air Installation

### Venting Installation

The water heater uses 3" or 2" diameter exhaust and 3" or 2" diameter intake air ducts. To ensure the draw of air directly from and exhaust of air directly to the outside of the building, create an airtight seal from the water heater collar to the vent termination.

Intake materials can be made of PVC, CPVC, PP.

For installation in Canada, field-supplied plastic vent piping must comply with CAN/CGA B149.1 (latest edition) and be certified by the Standard For Type BH Gas Venting Systems, ULC-S636. Components of this listed system must not be interchanged with other vent systems or unlisted pipes or fittings. All plastic components and specified primers and glues of the certified vent system must be from a single system manufacturer and must not be intermixed with another system manufacturer's parts.

#### Recommended Vent Material:

PVC Schedule 40 / Type BH Special Gas Vent Class IIA (PVC) / Type BH Special Gas Vent Class IIB (CPVC)  
This water heater has a built-in control to limit the exhaust temperature to 149°F (65°C).

The following type of non-metallic vent can be used

- PVC (schedule 40, ASTM-D1785)
- CPVC (schedule 40, ASTM-D2846)
- PP (ULC-S636)
  
- Use of cellular core PVC (ASTM F891), cellular core CPVC, or Radel (polyphenolsulfone) in venting systems shall be prohibited.
- Covering non-metallic vent pipe and fittings with thermal insulation is prohibited.

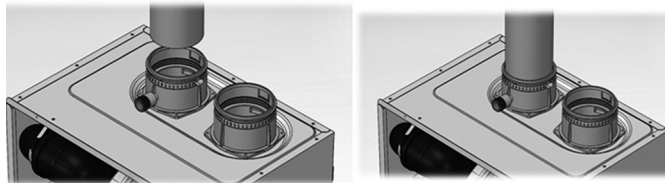
#### Vent Pipe & Combustion Air Pipe Adapters

Canada has adopted standard ULC S636 which requires the following additional items.

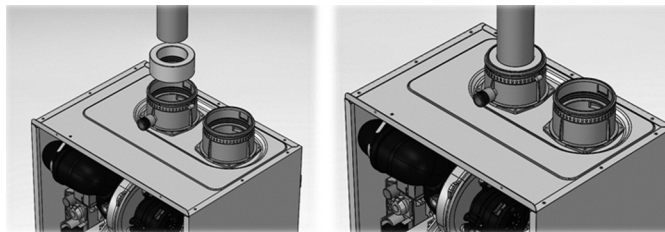
The following steps for cement application are highlighted:

- Clean and dry your selected PVC, CPVC, PP vent pipe and Water Heater adapter.
  - Select the size of vent pipe (2" & 3"), according to the installation requirements.
  - Push the pipe into the adapter until it touches the bottom of the fitting.

- 3inch pipe connecting



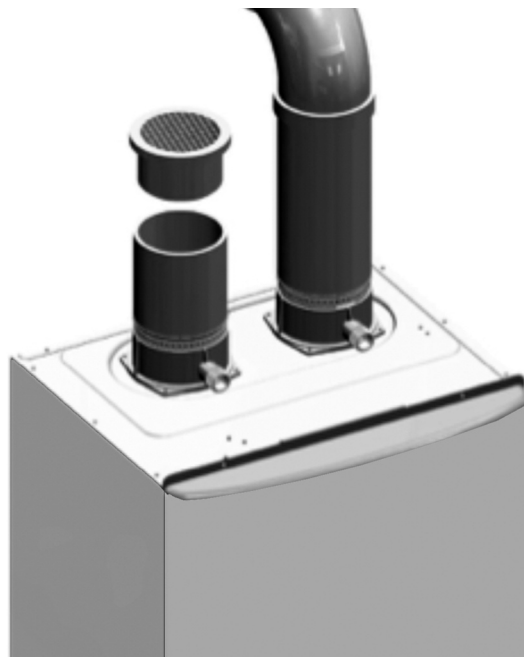
- 2 inch pipe connecting



- Tighten the clamps using a screwdriver.

#### Category IV Venting

1. Insert the termination end cap into the intake air duct as shown below.



2. Provide two openings to allow for circulation of combustion air as specified by ANSI Z223.1/NFPA 54 or CAN/CGA B-149.1:



## Gas Piping

<b>Model</b>	<b>TWH180 / TWH180LP</b>
Maximum Input (BTU/H)	180,000
Indoor make up air is provided, a minimum free area of 1 Inch per 1,000 BTU/H	180 square inches 13 1/2" (W) x 13 1/2" (H)

### Natural Gas Pipe Sizing

Maximum capacity of pipe in cubic feet of gas per hour for gas pressures of 0.5 psi or less and a pressure drop of 0.5 inch water column. (Based of a 0.60 Specific gravity gas).

#### Length of Black Iron Pipe (Schedule 40 Metallic)

Pipe Size	Length (ft)									
	10	20	30	40	50	60	80	100	150	200
1/2"	172	118	95	81	72	65	56	50	40	34
3/4"	360	247	199	170	151	137	117	104	83	71
1"	678	466	374	320	284	257	220	195	157	134
1-1/4"	1390	957	768	657	583	528	452	400	322	275
1-1/2"	2090	1430	1150	985	873	791	677	600	482	412
2"	4020	2760	2220	1900	1680	1520	1300	1160	928	794

Refer to the ANSI Z223.1 National Fuel Gas Code 2012 Edition)

### Propane Gas Pipe Sizing

Intended use: pipe sizing between single-or second-stage (low pressure) regulator and appliance.

Inlet Pressure: 11in. w.c./Pressure Drop: 0.5 in w.c.

/Specific Gravity: 1.5

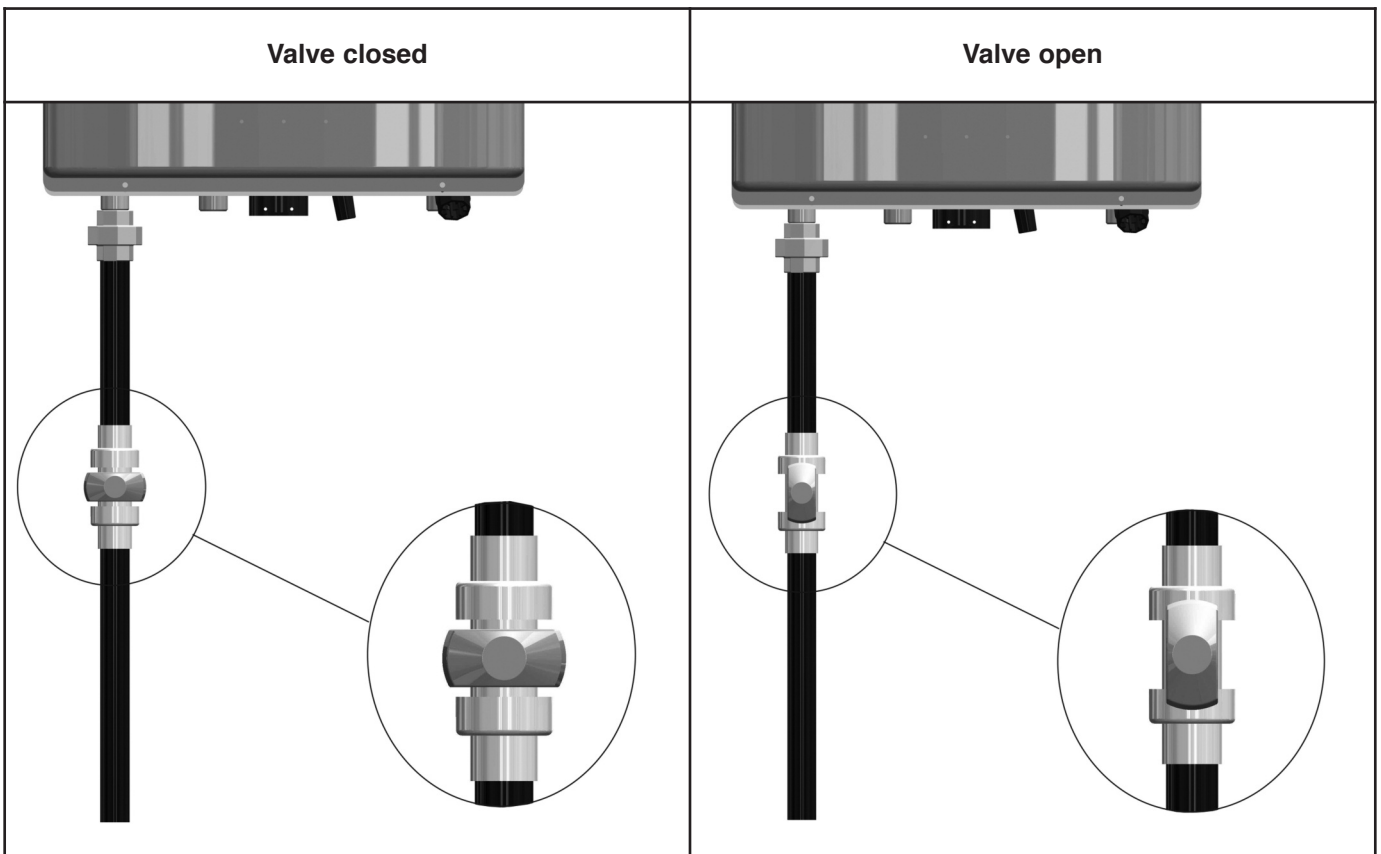
#### Length of Black Iron Pipe (Schedule 40 Metallic)

Pipe Size	Length (ft)									
	10	20	30	40	50	60	80	100	150	200
1/2"	291	200	160	137	122	110	101	94	84	67
3/4"	608	418	336	287	255	231	212	197	175	140
1"	1150	787	632	541	480	434	400	372	330	265
1-1/4"	2350	1620	1300	1110	985	892	821	763	677	543
1-1/2"	3520	2420	1940	1660	1480	1340	1230	1140	1010	814
2"	6790	4660	3750	3210	2840	2570	2370	2200	1950	1570

Refer to the ANSI Z223.1 National Fuel Gas Code 2012 Edition)

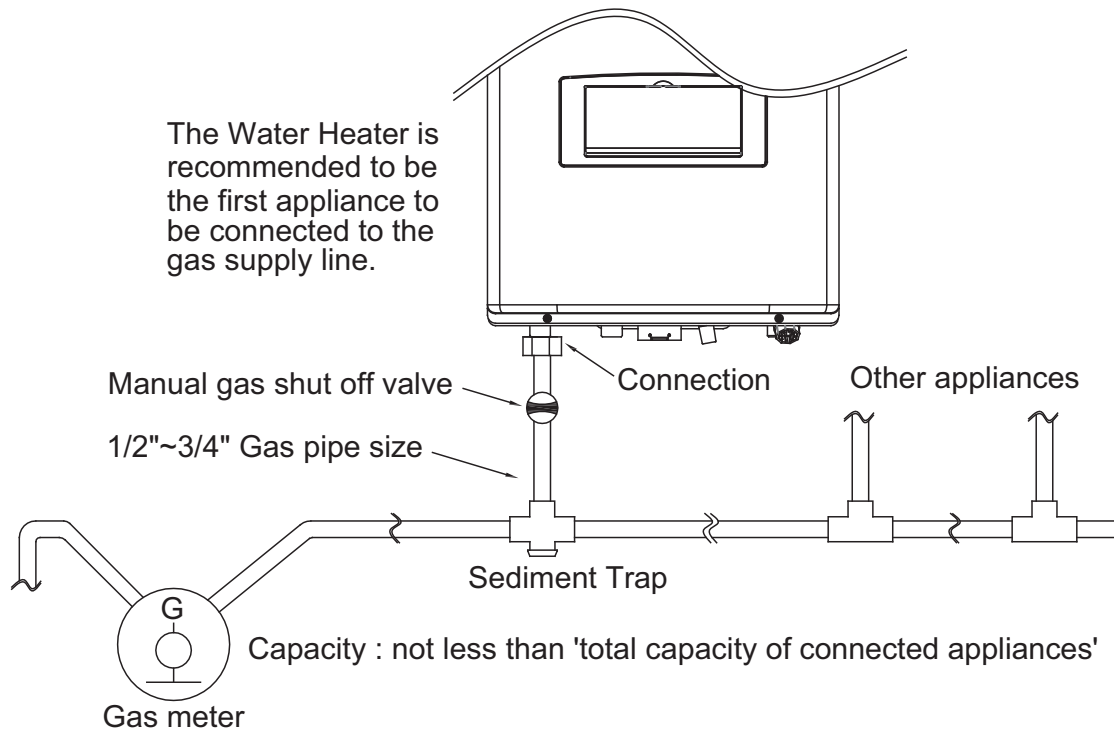
## Gas Piping

- The gas connection fitting on the unit is 3/4" female NPT.
- The supply line must be sized for the maximum output of the water heater model being installed. If there are additional gas appliances from the main supply line, you must measure sizes of the supply line according to the COMBINED total maximum BTUH draw for the appliances as if they were all operating at the same time.
- Measure the length of the gas supply line from the gas meter to the Water Heater.
- Use the tables in this manual or refer to the gas line manufacturers sizing information to determine the correct supply pipe size.
- The gas shut-off valve in the gas supply line should be installed close to the unit.
- To facilitate any future maintenance, it is also recommended that gas union be installed in the supply line between the shut-off valve and the 3/4" female NPT connection on the Water Heater.
  1. Install gas pipe to gas line connection under the Water Heater. Include manual shut off valve and gas union connection, as shown.
  2. Test gas pressure to make sure it meets the minimum standards and does not exceed the maximum standards for the water heater.
  3. Leak test the gas pipe before placing the unit in operation. Use approved leak detector liquid solutions only to check for leaks.
- Do not operate the water heater until all connections have been completed and the heat exchanger is filled with water

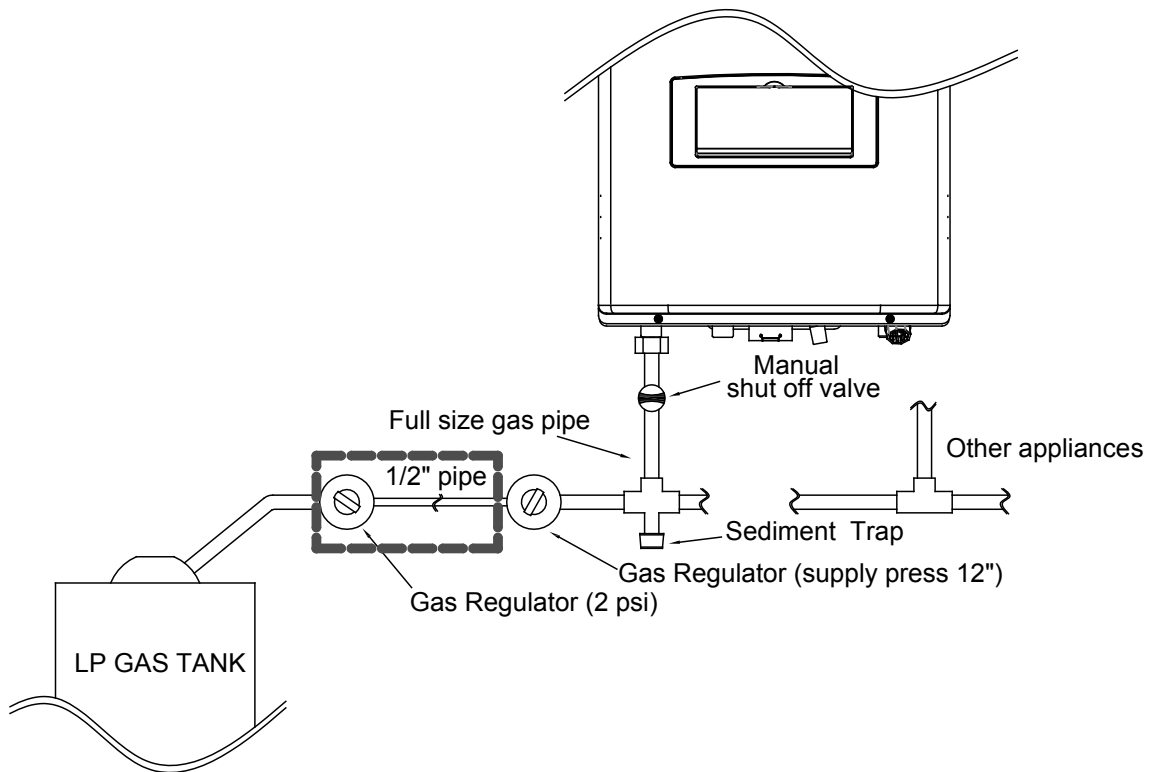


# Gas Piping

## NG Gas typical installation

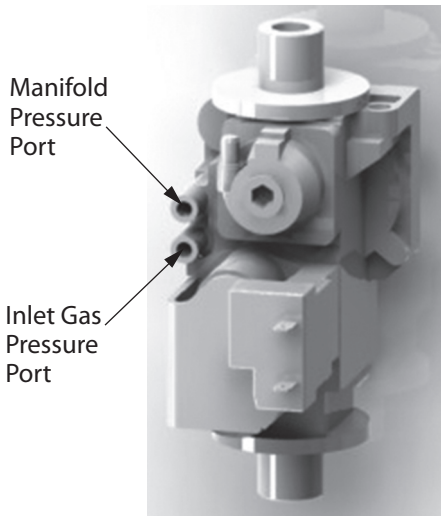


## LP Gas typical installation



## Water Piping

See below for location of inlet and manifold gas pressure ports on the gas valve.



The minimum and maximum inlet gas pressure are:

Natural Gas		LP Gas	
<b>Maximum Pressure</b>	10.5" WC	<b>Maximum Pressure</b>	13" WC
<b>Minimum Pressure</b>	3.5" WC	<b>Minimum Pressure</b>	8.0" WC

The appliance and its individual shutoff valve must be disconnected from the gas supply piping system during any pressure testing of that system at test pressures in excess of ½ psi (3.5 k Pa). The appliance must be isolated from the gas supply piping system by closing its individual manual shutoff valve during any pressure testing of the gas supply piping system at test pressures equal to or less than ½ psi (3.5 kPa).

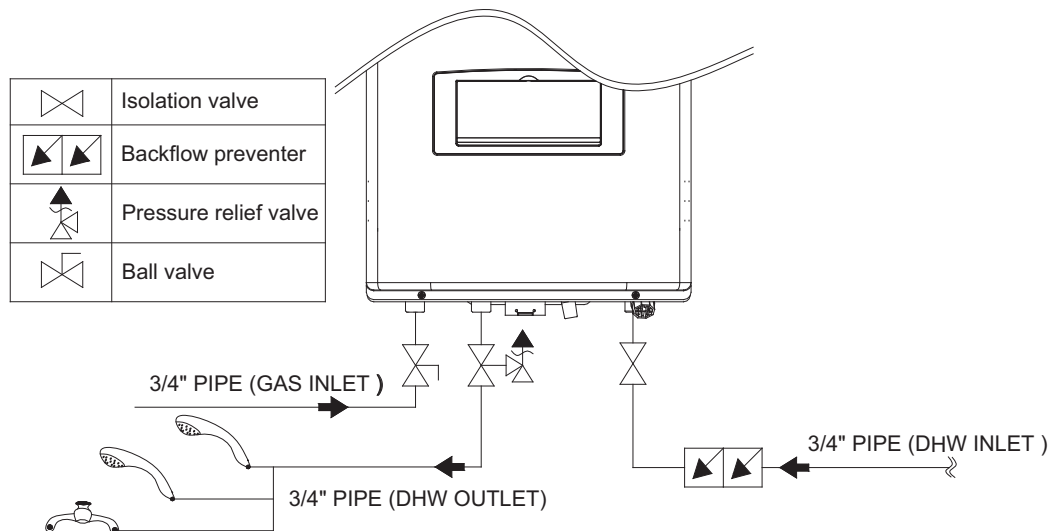
## Plumbing and Water Connection Guidelines.



- **Use at least the MINIMUM pipe size of 3/4" for all Water Heater loop piping**
  - The pipe must be cleaned and without any blemish.
  - Do not apply torch heat within 12" of the bottom connections of the unit.
  - The pipe size used for the inlet water should be the same size used for the outlet water.
  - The size of the hot water pipe should be a minimum 3/4" diameter.
  - Isolation valves must be used.
  - ACV-Triangle Tube highly recommends installation of tankless water heater isolation valves with flushing ports for routine maintenance.
  - All piping should be insulated.

## Backflow Preventer

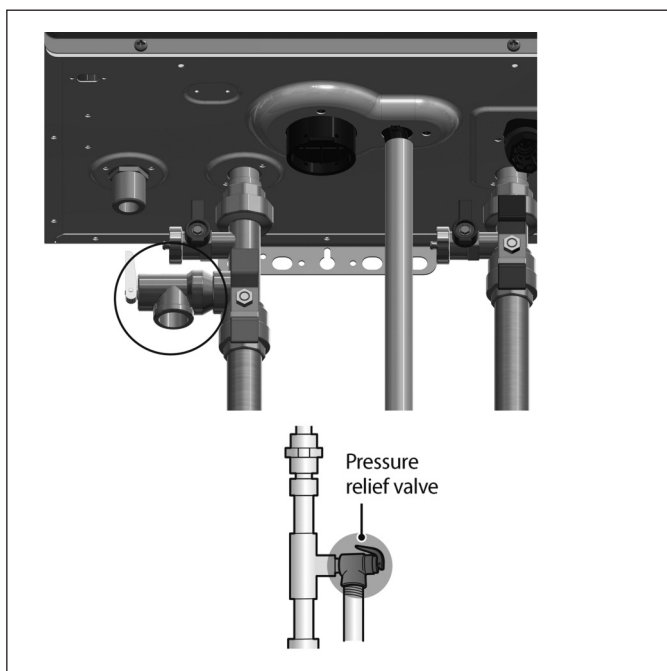
- Apply a backflow preventer valve in the make-up water supply (water Inlet) to the unit as required by local codes.



## Water Piping

### Pressure Relief Valve

- A pressure relief valve must be installed. Observe the following. Failure to comply with the guidelines on installing the pressure relief valve and discharge piping can result in personal injury, death or substantial property damage.
- DO NOT install a relief valve with pressure higher than 150psi. This is the maximum allowable relief valve setting for the water heater.
- Test the operation of the valve after filling and pressurizing system by lifting the lever.
- Make sure the valve discharges freely. If the valve fails to operate correctly, replace it with a new relief valve.
- An approved ASME HV Valve must be installed on the DHW supply line for hydronic domestic hot water loop as close to the unit as possible. (Valve size 3/4", maximum 150psi)
- This appliance has a high-temperature shut off switch built in as a standard safety feature therefore a "pressure only" relief valve is required.
- Direct the discharge piping of the pressure relief valve so that hot water will not splash on anyone or any nearby equipment. Attach the discharge line to the pressure relief valve and run the end of the line to a suitable drain.
- No other valve should be placed between the pressure relief valve.



### Condensate Drain

- The Water Heater creates condensate when it is operating.
- Condensate has acidic (pH) of approximately 3~4.
- Condensate must be drained in accordance with all local regulations.

Follow your local code with regards to the disposal of condensate.

- If a neutralizer is installed, periodic replacement of the limestone will be required. The rate of depletion of the limestone varies upon usage of the Water Heater.
- During the first year of operation, check the neutralizer every few months for depletion.
- Apply only corrosion-resistant materials for the condensate drain lines such as PVC, CPVC, Polypropylene pipe or included plastic hose.

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## Power Connection

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### Power Connection



Wire and electrically ground Water Heater in accordance with authority having jurisdiction or in the absence of such requirements follow the National Electrical Code, NFPA 70, and/or CSA C22.1 Electrical Code-Part 1 in Canada.

#### **ELECTRICAL SHOCK HAZARD**

For your safety, turn off electrical power supply at service entrance panel before making any electrical connections to avoid possible electric shock hazard. Failure to do so can cause severe personal injury or death.

- This appliance must be electrically grounded. Ensure the electrical receptacle, in which the water heater will be plugged into, is properly grounded.
- Do not attach the ground wire to either the gas or the water piping as plastic pipe or dielectric unions may isolate the Water Heater electrically.
- The wiring diagrams contained in this manual are for reference purposes only.
- Do not disconnect the power supply when the unit is in normal operation.
- Damage caused by freezing is not covered under the warranty.

## Control System

### General Description

P920C is a Display Interface with a Liquid Crystal Display.

It will be used to navigate and to change temperature set point, and change controller parameters.

### Operating Conditions

- Temperature
  - Operating Ambient Temperature Range: 50 to 140°F.
  - Operating Relative Humidity up to: 90% at 104°F.
  - Shipping & Storage Temperature Range of: 0 to 170°F.
- There is one set of DIP switches on the control module
- The number 6,7 DIP switch has to be OFF when operating the water heater at the normal state.



This unit is only approved for installation up to 10,000ft. above sea level.

#### Note:

This water heater may be installed at elevation up to 10,000ft for use with Natural Gas or Propane. To use the water heater at a specific altitude, Setting in Installer Mode should be set as describe below.

Above 2,000ft (610m), the water heater will de-rate by 4% for each 1,000ft (305m) of altitude gain.

Figures below are available within range of 2,000 ~4,500 ft (610~1350 m)

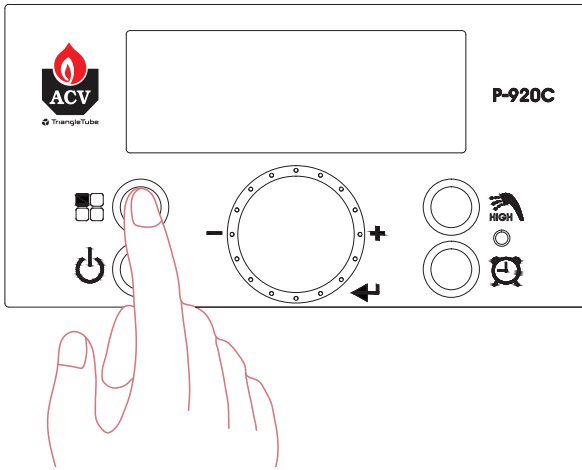
High Altitude Setting			
Level	Value		
9:HA	Choose an altitude from the following four options where water heater is installed		
0~2	0~1,999 ft (0~609m)		
2~5	2,000~4,999 ft (610~1,523m)		
5~8	5,000~7,999 ft (1,524~2,438m)		
8~10	8,000~10,000 ft (2,439~3,048m)		
Propane CO		Natural Gas CO	
3" VENT	2" VENT	3" VENT	2" VENT
100 ~ 300 ppm (Low - High Fire)			

High Altitude Setting	Firing Rate	Propane CO2	Natural Gas CO2
		3"/2" VENT	3"/2" VENT
0~2	Max. fire +/- 0.1%	10.7	10
	Min. fire +/- 0.1%	9.7	8.5
2~5	Max. fire +/- 0.1%	10.2	9.1
	Min. fire +/- 0.1%	10.3	9.7
5~8	Max. fire +/- 0.1%	10.3	9.1
	Min. fire +/- 0.1%	10.4	9.8
8~10	Max. fire +/- 0.1%	10.5	9
	Min. fire +/- 0.1%	10.6	9.8

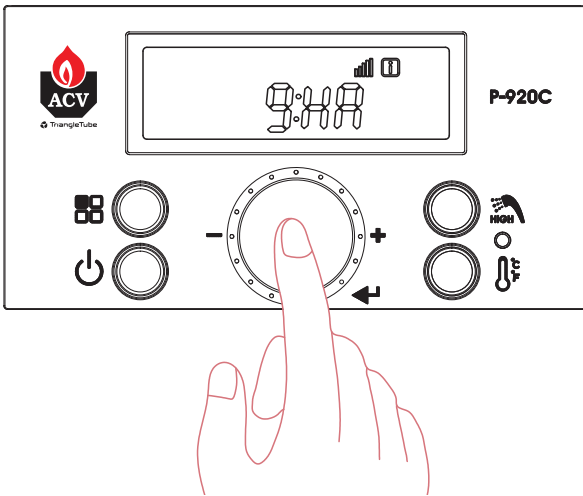
## Control System

- Setting the High Altitude Setting

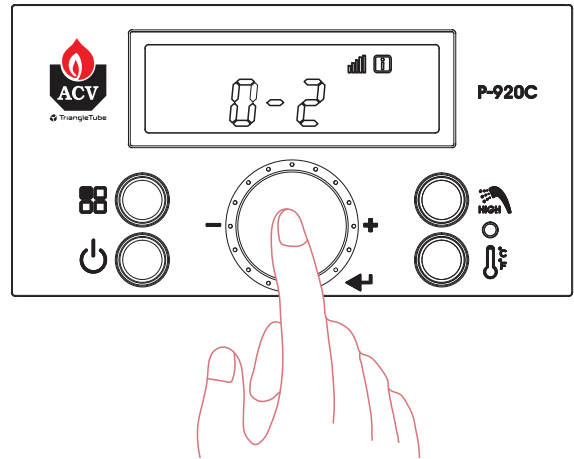
1. Press the ON/OFF button on the display to turn the unit OFF. Press and hold the Menu Button for approximately 5 seconds to get into the "Installer mode".



2. Turn the dial to reach the high altitude setting then press the dial button.



3. Turn the dial clockwise to select the high altitude setting for the application. (Default setting is '0-2' and high elevation is above 2,000ft as sea level.

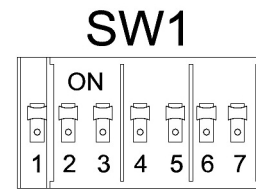


4. Press the dial button to store the current setting and return back to "Installer mode".



## Control System

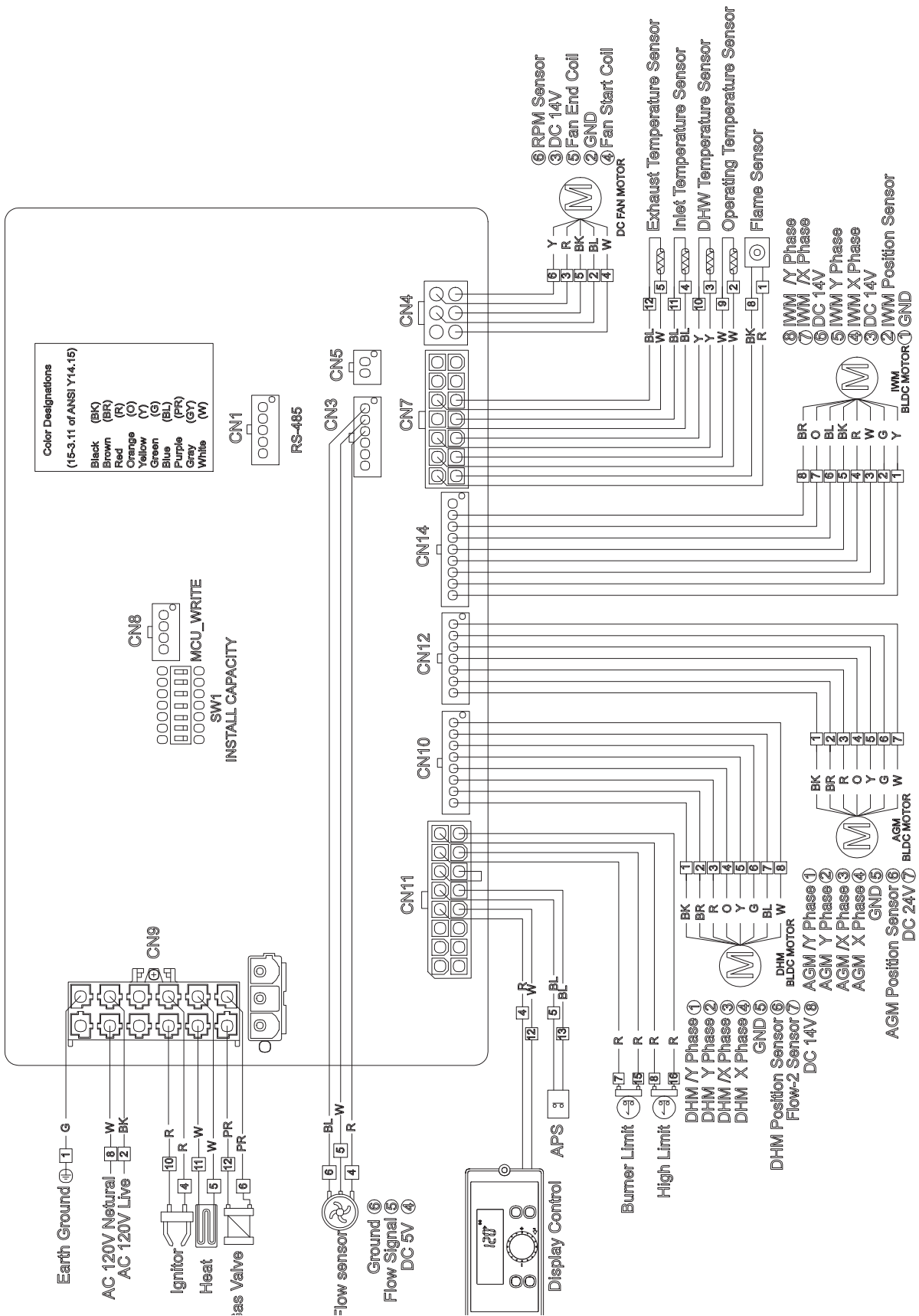
Dip Switch		OFF	ON
1-3	N/A	N/A	
4	Inlet Limit	Operating	Not Operating
5	Gas Type	LP	NG
6	Max.	Normal	Max.
7	Min.	Normal	Min.



- System Control Specifications

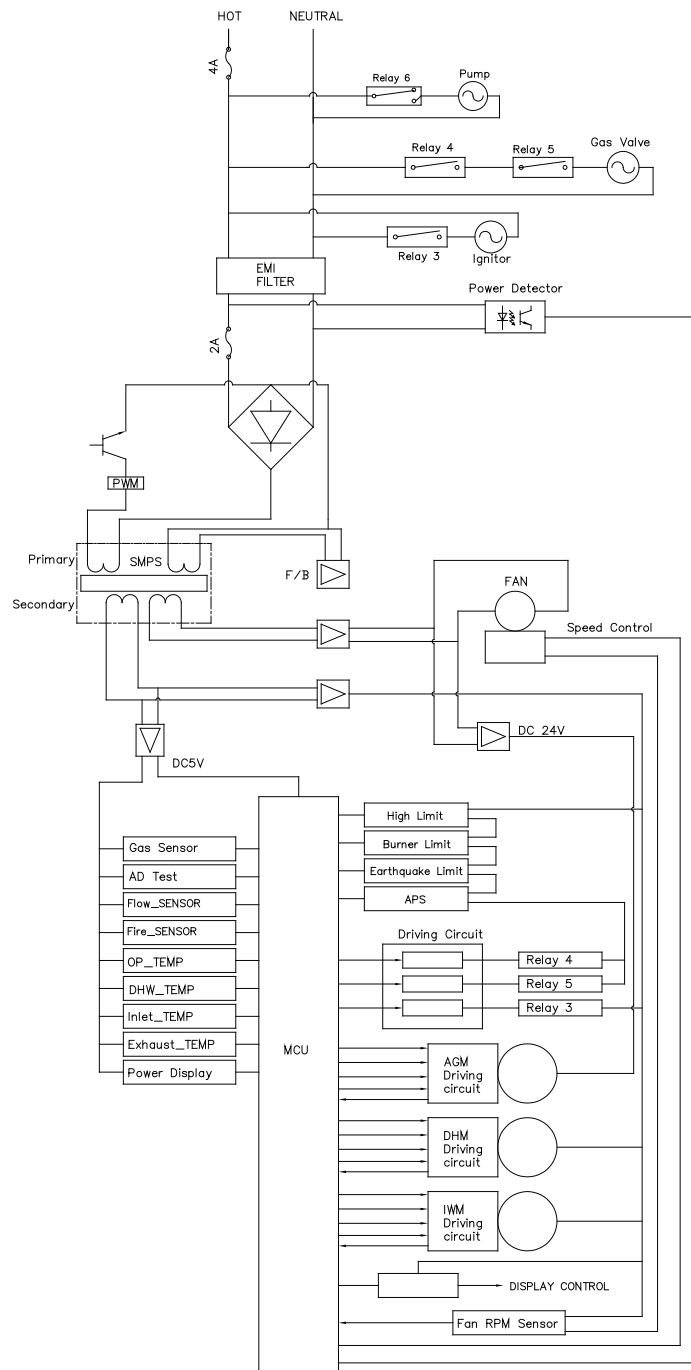
Maximum flame detecting voltage	2.4 V
Pre-purge time	Maximum 10s, minimum 1s
Safety Time (igniting time)	3.5s
Igniting interval time	<10s
Post-purge time	180s
Over-heating 1,2,3 protection detection time	<1s
Temperature sensor fault detection time	<2s
Nr. of trial for ignition	10
DHW water SET temperature range	
DHW water OFF temperature	DHW target temperature + DHW differentials temperature (15°C)
DHW water ON temperature	Below DHW target temperature +3°C
DHW water ON minimum water flow	0.5 GPM
DHW water OFF minimum water flow	0.4 GPM

# Control System





# Control System

- Ladder Diagram



## Control System

Connector			Descriptions	HT SELV	HT SELV Max. Length
no. of location and type	Pin nr.	Board Silk			
CN9 65001WS-12	1	-	CASE GROUND	-	-
	2	L	Power Supply Line	HT (120VAC)	-
	3	CP1	Unused	HT (120VAC)	-
	4	IT	Ignitor	HT (120VAC)	-
	5	L(HT)	Heater	HT (120VAC)	-
	6	GV	Gas Valve	HT (120VAC)	-
	7		EARTH GROUND	HT (120VAC)	-
	8	N	Power Supply Neutral	HT (120VAC)	-
	9-12		AC Power COM Line	HT (120VAC)	-
CN1 SMW250-03	1	RS-485	RS485 +	SELV (5VDC)	<=1km
	2		RS485 -	SELV (5VDC)	<=1km
	3		-	-	-
CN4 LWD1140-06	1	FAN	Unused	-	<=1.5m
	2		GND	SELV (30VDC)	<=1.5m
	3		VDD	SELV (14VDC)	<=1.5m
	4		Fan power(start coil)	SELV (30VDC)	<=1.5m
	5		Fan power(end coil)	SELV (30VDC)	<=1.5m
	6		Fan speed feedback signal	SELV (14VDC)	<=1.5m
CN8 SMW250-04	1	MCU ISP	GND	SELV (5VDC)	<=1.5m
	2		ISP /Reset port	SELV (5VDC)	<=1.5m
	3		ISP TOOL0 Data port	SELV (5VDC)	<=1.5m
	4		VCC	SELV (5VDC)	<=1.5m
CN11 LWD1140-16	1	HWL	Unused	-	-
	8				
	2	LWL	Unused	-	-
	10				
	3	HD	Unused	-	-
	11				
	4	TH	Connect to the Display Control (Thermostat)	SELV (14VDC)	Min:AWG20, <=100m
	12				
	5	APS	Air Pressure Switch	SELV (14VDC)	<=1.5m
	13				
	7	BL	Burner Limit	SELV (14VDC)	<=1.5m
	15				
	8	HL	High Limit	SELV (14VDC)	<=1.5m
17					

## Control System

Connector			Descriptions	HT SELV	HT SELV Max. Length
no. of location and type	Pin nr.	Board Silk			
CN7 LWD1140-14	1	F.S	Flame detect sensor	SELV (5VDC)	<=1.5m
	8				
	2	OP.S	Operation water temperature sensor	SELV (5VDC)	<=1.5m
	9				
	3	DH.S	DHW temperature sensor	SELV (5VDC)	<=1.5m
	10				
	4	I.S	Inlet water temperature sensor	SELV (5VDC)	<=1.5m
	11				
	5	BG.S	Exhaust temperature sensor	SELV (5VDC)	<=1.5m
	12				
	6	ST.S	Unused	-	-
	13				
	7	SP.S	Unused	-	-
	14				
CN12 SMW250-07	1	AGM	AGM stepper motor coil /Y phase	SELV (24VDC)	<=1.5m
	2		AGM stepper motor coil /Y phase	SELV (24VDC)	<=1.5m
	3		AGM stepper motor coil /X phase	SELV (24VDC)	<=1.5m
	4		AGM stepper motor coil /X phase	SELV (24VDC)	<=1.5m
	5		GND	SELV (24VDC)	<=1.5m
	6		AGM stepper motor coil /Y phase	SELV (24VDC)	<=1.5m
	7		VDD	SELV (24VDC)	<=1.5m
CN10 SMW250-08	1	DHM	DHM stepper motor coil /Y phase	SELV (14VDC)	<=1.5m
	2		DHM stepper motor coil /Y phase	SELV (14VDC)	<=1.5m
	3		DHM stepper motor coil /X phase	SELV (14VDC)	<=1.5m
	4		DHM stepper motor coil /X phase	SELV (14VDC)	<=1.5m
	5		GND	SELV (14VDC)	<=1.5m
	6		DHM stepper motor position	SELV (14VDC)	<=1.5m
	7		Unused	SELV (14VDC)	<=1.5m
	8		VDD	SELV (14VDC)	<=1.5m
CN14 SMW250-09	1	IWM	GND	SELV (14VDC)	<=1.5m
	2		IWM stepper motor position	SELV (14VDC)	<=1.5m
	3		VDD	SELV (14VDC)	<=1.5m
	4		IWM stepper motor coil X phase	SELV (14VDC)	<=1.5m
	5		IWM stepper motor coil Y phase	SELV (14VDC)	<=1.5m
	6		VDD	SELV (14VDC)	<=1.5m
	7		IWM stepper motor coil /X phase	SELV (14VDC)	<=1.5m
	8		IWM power IWM stepper motor coil /Y phase	SELV (14VDC)	<=1.5m
	9		Unused	-	-

## Control System

Connector			Descriptions	HT SELV	HT SELV Max. Length
no. of location and type	Pin nr.	Board Silk			
CN3 SMW250-06	1	WPS	Unused	SELV (5VDC)	<=1.5m
	2		Unused	SELV (5VDC)	<=1.5m
	3		Unused	SELV (5VDC)	<=1.5m
	4	FLUX1	VCC	SELV (5VDC)	<=1.5m
	5		Water flow sensor	SELV (5VDC)	<=1.5m
	6		GND	SELV (5VDC)	<=1.5m
CN5 SMW250-10	1	RPM	Fan RPM check	SELV (5VDC)	<=1.5m
	2		GND	SELV (5VDC)	<=1.5m

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## Start-Up Procedures

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### Quick Review

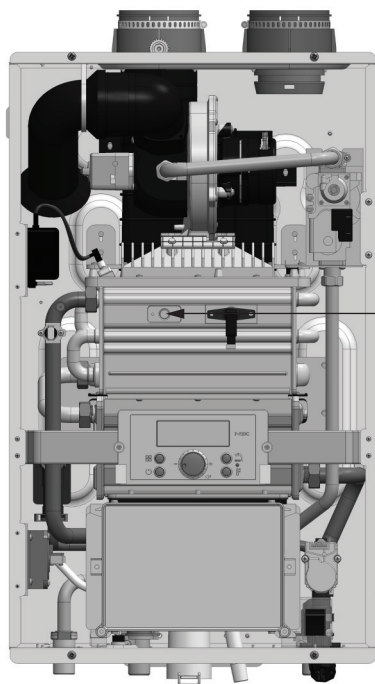
- Before Installing
  - Make sure that there is enough space for installing Water and gas line.
  - Verify vent/air termination is located as required.
- Install Water Piping
  - Water Heater piping must be sized to the minimums listed in the Water Heater manual. Using smaller piping will cause performance problems.
- Install Vent & Air Piping
  - Slide the air inlet pipe and vent pipe into the Water Heater adapters.
  - Make sure the terminations are placed as required in the manual and that terminations are at least 12 inches above normal snow line.
- Install Condensate Piping / Tubing & Components
  - Pipe condensate drain to suitable drain or condensate pump.
- Install Gas Piping
  - Install a union and shutoff valve.
- Wire the Water Heater
  - Connect power wiring.
- Start up, Adjust & Test
  - Follow the Water Heater manual instructions to clean the system if needed, then fill and check water chemistry.

### Final check list

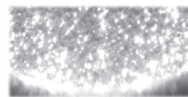
- Final check : Installation conditions.
  - Is there a drain which is close to the Water Heater?
  - Is there any combustible material near the Water Heater or vent pipe?
  - Is air supply sufficient for proper operation of the Water Heater?
  - Are the proper service clearances maintained?
  - Is the distance between the Water Heater and point of vent termination minimized?
  - Are the proper space from windows, doors, and other intake vents maintained?
- Final check : Gas pipe installation
  - Is the gas supply line equipped with a manual shut off valve?
  - Is the gas supply line a minimum of 3/4" diameter?
  - Is the gas supply line length and diameter adequate to deliver the required BTU's?
  - Has the gas supply line pressure been measured?
  - Does the gas type match with the type indicated on the rating plate?
- Final check: Air/Vent pipe installation
  - Has the Water Heater been vented with PVC, CPVC, Polypropylene, or BH Special Vent (S636 PVC, CPVC) in accordance with this manual and your local code?
  - Is the vent termination at least 12" above the exterior grade?
  - Is the total vent length within the maximum vent length restriction?
  - Have you checked the air/vent piping for leaks?
  - Have you properly supported the vent termination?
  - Are all vent runs properly supported?
  - Is the vent sloped upward toward the vent termination at a rate of 1/4" per foot (2% grade)?

## Start-Up Procedures

- Final Check: Condensate drain installation
  - Have you installed a condensate drain line from the water heater to a drain or laundry tub?
- Final check: Setting the DIP switches
  - Are all DIP switches correctly set on the main board?
- Final check : Connecting the power supply
  - Is the AC 120V power correct ?
  - Have you checked the polarity of the electrical connection?
- Final check : Pressure relief valve
  - Have you installed an approved pressure relief valve on the water heater?
- Is the pressure relief valve at least 3/4" in diameter?
- Have you installed the pressure relief valve on the hot water outlet pipe near the Water Heater?
- Final check : Burner flames
  - The burner flame must be checked periodically for a constant proper blue color.
  - If the flame does not appear normal, the burner may need to be cleaned.
  - If the burner needs to be cleaned, it must be performed by a qualified service technician.



Sight Glass



Blue flame picture

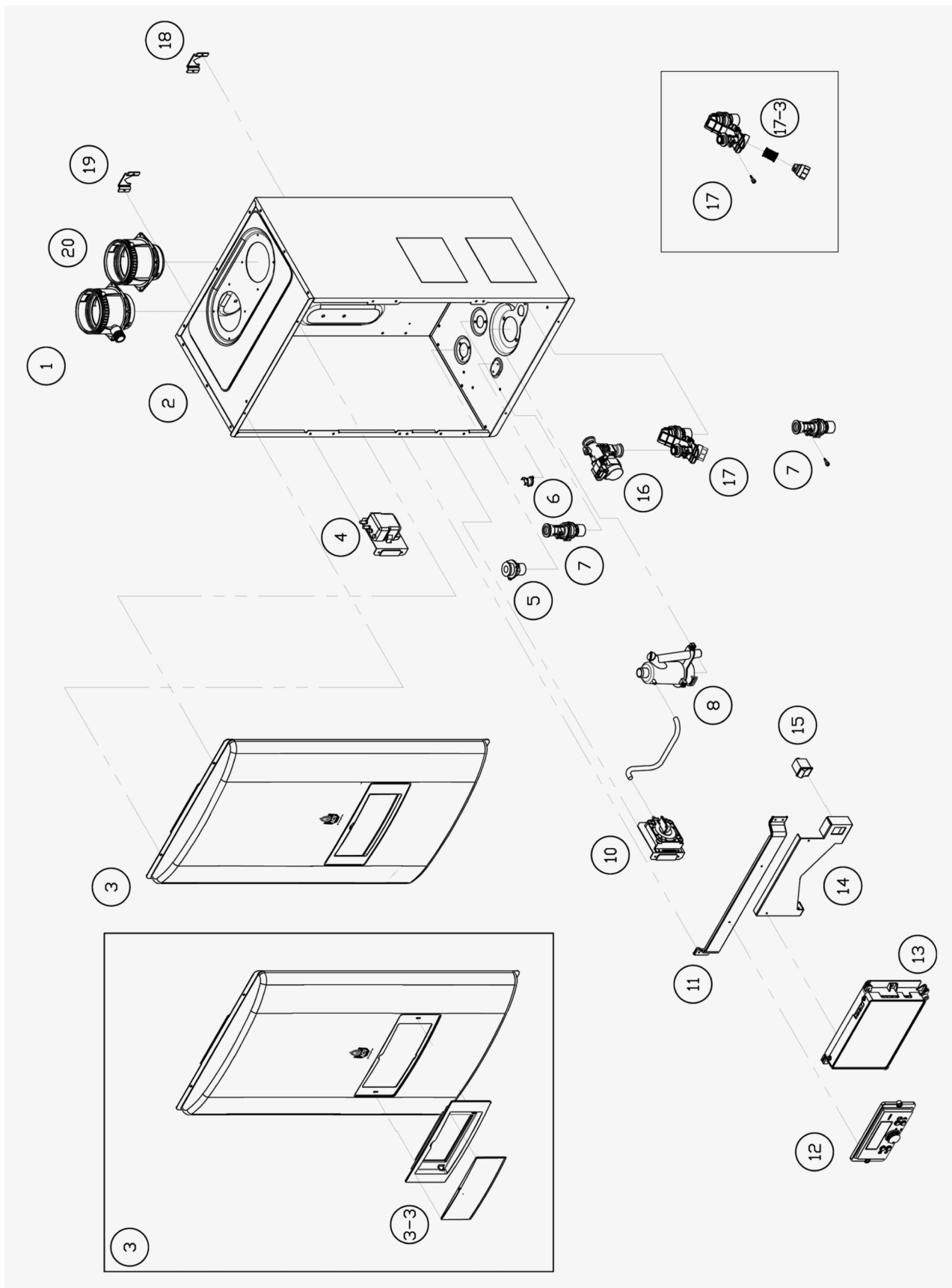


## Trouble Shooting

### FMEA

Electrical Component	Wiring Mode	Effect And Consequences	Failure Control Actions
Temperature sensor (INLET NTC)	CN7 Lead Disconnect I.S(4,11)	Temperature sensor Circuit Open/Short	<ul style="list-style-type: none"> <li>• Gas Valve locks Out below 2 Seconds</li> <li>• Controlled safety cut-off "E31" displays</li> </ul>
Temperature sensor (OUTLET NTC)	CN7 Lead Disconnect DH.S (3,10)	Temperature sensor Circuit Open/Short	<ul style="list-style-type: none"> <li>• Gas Valve locks Out below 2 Seconds</li> <li>• Controlled safety cut-off "E32" displays</li> </ul>
Temperature sensor (OP NTC)	CN7 Lead Disconnect OP.S(2,9)	Temperature sensor Circuit Open/Short	<ul style="list-style-type: none"> <li>• Gas Valve locks Out below 2 Seconds</li> <li>• Controlled safety cut-off "E33" displays</li> </ul>
Temperature sensor (Exhaust NTC)	CN7 Lead Disconnect BG.S(5,12)	Temperature sensor Circuit Open/Short	<ul style="list-style-type: none"> <li>• Gas Valve locks Out below 2 Seconds</li> <li>• Controlled safety cut-off "E35" displays</li> </ul>
FAN	CN4 FAN(2,3,6)	Fan speed too high as to flue blocked	<ul style="list-style-type: none"> <li>• Gas Valve locks Out below 2 Seconds</li> <li>• Controlled safety cut-off "E41" displays</li> </ul>
Burner Limit Overheating S/W	CN11 EL(7,15)	Burner Limit Overheated	<ul style="list-style-type: none"> <li>• Gas Valve locks Out below 1 Seconds</li> <li>• Controlled safety cut-off "E43" displays</li> </ul>
High Limit Overheating S/W	CN11 HL(8,16)	High Limit Overheated	<ul style="list-style-type: none"> <li>• Gas Valve locks Out below 1 Seconds</li> <li>• Controlled safety cut-off "E20" displays</li> </ul>
APS	CN11 APS(5,13)	Condensate is blocked	<ul style="list-style-type: none"> <li>• Gas Valve locks Out below 1 Seconds</li> <li>• Controlled safety cut-off "E29" displays</li> </ul>
Flame Sensor	CN7 F.S(1,8) Flame Sensor Lead Disconnect	Flame Sensor Circuit Opened	<ul style="list-style-type: none"> <li>• Gas Valve locks Out Instant</li> <li>• Safety shut-off after 10 times Re-ignition, "E72"</li> </ul>
IGNITER	CN9 I.T(4,10) IGNITER Lead Disconnect	IGNITER Circuit Opened	<ul style="list-style-type: none"> <li>• Safety shut-off after 10 times Re-ignition, "E11" displays</li> </ul>
Gas Valve	CN9 GV(6,12) GAS Valve Lead Disconnect	GAS Valve Circuit Opened	<ul style="list-style-type: none"> <li>• Gas Valve locks Out Instant</li> <li>• Safety shut-off after 10 times Re-ignition, "E11"</li> </ul>

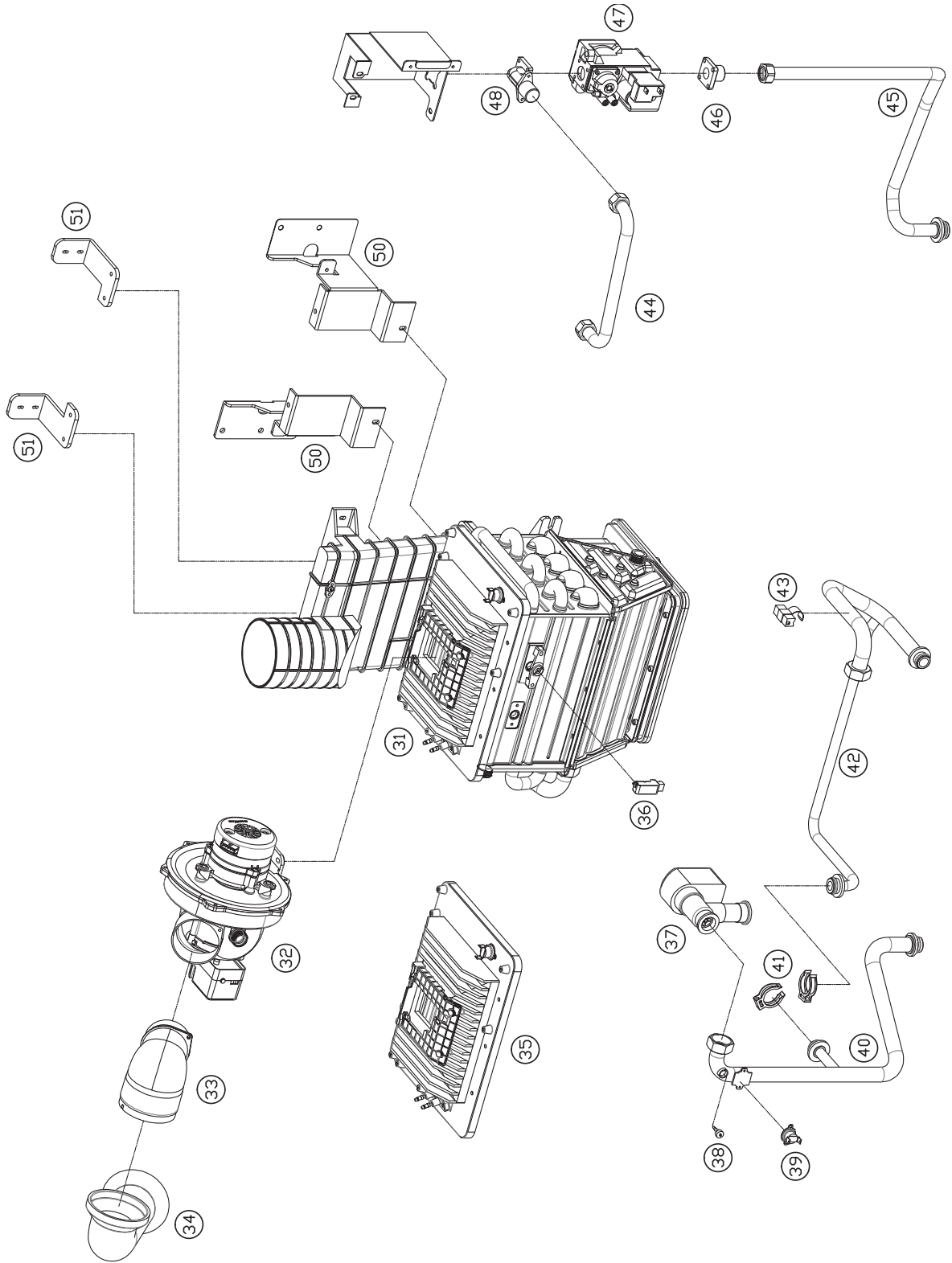
# Repair Parts Diagram



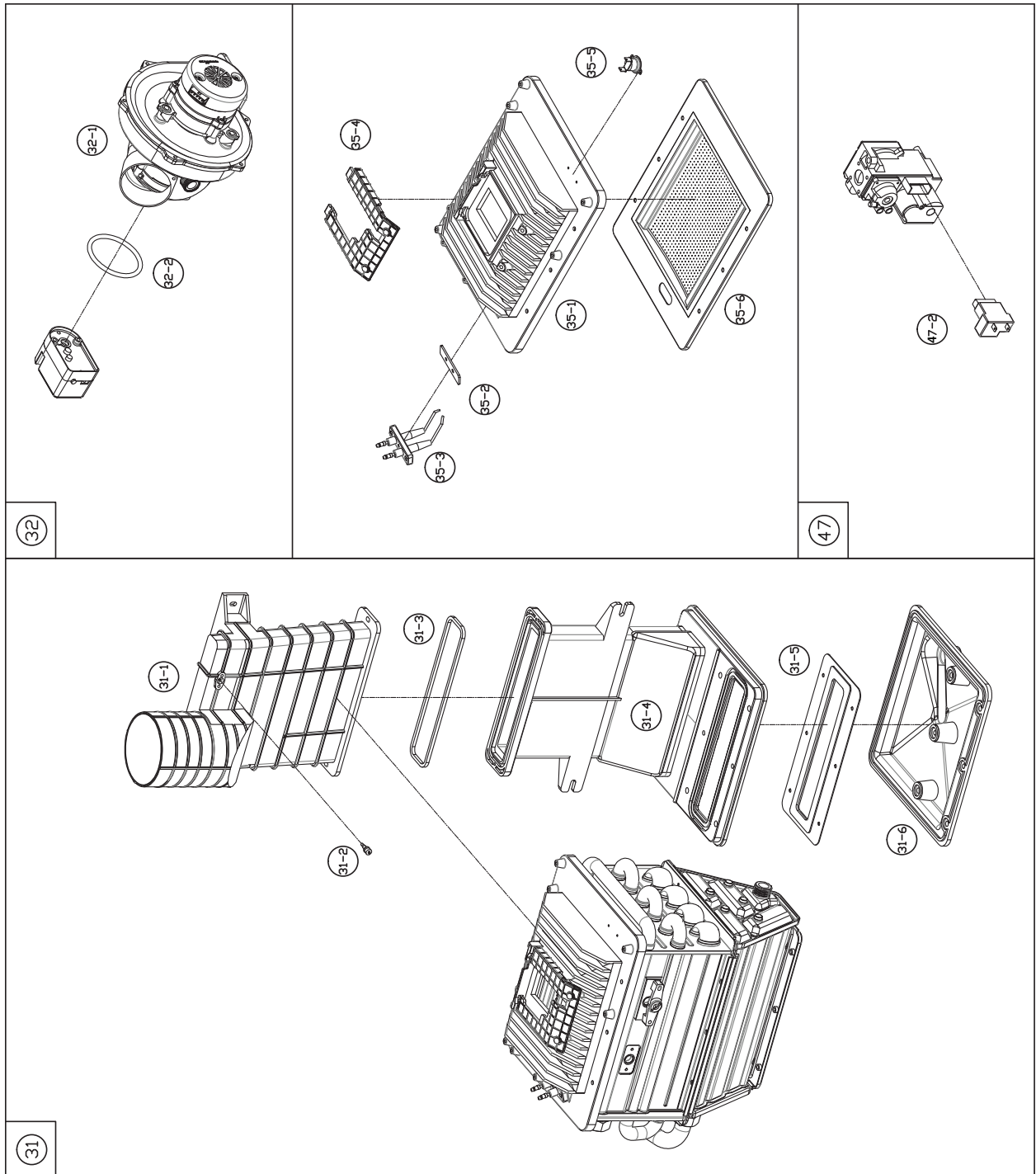
## Repair Parts Diagram

No.	Description	Part number
1	Exhaust Adapter	MQRKIT05
2	Case	MQJKT01
3	Door ASS'Y	MQJKT02
3-3	Display Cover	MQCVR01
4	Ignition Transformer	MQTRAN01
5	Gas Inlet Nipple	MQNIP01
6	Overheat Sensor	MQSENS01
7	DHW Supply Pipe	MQPIP01
8	Condensate Trap	MQTRAP01
10	Air Pressure Switch	MQSWI01
11	Bracket	MQBRK01
12	Display	MQDISP01
13	Controller	MQCON01
14	Controller Bracket	MQBRK02
15	Power Switch	MQSWI02
16	Flow Control Valve	MQVLV01
17	Water Inlet Pipe ASS'Y	MQVLV02
17-3	Water Inlet Filter	MQFIL01
18	Case Bracket (Left)	MQBRK03
19	Case Bracket (Right)	MQBRK03
20	Intake Air Adapter	MQADPT02

# Repair Parts Diagram



# Repair Parts Diagram



## Repair Parts Diagram

No.	Description	Part number
31	Heat Exchanger Assembly	MQHX200
31-1	Exhaust Pipe Assembly (Upper)	
31-2	Exhaust Temperature Sensor	MQSENS02
31-3	Exhaust Gasket	MQGSK01
31-4	Exhaust Pipe Assembly (Lower)	
31-5	Exhaust Gasket	MQGSK02
31-6	Condensate Pan	
32	Fan Assembly	MQBLOW01
32-1	Fan	MQBLOW02
32-2	O-Ring	MQGSK03
33	Silencer Elbow	MQELB01
34	Silencer Body	MQELB02
35-1	Top Plate	MQHEAD01
35-2	Igniter Gasket	MQGSK04
35-3	Igniter	MQIGN01
35-4	Fan Bracket	MQBRK04
35-5	Burner Overheat Sensor	MQSENS03
35-6	Burner Head	MQHEAD02
36	Flame Detector	MQSENS04
37	Mixing Valve	MQVLV06
38	Heat Exchanger Temperature Sensor	MQSENS05
39	Heat Exchanger Overheat Sensor	MQSENS06
40	DHW Outlet Pipe	MQPIP02
41	Water Pipe Clip	MQCLP01
42	DHW Inlet Pipe	MQPIP03
43	Ceramic Heater	MQHEA01
44	Gas Valve Pipe (Upper)	MQVLV03
45	Gas Valve Pipe (Lower)	MQVLV04
46	Gas Valve Adapter (Lower)	MQADPT03
47	Gas Valve Assembly	MQVLV05
47-2	Gas Valve Plug	MQPLG01
48	Gas Valve Adapter (Upper)	MQADPT04
50	Heat Exchanger Bracket	MQBRK05 (Left) MQBRK06 (Right)
51	Burner Bracket	MQBRK07

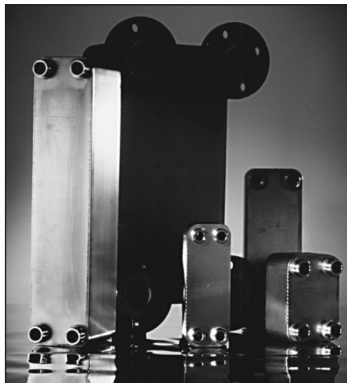
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