Rev 12_2024

DTH SERIES

INDIRECT GAS-FIRED DUCT FURNACE

Indoor and Outdoor installation

INSTALLATION AND OPERATION MANUAL

Gas Unit Heaters, Gas Packaged Heaters, Gas Utility Heaters, And Gas-Fired Duct Furnace

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Warning

FIRE OR EXPLOSION HAZARD

- Failure to follow safety warnings exactly, could result in serious injury, death or property damage.
- Be sure to read and understand the installation, operation and service instruction in this manual.
- Improper installation, adjustment, alteration, service or maintenance can cause serious injury, death or property damages.

- 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;
  - Leave the building immediately;
  - Immediately call your gas supplier from a phone remote from the building. 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.

REMARKS

This instruction manual must be kept with the device and kept readable.

Hazard and risk identification is the first step in risk assessment, please read carefully:

	**DANGER!**	Indicates a situation of imminent risk that, if not avoided, will result in death or serious injury.
	**WARNING!**	Indicates a potentially risky situation that, if not avoided, could result in death or serious injury.
	**CAUTION!**	Indicates a potentially risky situation that, if not avoided, can result in bodily injury or property damage.
	**NOTES!**	Indicates special instructions for installation, operation or maintenance that are important but are not related to bodily injury or property damage.

- **Before you begin installing the device, read, understand and follow all the instructions given in this manual, including all safety precautions and warnings.**
- **This device is connected to high voltages and contains parts that can move unexpectedly.**
- **Never open the access doors to the device while it is running.**
- **The unit must be securely and properly grounded.**
- **An electric shock, serious injury or death could occur if the instructions given in this manual are not followed.**
- **Always unplug and lock the power supply before maintaining this equipment. All work must be done by a qualified technician.**
- **DO NOT BYPASS LOCK OR SAFETY SWITCHES UNDER ANY CIRCUMSTANCES.**

SUMMARY

NOTICE: The features, characteristics, illustrations and description of this document were, to the best of our knowledge, accurate at the time of printing. We reserve the right to modify or stop offering certain features as well as to stop producing a given model without notice or commitment on our part. For more information, please contact your local representative and authorized distributor.

1. CODE AND REGULATION

This product is intended for installation on positive pressure side of the circulating air blower. This heating unit is designed for industrial or commercial use only. The installation must comply with the latest laws and regulation for heating units; CSA B149.1, ANSI Z223.1 / NFPA 54, to the electrical code CSA C22.1/ NFPA 70 and to local regulations. All inside and outside electrical installation must comply with the unit's electrical diagrams.

The electrical, gas and air flow ratings are described on the rating plate applied on the unit. Following these rating is mandatory for a safe usage of the unit. To learn more, refer to the start-up instruction and the operating sequence section of this manual.

Clearances from combustible materials

A minimum clearance of **1** inch between the unit walls and any combustible material is required on all side and top. A minimum clearance of **36** inches is required in front of the door to access controls and **18** inches around the flue vent. Install the unit on a non-combustible floor.

Allocate enough space around the unit for maintenance and around the combustion air intake and the inlet air hood to prevent harmful accumulation of snow.

Clearances to combustible materials	
Position	**Inch [mm]**
Controls	36 [914]
Top	1 [25]
Back	1 [25]
Flue vent	18 [457]
Floor	Non-combustible

WARNING!

- **Installation, modification, adjustment or poor maintenance can cause property damage, injury or death. Read the installation, start-up and maintenance instructions carefully before installing, using or repairing the device.**
- **Units installed within a building must have fresh air for combustion in sufficient quantity to get a good combustion. Refer to CSA B149.1 installation code for Canada and ANSI Z223 for USA for more information and minimum requirements.**
- **Gas units must be connected to a flue vent properly sized to ensure proper and safe operation.**
- **When required to pipe to outdoor the regulator vent pipes must be terminated with a downward elbow and a fine mesh screen in order to prevent blockage.**
- **The above instructions show the recommended installation and use that we have tested and believe to be safe. If the installer decides not to follow these instructions, it will be the installer's responsibility to test and validate the security and functionality.**

2. SPECIFICATIONS

DTH Model	Input capacity		Output capacity		Turndown ratio	Air flow*			
	MBTU	kW	MBTU	kW		CFM		l/s	
						Min.	Max.	Min.	Max.
35	438	128	350	102	15:1	2701	6481	1275	3059
40	500	143	400	117	17:1	3086	7407	1457	3496
50	625	183	500	146	21:1	3858	9259	1821	4370
55	688	201	550	161	17:1	4247	10193	2004	4810
65	813	238	650	190	20:1	5019	12054	2368	5684
75	938	275	750	220	23:1	5790	13896	2733	6558
85	1063	311	850	249	27:1	6562	15748	3097	7432
100	1250	366	1000	293	31:1	7716	18519	3642	8740
125	1563	458	1250	366	26:1	9645	23148	4552	10925
150	1875	549	1500	439	31:1	11574	27778	5462	13110

Electrical supply: 120VAC / 1ph/60Hz – (from 4 to 15 Amp. Refer to name plate for specific value)

NOTES: * Intended for a temperature rise of 50°F to 120°F (28°C to 67°C)

- 1 MBTU: 1000 BTU/ Hr
- CFM: Cubic foot per minute
- Ratings are based on 1000 Btu/ft^3 for natural gas (2500 Btu/ft^3 for propane) at sea level. Reduce burner capacity for altitude over 2000ft by 4% for each 1000ft above sea level.

3. GAS SUPPLY

WARNING!

All gas piping must be performed by qualified personnel following the local codes and CSA B149 installation code for Canada or ANSI Z223.1/NFPA 54 for the United States.

Dim	Gas train connections (NPT)										
Model	35	40	50	55	65	75	85	100	125	150*	150**
Ø Gas	1	1	1	1	1	1	1-1/2	1-1/2	1-1/2	1-1/2	2
Ø Regulator Vent***	N/A: Vent limiter factory installed***										1/2
Ø Vent valve	N/A: Valve proving system included with IRI gas train option.										

*: With 10''w.c. minimum inlet pressure.
**: With optional 2'' NPT gas train for 7''w.c. inlet pressure. The vent must be piped to outdoor.
***: To be used in ventilated space only. In other case the regulator vent must be piped to outdoor. Use ½'' NPT tubing.

NOTES:

- This table should not be used to size the gas supply line.
- If supply gas pressure exceeds 14 inches w.c., a high pressure regulator must be installed at gas piping inlet. The regulator must be suitable for modulation ratio of 40:1 to properly regulate gas pressure at low fire.
- The regulator vent must be piped separately towards the outside of the building as stated by CSA B149.1 for Canada and ANSI Z223 for USA and local codes.

4. GAS PRESSURE ADJUSTMENTS

4.1. NATURAL GAS PRESSURE ADJUSTMENTS

DTH Model	Natural Gas					
	Dynamic supply pressure****		Nominal Manifold pressure*	Pilot pressure	Low fire inlet capacity	
	Minimum In.w.c [kPa]	Maximum In.w.c [kPa]	At maximum capacity In.w.c [kPa]	In.w.c [kPa]	MBH	Kw
35	7" [1.74]	10" [2.5]	2.3" [0.57]	3.5" [0.87]	30	8.79
40			2.9" [0.72]			
50			4.6" [1.15]			
55			3.1" [0.77]		40	11.7
65			2.8" [0.69]			
75			2.3" [0.57]			
85			2.9" [0.72]			
100			3.8" [0.95]			
125			2.6" [0.65]		60	17.6
150**			3.9" [0.97]			
150***	10"[2.5]	14"[3.5]	4.0" [0.99]			

4.2. PROPANE GAS PRESSURE ADJUSTMENTS

DTH Model	Propane Gas (LP)					
	Dynamic supply pressure****		Nominal Manifold pressure*	Pilot pressure	Low fire inlet capacity	
	Minimum In.w.c [kPa]	Maximum In.w.c [kPa]	At maximum capacity In.w.c [kPa]	In.w.c [kPa]	MBH	Kw
35	11" [2.74]	14" [3.5]	(Consult factory or rating plate)	2.5" [0.62]	30	8.79
40						
50						
55					40	11.7
65						
75						
85						
100						
125					60	17.6
150						

*: The pressure adjustment may vary slightly. See the unit nameplate for the exact value.
**: With optional 2'' NPT gas train.
***: With standard 1-1/2'' NPT gas train.
****: At maximum capacity (dynamic pressure).

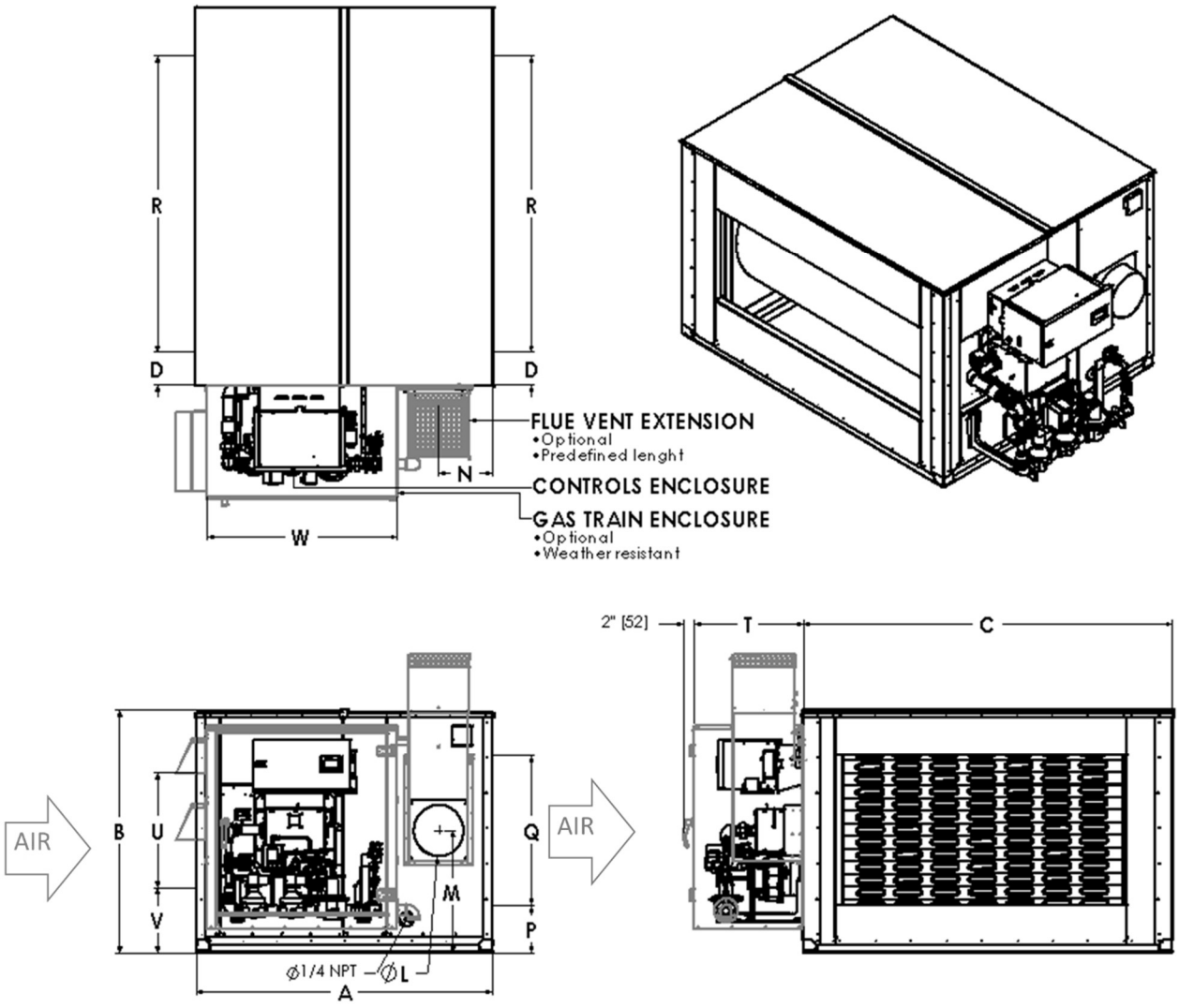
5. UNIT DIMENSIONS

5.1. DTH – HORIZONTAL DISCHARGE

WARNING!

Improper installation, adjustment, alteration can cause serious injury, death or property damages.

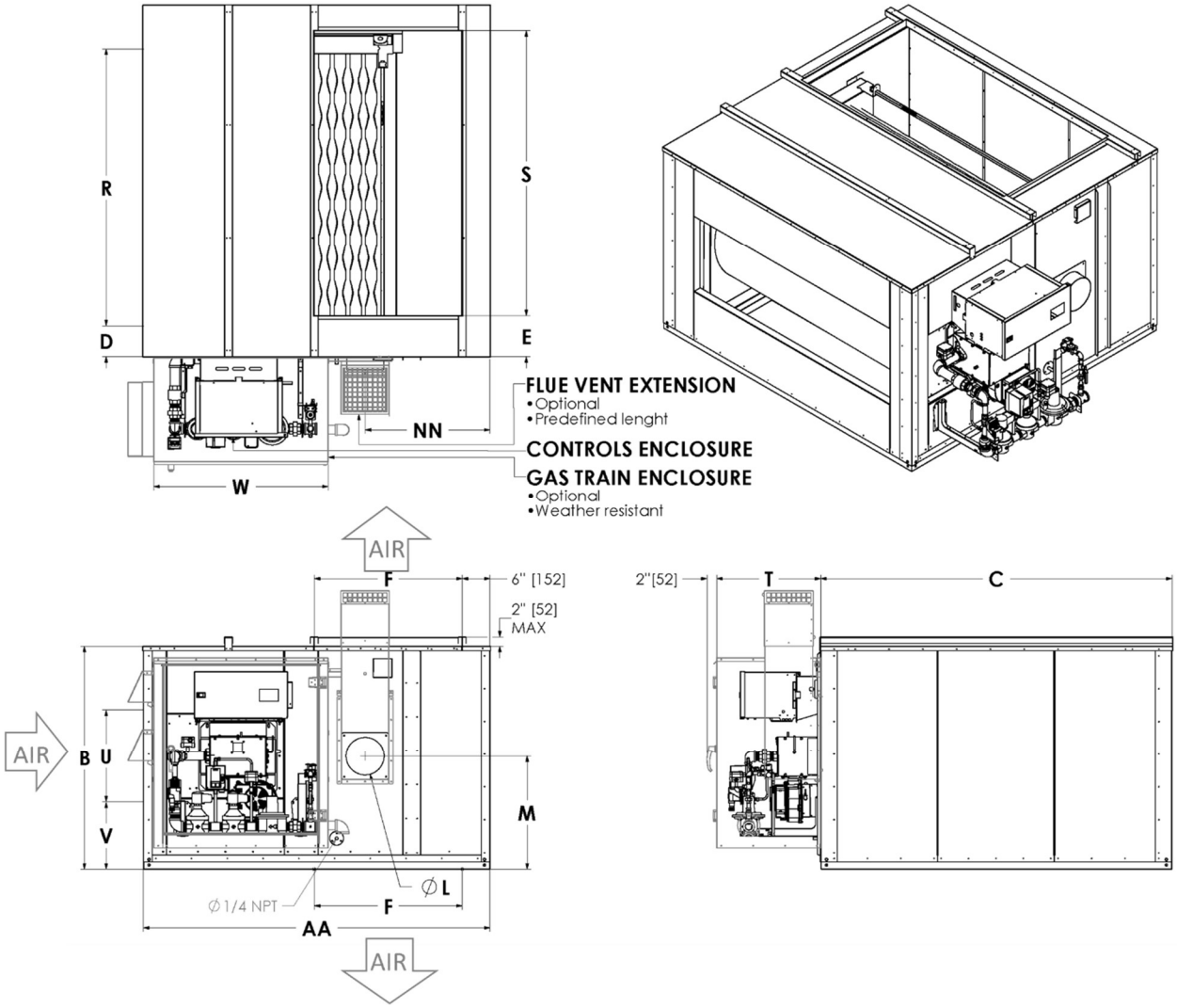
- Left hand control (when facing air stream)



NOTES: The controls shown are on the left-hand side of the unit (for a right-hand unit, the drawing is mirrored and dimensions are identical).

5.2. DTH – VERTICAL DISCHARGE

- Left hand control (when facing air stream)



NOTE: The controls shown are on the left-hand side of the unit (for a right-hand unit, the drawing is mirrored and dimensions are identical).

5.3. UNIT DIMENSIONS

Dim	UNIT DIMENSIONS									
	35	40	50	55	65	75	85	100	125	150
	Imperial [in]									
A	47	47	47	52 1/2	52 1/2	56	58	61	67 3/4	67 3/4
B	43	43	43	48 1/4	48 1/4	48 1/4	48 1/4	48 1/4	55	55
C	64 ½	64 ½	64 ½	64 ½	70 ½	70 ½	76	76	78	95 ½
D	6 3/4	6 3/4	6 3/4	6 3/4	6 3/4	6 3/4	6 3/4	6 3/4	6 3/4	6 3/4
L	6	6	6	6	6	8	8	10	10	10
M	21 7/8	21 7/8	21 7/8	24 3/8	24 3/8	24 3/8	24 3/8	24 3/8	28 1/2	28 1/2
N	9	9	9	9	9	10	10	11	11	11
P	13 3/8	12 3/8	10 3/8	11 7/8	11 3/8	9 3/8	9 3/8	9 3/8	11	11
Q	17	19	23	25	26	30	30	30	35	35
R	48 1/2	48 1/2	48 1/2	48 1/2	54 1/2	54 1/2	60	60	60	75 1/2
T	21 1/2	21 1/2	21 1/2	21 1/2	21 1/2	21 1/2	21 1/2	21 1/2	26	26
U	10	11 1/2	14 1/2	16	17	19 1/2	20	23	29	28
V	16 7/8	16 1/8	14 5/8	16 3/8	15 7/8	14 5/8	14 3/8	12 7/8	14	14 1/2
W	29 5/8	29 5/8	29 5/8	35	35	36 3/4	37 3/4	39 1/4	46 1/4	46 1/4
AA	56 1/4	58 1/4	62 1/4	70	71	75	75	75	91 3/4	91 3/4
F	19	21	25	27	28	32	32	32	37	37
E	8 7/8	8 7/8	8 7/8	8 7/8	8 7/8	8 7/8	8 7/8	8 7/8	8 7/8	8 7/8
S	45	45	45	45	51	51	56 1/2	56 1/2	56 1/2	72
NN	18 1/4	20 1/4	24 1/4	26 1/2	27 1/2	29	27	25	35	35

Dim	Metric [mm]									
A	1194	1194	1194	1334	1334	1422	1473	1549	1721	1721
B	1092	1092	1092	1226	1226	1226	1226	1226	1397	1397
C	1638	1638	1638	1638	1791	1791	1930	1930	1981	2426
D	171	171	171	171	171	171	171	171	171	171
L	152	152	152	152	152	203	203	254	254	254
M	556	556	556	619	619	619	619	619	724	724
N	229	229	229	229	229	254	254	279	279	279
P	340	314	264	302	289	238	238	238	279	279
Q	432	483	584	635	660	762	762	762	889	889
R	1232	1232	1232	1232	1384	1384	1524	1524	1524	1918
T	546	546	546	546	546	546	546	546	660	660
U	254	292	368	406	432	495	508	584	737	711
V	429	410	371	416	403	371	365	327	356	368
W	752	752	752	889	889	933	959	997	1175	1175
AA	1429	1480	1581	1778	1803	1905	1905	1905	2330	2330
F	483	533	635	686	711	813	813	813	940	940
E	225	225	225	225	225	225	225	225	225	225
S	1143	1143	1143	1143	1295	1295	1435	1435	1435	1829
NN	464	514	616	673	699	737	686	635	889	889

6. INSTALLATION GUIDELINES

6.1. GENERAL

- Install the unit on the positive side of the air-circulating blower (supply side).
- The air intake must be located in order to avoid snow, rain, flammable, toxic gases and other harmful substances from entering the heater.
- In operation mode, the system design must provide enough air to the heat exchanger to ensure a temperature rise between 50°F (28°C) and 120°F (67°C) and maintain an average supply temperature of 130°F (54°C) maximum. Note that the temperature high limit protection is factory set at 160°F (71°C).
- The inlet ducting must have the same cross-sectional area as the inlet connection. Both inlet and outlet ducts must have a removable access panel. These panels shall be sized to permit inspection of the heat exchanger at start-up on routine inspection.
- If fire dampers are used, they must be equipped with switches connected to the safety control circuit in order to interrupt the heater if there is a fire or high temperature in the ventilation duct. The electric actuators must be adjusted in order to close the safety loop on the flame safeguard only when the dampers are fully open.
- Depending on the model, the flue vent connection diameter ranges from 6 to 10 inch. The DTH models are designed to operate effectively and safely with a **positive stack (category III) type** sealed single wall or double wall flue vent listed for this application, whether vertical or horizontal arrangement or a combination of both. The minimum diameter of all sections must be identical to the unit's connection diameter. Refer to the exhaust system sections of this manual.
- If no control cabinet is supplied by ***Nagas Innovation Inc.*** with the unit, the installer must be made one for component protection and must include aeration openings at least equal of two 2 inches holes. See gas installations code for more requirements.

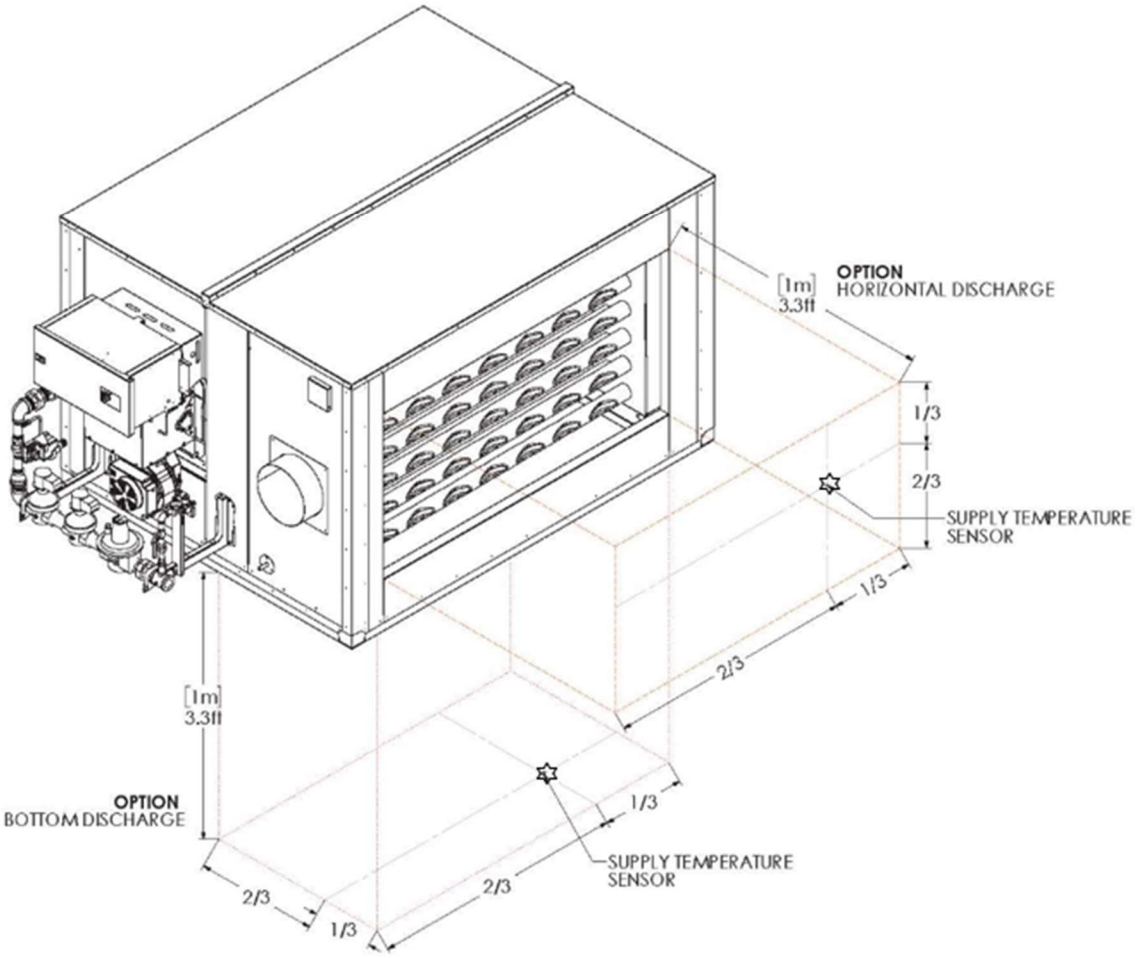
NOTICE!

- In order to minimize the risk of freezing pipes inside the building, the installer must equip the system with a low temperature sensor that will interrupt operation, stop the fan and close the dampers in the event that low temperature (lower than 40°F) are detected downstream of the heater.
- In certain conditions these units can produce condensate. This corrosive liquid must be treated and drain correctly with provision to prevent freezing.
- It is necessary to mechanically attach the unit to the roof base or other support structure with screws or other suitable fasteners to prevent wind or earthquake damage.

6.2. POSITIONING OF THE SENSOR CONTROLLING THE SUPPLY TEMPERATURE

WARNING!

The positioning of the supply temperature sensor is essential for the proper operation of the unit. Improper positioning of the supply temperature sensor could result in high temperatures in the supply ducts, a thermal protection shutdown, the closing of the fire damper and may result in damage to the unit and void the warranty. In addition, the control system (PID) must also be calibrated to prevent temperature overruns.



7. ELECTRICAL CONTROL

WARNING!

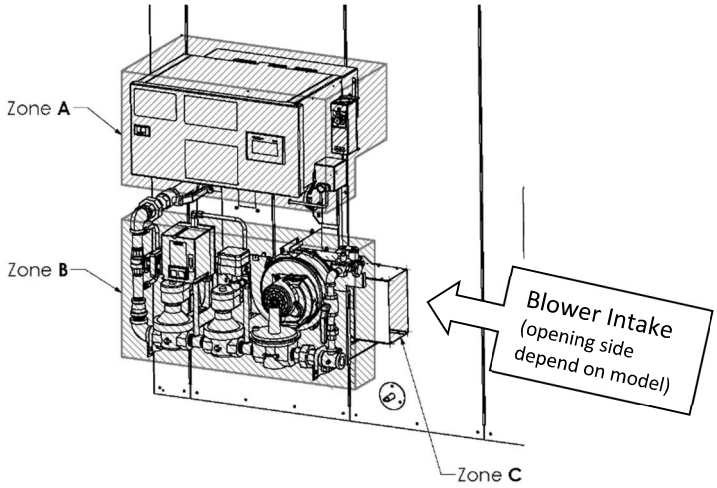
All electrical connections must be performed by a qualified electrician in accordance with the electrical diagram provided with the unit following applicable local laws and regulations. Also refer to Electrical codes CSA C22.1 for Canada and ANSI/NFPA #70 for the United States. The operating sequence described by the wiring diagrams or in the PLC should never be changed without the approval of the manufacturer.

Always use copper wire with the proper size suited for the application.
The unit is already pre-wired at factory. Refer to the wiring diagram for remaining wiring connections:

- Main 120V/60Hz/1ph ac power supply (see wiring diagram for current);
- On/Off contact for heating demand. This heating demand must be wired in series with at least one of the following but not limited to; a motor contactor auxiliary switch, an air proving switch or another air flow device.
- 2-10 VDC modulation signal.

8. COMPONENTS

Component minimum ambient temperature heating requirement

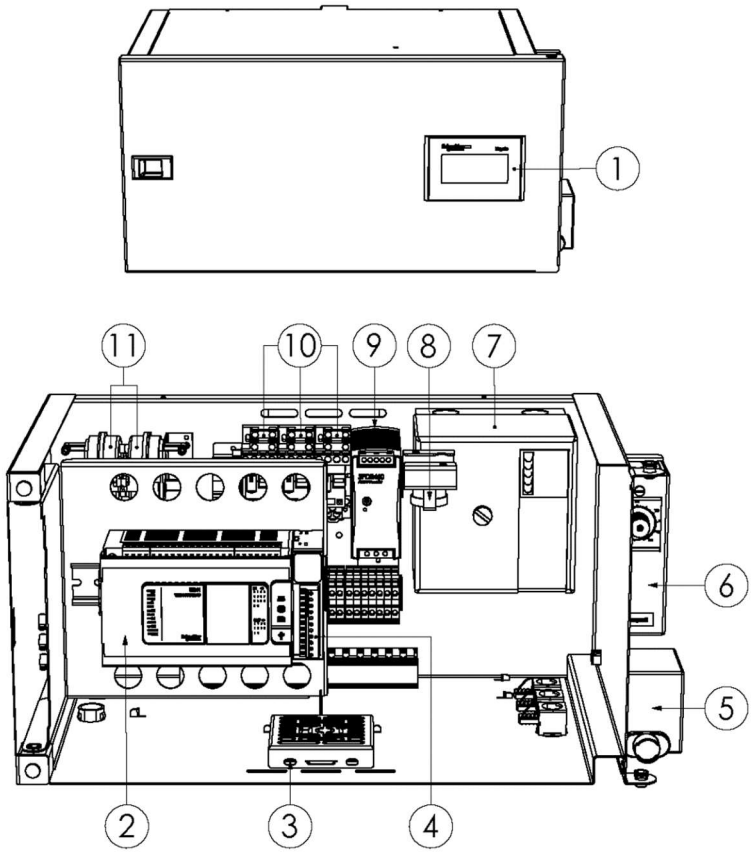


WARNING!

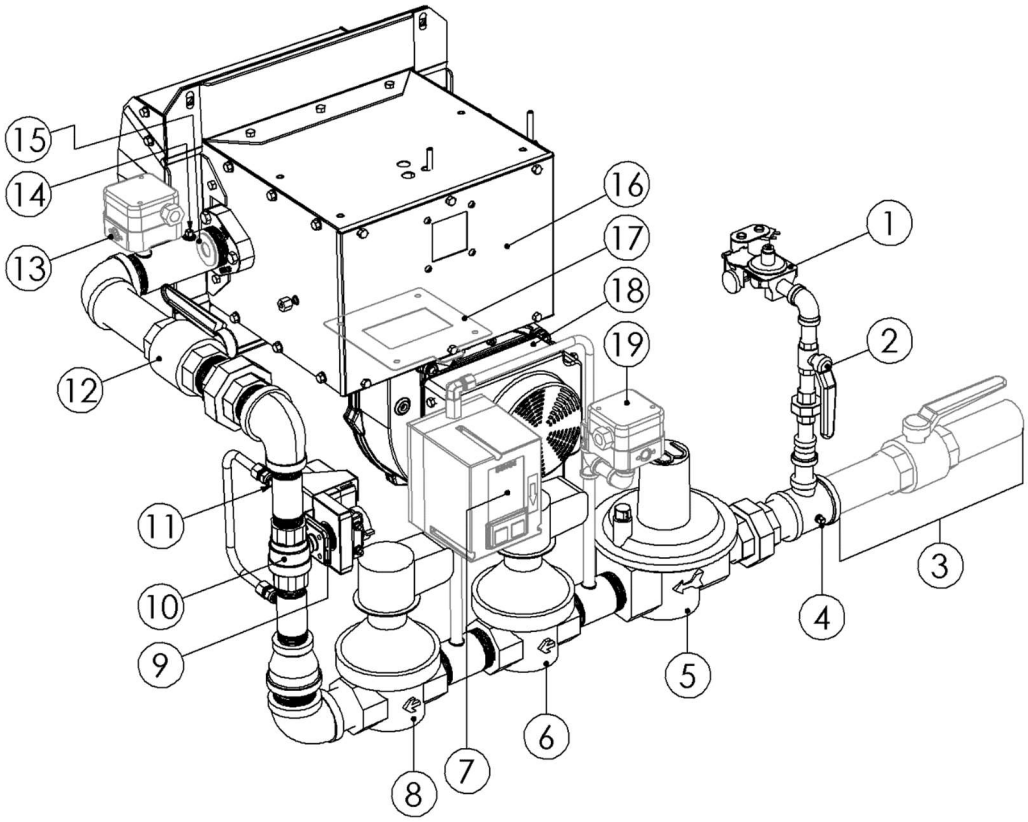
Every component requires a minimum ambient temperature during operation. If you don't order the *Nagas Innovation Inc.* heating and control cabinet solution you must build your own. Also, every component must be protected from environmental elements and covered because of high voltage hazard.

Minimum operation temperature		
Zone A	**Zone B**	**Zone C**
0°C (32°F)	-20°C (-4°F)	-40°C (-40°F)

- Component identification



Electrical box	
1	HMI touch screen interface
2	Programmable logic controller (PLC)
3	Heating element
4	Input/output expansion module (I/O)
5	Ignition transformer
6	High limit protection (set at 160°F)
7	Flame safeguard module
8	Thermostat for heating element
9	Power supply transformer
10	Control relays
11	Safety pressure switches



Gas train	
1	Pilot solenoid valve and gas regulator
2	Pilot manual gas valve
3	Main manual valve (by other outside the unit)
4	Test port inlet pressure
5	Main gas regulator
6	Main gas safety shutoff valve 1
7	Valve proving system (with IRI option)
8	Main gas safety shutoff valve 2
9	Modulating gas valve actuator
10	Modulating gas valve
11	Low fire orifice bypass
12	Test firing gas valve
13	High gas pressure switch (FM and IRI option)
14	Test port manifold pressure
15	Main gas orifice (some models, various sizes)
16	Burner box
17	Air orifice plate (some models, various sizes)
18	Burner air blower
19	Low gas pressure switch (FM and IRI option)

9. FLUE VENT AND COMBUSTION AIR

Depending on the model, the flue vent connector diameter ranges from 6 to 10 inches. The DTH model series is designed to operate effectively and safely (against a positive pressure of 0.25 in.w.c) with a **positive stack (category III) type** sealed single wall or double wall flue vent **listed** for this application, whether vertical arrangement or horizontal or a combination of both. The minimum diameter of all sections must be identical to the unit's connection diameter or greater. **Do not intermix different listed vent system parts from different manufacturers in the same venting system.**

A listed vent cap or termination of the same diameter as the exhaust pipe must be used at the extremity located at the exterior of the building (see drawings below). See pictures below for recommended end cap and configurations. The exhaust pipe must end at the exterior of the building while respecting (at least but not limited to) the following clearances:

Clearance for vent terminals **

Structure	Minimum Vent Terminal Clearances
Motorised air intake less than 1.8m (6')	0.9m (3') above and 1.8m (6') to the side
Combustion air intake from another device	1.8m (6') above and 1.8m (6') to the side
Door, openable window, revolving door, or all other openings	1.8m (6') to the side
	0.9m (3') above
Electrical or gas meter, regulator, and relief equipment *	1.8m (6') to the side (Canadian standards) 1.2m (4') to the side (U.S.A. standards)
Vent outlet from another service	0.9m (3')
Building or adjacent wall or parapet	1.8m (6') (might have to be increased for horizontal discharge)
Sidewalk or parking lot	2.1m (7') above
Ground vent	0.3m (1') above snow level
Wall of vent outlet	0.3m (1') minimum
Roof of vent outlet	0.9m (3') minimum and 0.6m (2') above all obstacles less than 3m (10')

* Never install a flue vent outlet above a service regulator or a gas meter.

** Local codes always supersede the above provisions.

*** Take all necessary precautions to avoid the installation of vent outlets where snow accumulation can occur naturally or due to roof snow slides or snow removal dumps. In the case of a horizontal exhaust, a secure distance of 3m (10') must be added to the distance found in the table for horizontal direction, measured from the mechanical or gravity air intakes.

The flue vent must be built using a category III listed vent pipe system sealed corrosion resistant steel pipe having a minimum thickness of 24 gauge or heavier, in the interior of the building. However, a double-wall corrosion resistant pipe section is required to get through the external walls of the building to the vent cap (consult vent pipe supplier instructions). Make sure to have provision for combustion testing port close to the unit for verifications and adjustments.

The flue vent joints must be sealed in a manner that will not allow leakage of the combustion product into the room. See flue vent manufacturer instructions for more details.

The horizontal conduit sections should be supported every six feet with non-combustible products such as, chains or steel belts. Do not use the unit or the vertical conduit section as a support.

Flue vent dimensions must respect the unit diameters (minimum) and **maximum equivalent lengths of 100 feet calculated**. The equivalent length is calculated by adding the lengths of straight sections of the flue vent, to the equivalent length of all the elbow pipes used. A 90-degree elbow pipes has an equivalent length of 3m (10') and a 45-degree angle elbow pipes has an equivalent length of 1.5m (5').

To avoid accumulation of condensation in a horizontal exhaust pipe, a slope of at least 48:1 (1/4'' per foot) must be maintained on the entire length of the horizontal sections, headed towards the unit. If a horizontal section is followed by a vertical section, a T section with drain can be added where the condensation may accumulate.

To avoid condensation formation while the burner is functioning, it is suggested to isolate the flue vent on its entire length, if the room temperature is maintained below 10 Celsius (50F). The flue vent can be insulated using a 1/2 inch (minimum) thick fiberglass insulator, able to withstand temperatures of 288 Celsius (550F).

In certain conditions these units can produce condensate. This corrosive liquid must be treated and drain correctly with provision to prevent freezing.

It is very important not to orient the vent outlet towards a fresh air duct, another device's combustion air intake, or any other opening of a building. It is possible that the clearances indicated in table above, from the vent cap, are not suitable because of the horizontal release of the combustion products. Special attention must be taken to each application. In the case of a horizontal exhaust, a secure distance of 3m (10') must be added to the distance found in the table for horizontal direction, measured from the mechanical or gravity air intakes.

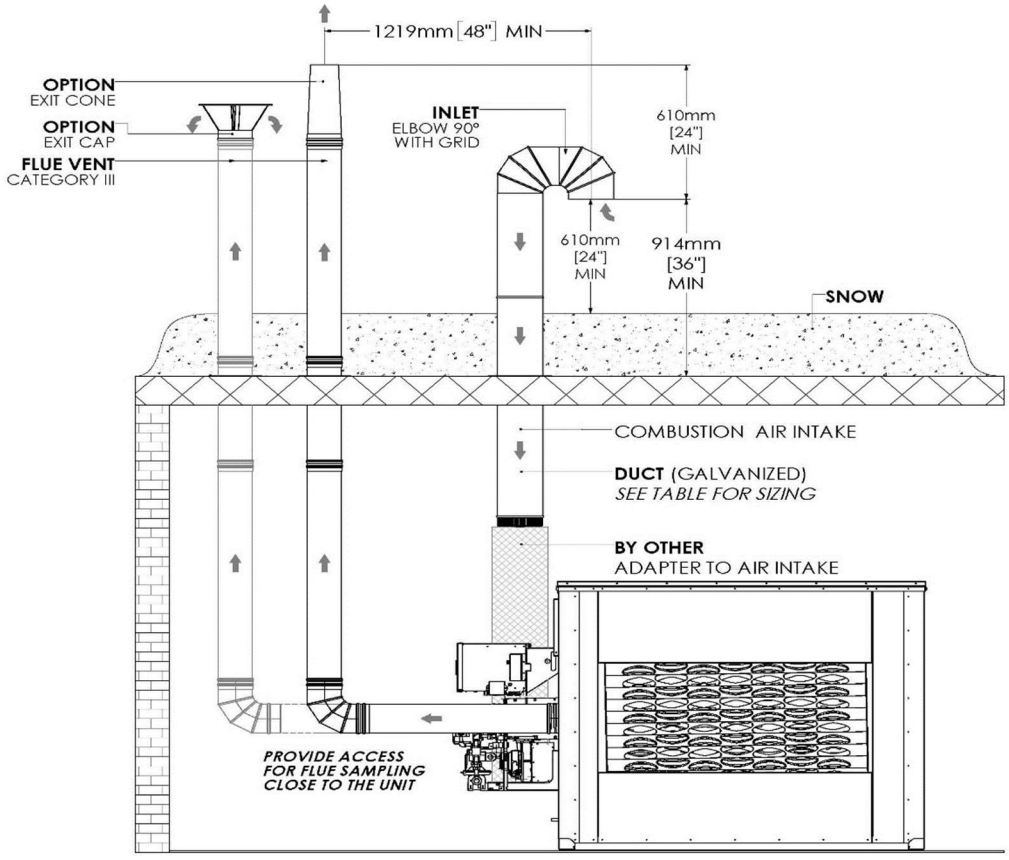
If the combustion flue gas outlet is too close to a building's opening or to where the direction of gasses is undesirable, it is possible to add a vertical flue vent extension.

WARNING!

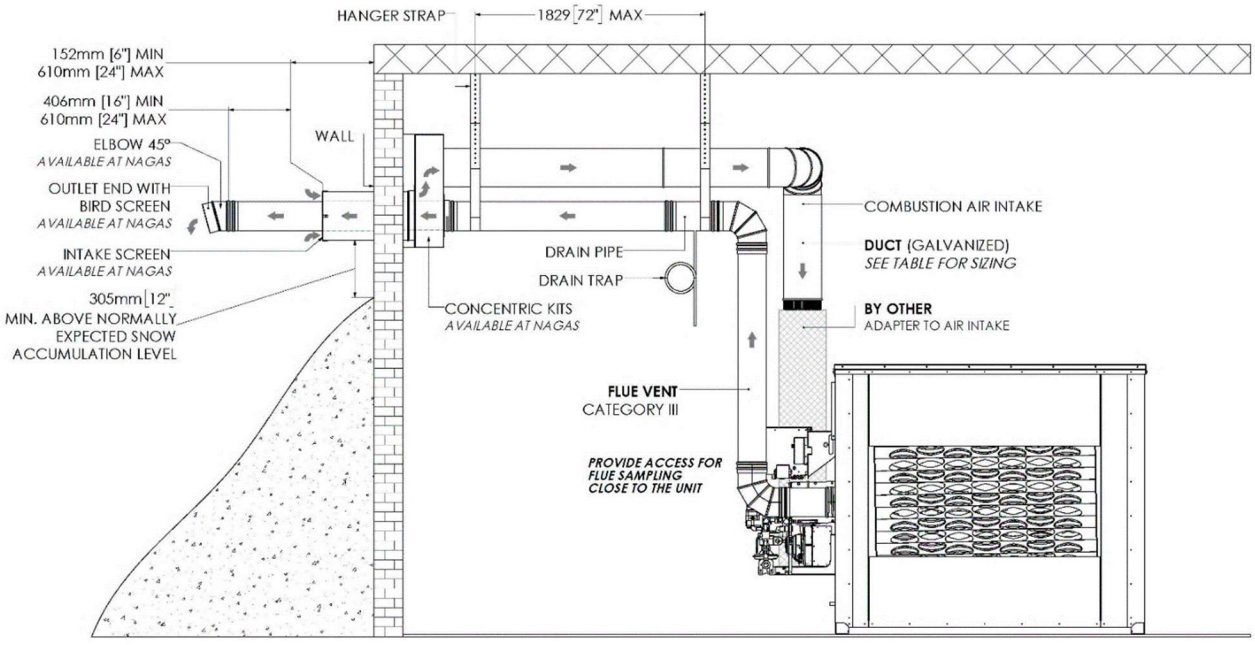
Two or several units installed in a common or independent ventilation system requires an installation of a separate, independent exhaust system for each unit. The installation of two units onto one same exhaust system is forbidden and dangerous. A repression of combustion gas of one of the devices could migrate towards the second and cause combustion gas exhaust to drift into the room.

A secure and effective operation requires sufficient exhaust of combustion gas. An exhaust system that is broken or that has a leak is dangerous and can be fatal. This can also prevent proper functioning of the device and will void the warranty.

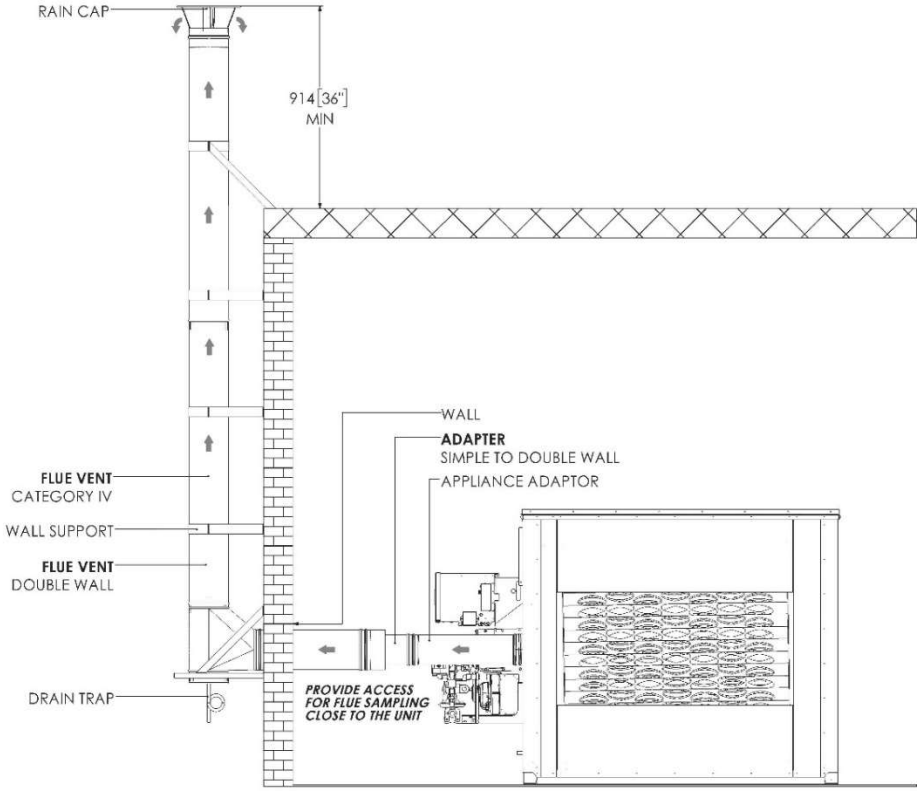
- **Recommended roof top Flue Vent Exhaust and/or Combustion Air Duct**



- **Recommended wall horizontal Flue Vent Exhaust and Combustion Air Duct – Concentric kit**



- **Recommended wall vertical Flue Vent Exhaust**



DTH Model	Unit Flue vent diameter		Unit Flue vent diameter (minimum)		Combustion Air intake diameter (minimum)	
	Inches	mm	Inches	mm	Inches	mm
35	6	152.4	6	152.4	8	203.2
40						
50						
55						
65						
75	8	203.2	8	203.2	10	254
85						
100	10	254	10	254	12	304.8
125						
150						

NOTICE!

The **flue vent** and **combustion air** duct can have a **maximum equivalent length of 100 feet calculated**. The equivalent length is calculated by adding the lengths of straight sections of the flue vent, to the equivalent length of all the elbow pipes used. A 90-degree elbow pipes has an equivalent length of 3m (10') and a 45-degree angle elbow pipes has an equivalent length of 1.5m (5').

10. START-UP INSTRUCTIONS

NOTICE!

Start-up can only be performed by a qualified technician qualified to install gas heating system (with accreditation) with knowledge in electricity and ventilation.

WARNING!

- **DO NOT SMOKE during gas heater start-up.**
- **DO NOT TRY TO LIGHT THE BURNER IF THE GAS HAS ACCUMULATED IN COMBUSTION CHAMBER OR IN ARE, IF THE COMBUSTION CHAMBER FILLED WITH VAPORS OR IF IT IS VERY HOT**

10.1. PRELIMINARY

These instructions must be followed once the ventilation unit has been started, the fan is running, and the supply air corresponds to design criteria. All gas piping must leak tested and regulator vents must be piped (if necessary) adequately before start-up.

- Install a pressure gauge (0-20 in. w. c.) on the inlet pressure test port located upstream of the low-pressure regulator. See component identification section for location.
- Ensure that the gas inlet pressure complies with the following value:

Standard inlet pressure	Natural Gas	Propane (LP)
Minimum	7in.w.c. (1.74 kPa)	11in.w.c. (2.74 kPa)
Maximum	10in.w.c. (2.49 kPa)	14in.w.c. (3.48 kPa)

NOTE: See gas pressure adjustment section for more details.

- Before starting the burner and without any heating demand perform the **Fan RPM auto tuning** in the Level 2 menu of the HMI touch screen.

10.2. PILOT ADJUSTMENT

- Install a pressure gauge (0-10 in. w. c.) on the test port located on the pilot valve. See component identification section for location.
- Close the test firing valve and open the pilot manual gas valve.
- Turn ON the main electrical disconnect and create a heat demand.
- Check for pilot lighting sequence then adjust the pilot pressure written in the **Specification section (3.5in.w.c. for natural gas, 2.5in.w.c. for propane)**.
- Take a reading of the flame signal (4-10VDC) directly on the flame safeguard relay to be sure the flame signal is good and stable (above 6 VDC minimum).

10.3. BURNER ADJUSTMENT

- Install a pressure gauge (0-10 in. w. c.) on the manifold pressure test port located downstream of the modulation gas valve. See component identification section for location.
- For the combustion test, it is recommended to use a (2-10VDC) manual potentiometer to simulate the modulation signal to the burner.
- Start the burner at the minimum voltage of 2.5 VDC and verify the flame stability. Take a combustion reading before increasing to high fire.
- Run the burner slowly to its maximum capacity (high fire) while looking to the combustion tester to be sure to have good combustion and sufficient excess air.
- Compare the manifold pressure with the name plate indication. Adjust the gas regulator if needed to obtain the right value.
- At high fire, you should have a combustion reading of 3-5% O_2 approx. and a CO reading close to 0 ppm and never above 400 ppm of air-free CO.
- The targeted oxygen % over the modulation is ±3 to 5% O_2 at high fire and ±18% O_2 at low fire with a progressive curve between the two operation points. Note that the combustion results when increasing capacity and decreasing are different (less oxygen % when decreasing).
- If the readings are out of the range, use the *Air/Gas relation* window (level 1 menu) on the HMI touch screen to adjust (see **LEVEL 1: AIR/ GAS RELATION** section on page 33).

WARNING!

Do not adjust burner flame only visually. Using a combustion analyzer and combustion instruments is the only recommended method to adequately adjust burner combustion.

11. CONTROL SEQUENCE

A PLC controls the burner duties by controlling the modulating gas valve, the fan speed and their relative position to each other depending on the input signal (2-10 VDC) from the temperature controller.

The control sequence is defined and executed following these eight steps:

1. **Standby**
2. **Safety verification (1 and 2)**
3. **Pre-purge**
4. **Burner Ignition (pilot and main flame)**
5. **Flame stabilization**
6. **Modulation**
7. **Low fire**
8. **Post-purge**

Main steps description

The control sequence begins by the Standby step if a start/stop burner request is present.

Step 1 - Standby (S10)
The blower and the burner are stopped and waiting for a burner heating request greater than 2.3 VDC to starts. If the burner modulation signal request is above 2.3 VDC, the ***safety verification*** is enabled.

Step 2 - Safety verification (S20,S25)
The burner air proving switch (PAB1) is verified during the two following tests:

1. **Activation of the air proving switch normally open (NO) contact.**
   The blower starts and its speed changes to 30%. The burner air proving NO contact should close within a period of 15 seconds. If it closes, the test #2 is automatically performed. If it doesn't close, another try will be performed after the test #2 is executed.

2. **Deactivation of the air proving NO contact.**
   The blower stops. The burner air proving NO contact should open within a period of 30 seconds. If it opens and the test #1 was correct the Pre-purge stage is enabled. If it doesn't open, the test #1 is done again.

If both tests are not satisfied within 2 trials the ***Low air pressure*** alarm is activated and the sequence goes back to the ***Standby*** step. A manual reset is required on the PLC screen to clear the alarm.

Step 3 - Pre-Purge (S40)
The blower starts and set to 100% of its capacity for about 60 seconds then a 10 seconds timer to let the fan speed slow down before the burner ignition. When complete the ***burner ignition*** step is enabled

Step 4 - Burner ignition (S60)
The blower speed is reduced to the ignition setting. The flame safeguard will light the pilot and then the main burner. The ***flame stabilization*** is allowed once the burner status is received.

Step 5 - Flame stabilization (S70)
A 10 seconds delay is set to let the flame stabilize. Once the time delay is reached the ***modulation*** step is allowed and the modulation gas valve can operate.

Step 6 – Modulation (S80)
With the burner in operation, the gas valve and the blower modulation begin. Modulating gas valve and the blower follow the request signal value. According to the gas valve position the blower modulates following an air/gas relation curve (pre-set into the PLC memory) to achieve an accurate clean combustion.

Notice:
- The unit model is pre-set at factory with the correct air/gas relation. You can fine tune this relation on the PLC screen at the air/gas relation set-up page at level 1.
- The gas valve input signal can be different from the heating demand (ex: heating demand 8 Vdc can gives 7.1 Vdc to the gas valve) following a capacity curve.

• If the burner modulation request signal is lower than 2.3VDC the ***low fire*** step is enabled.

Step 7 - **Low fire (S90)**
The burner is in low fire mode during about 240 seconds at a blower and gas valve fixed position. At the end of the timer, the Post-purge step is enabled.

However, if within the timer delay the burner modulation requests become greater than 2.3VDC, the sequence returns to the ***Modulation*** step 6.

Step 8 - Post-purge (S100)
This step is allowed when the burner modulation request is lower than 2.3V DC for more than the low fire delay, if the heating demand is turn OFF or if an alarm has been detected with the burner operation.

The burner is stopped, the modulating gas valve close and the blower speed is set to 100% for 60 seconds approximately in order to purge the heat exchanger.

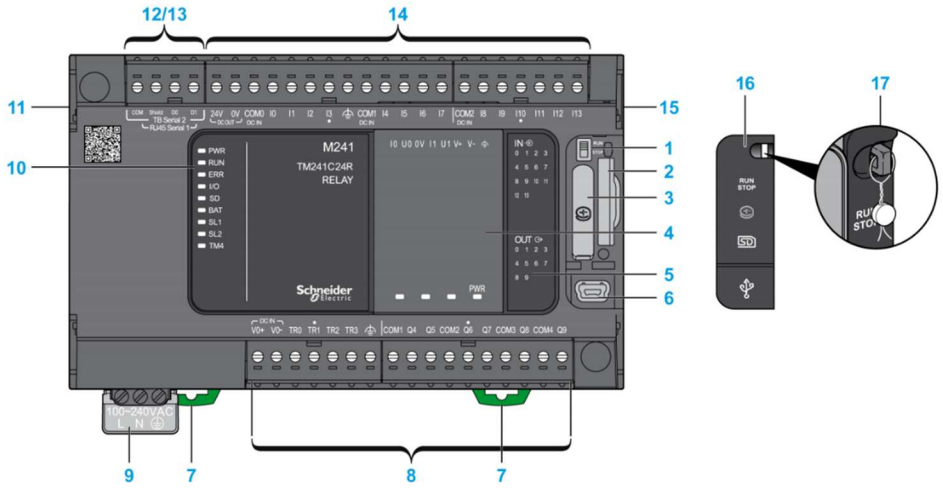
After the post-purge delay, the sequence returns to the ***standby*** step. But if an alarm is active, a manual reset is required on the HMI touch screen. When the alarm is cleared the sequence can be started again.

Depending on the step when the alarm is detected, the ***standby*** or the ***post-purge*** steps will be executed:

- **The Stand-by step** is performed if an alarm has been detected during the execution of ***safety verification*** or ***pre-purge*** step.

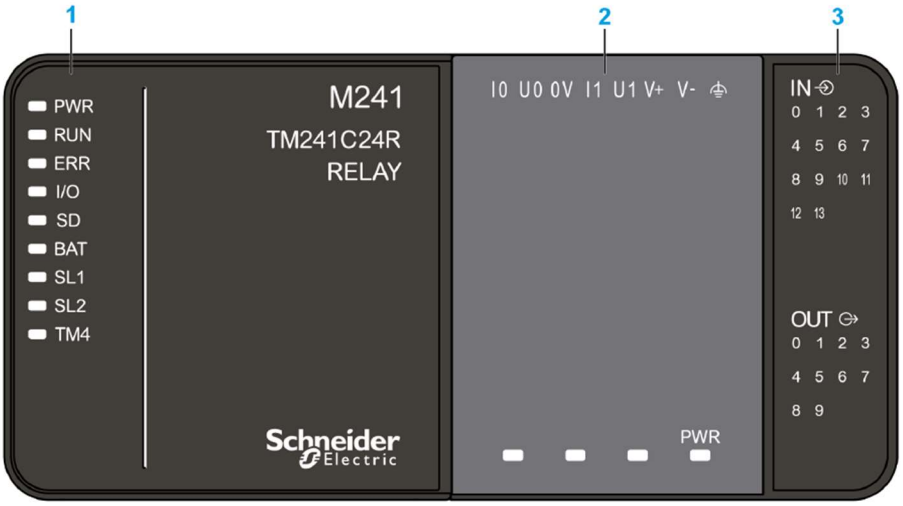
- **The Post-purge step** is performed if an alarm has been detected when the ***Burner ignition*** is activated or after.

12. PROGRAMMABLE LOGIC CONTROLLER FEATURES & I/O



Item	Option	Description
1	**Run/Stop** switch	Run/Stop manual switch
2	**SD card** slot	SD card programming slot
3	**Battery holder**	Real Time Clock battery (RTC) **Replace every 2 years (BR2032)**
4	**Cartridge slot**	Not used
5	**LEDs** I/O states	Digital inputs, relay outputs and fast output LEDs
6	**USB mini-B** port	For terminal connection to a computer for programming (need SoMachine program)
7	**Clip-on lock**	For 35mm (1.38 in) top hat section rail (DIN-rail) installation.
8	**Output** terminals	Relay and fast transistor outputs terminals
9	**Power supply**	100…240 Vac 50/60Hz power supply.
10	**Status LED**	See status LED list.
11	**TM4** bus connector	Not used
12	**Serial line** port 1	Type RJ45 (RS-232 or RS-485) - Used for HMI communication
13	**Serial line** port 2	Screw terminal block type (RS-485)
14	**Input** terminals	Digital inputs
15	**TM3/TM2** bus connector	For TM3 expansion modules
16	**Protective cover**	Cover for SD card, Run/Stop switch and USB mini-B programming port.
17	**Locking hook**	Hook not included

PLC status LEDs description:



1 System status LEDs
2 Cartridge status LEDs (optional)
3 I/Os status LEDs

#1 System status LEDs			
Label	**Function**	**Color**	**Description**
PWR	Power	Green	**On:** Power is applied
RUN	Machine status	Green	**On:** Valid application running **Flashing:** valid application stopped **1 flash:** Paused at BREAKPOINT **Off:** Not programmed
ERR	Error	Red	**On:** Exception **Flashing:** Internal error **1 single flash:** minor error detected **3 flashes:** No application
I/O	I/O error	Red	**On:** Error on serial 1 or 2, SD card, cartridge, TM4 bus or TM3 bus.
SD	SD card access	Green	**On:** SD card is being accessed
BAT	Battery	Red	**On:** Battery needs to be replaced **Flashing:** Battery charge is low
SL1	Serial line 1	Green	**Flashing:** Activity on serial line 1 to HMI touch screen panel
SL2	Not used	-	-
TM4	Not used	-	-

#3 Used PLC I/Os	
Input	Description
I0	Blower Speed (RPM)
I5	Start/Stop Burner request (by others)
I6	Burner air proving switch (Alarm)
I7	Flue vent back pressure (Alarm)
I8	Burner On status proof relay
I9	Air Intake low pressure (Alarm)
I11	Valve proving system relay (with IRI option)
V0	24VDC input

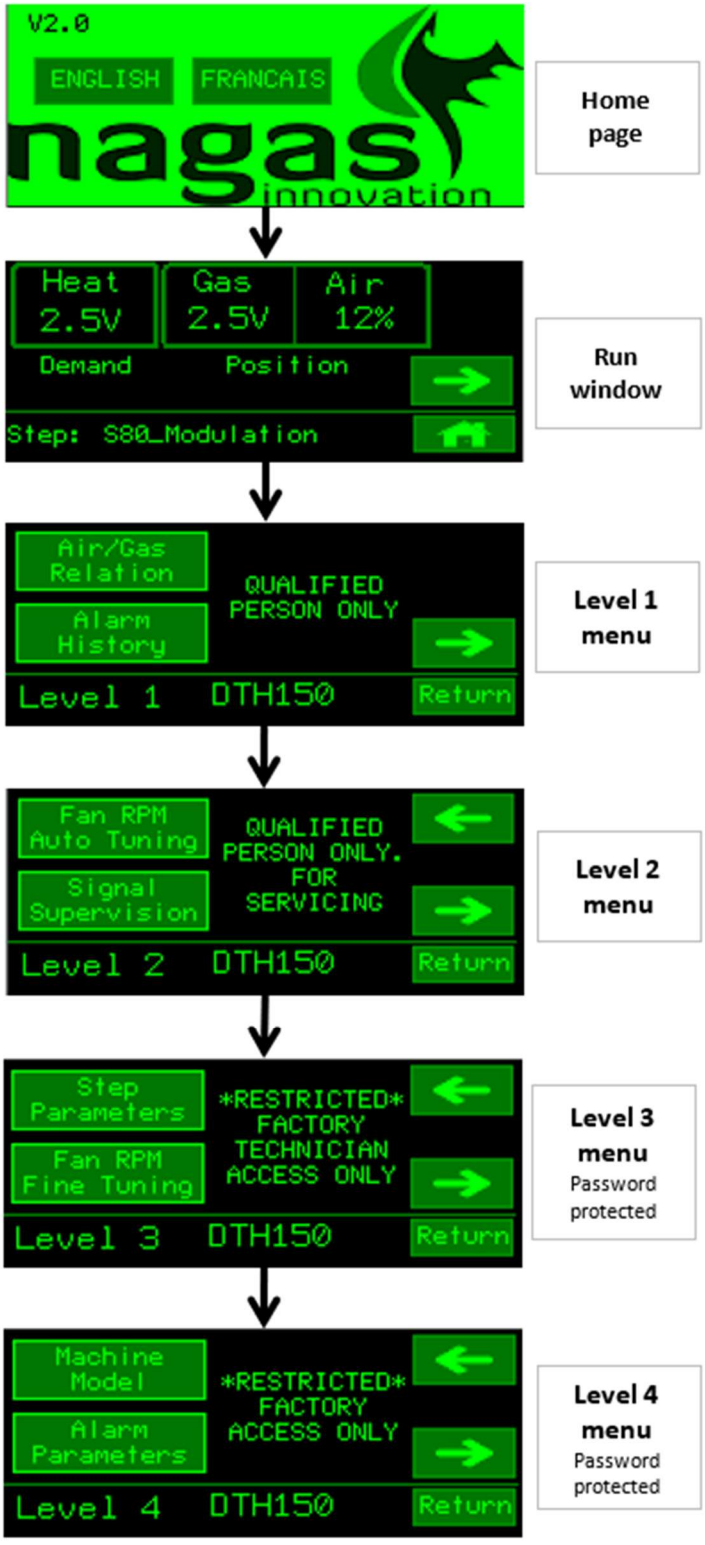
Output	Description
Q4	Start/Stop Burner ignition command
Q5	Start/Stop Blower command
Q9	Alarm dry contact (by others)
TR0	Blower modulation (PWM)

Expansion module TM3

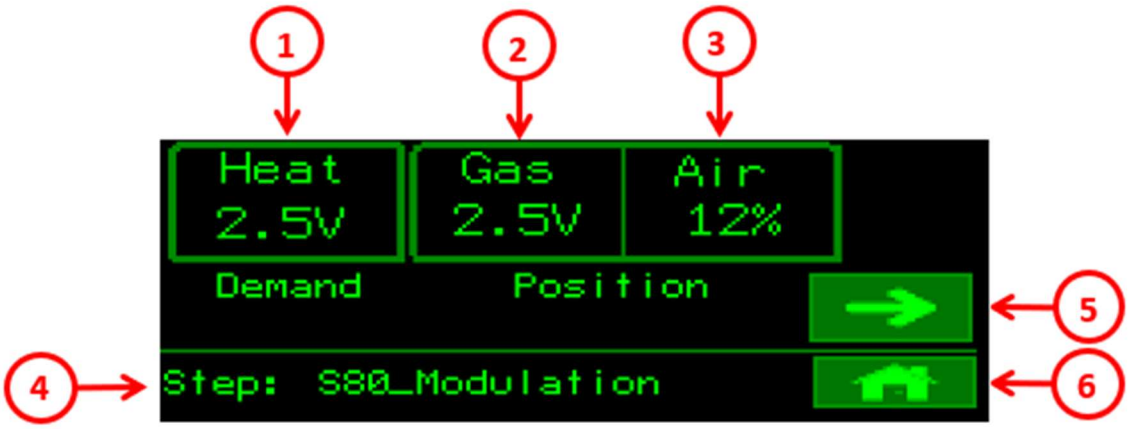
Used expansion module I/Os	
Port	Description
I0	Gas valve feedback (2-10Vdc)
I1	Burner modulation request (2-10Vdc) (by others)
Q	Gas valve modulation (2-10Vdc)

13. DISPLAY (HMI) FEATURES

The following diagram describes the structure of different levels in the HMI.



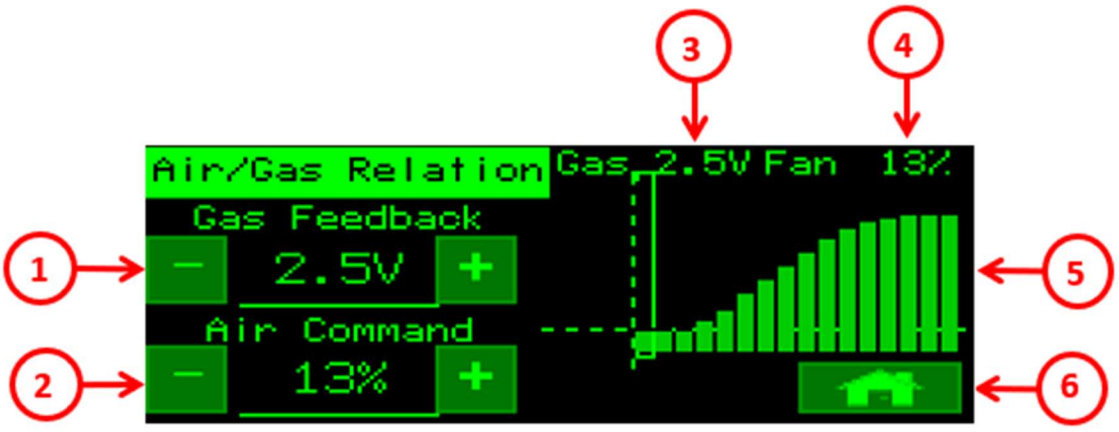
14. RUN WINDOW



Run window features:

#	Item	Description
-	General	This section allows the user to see what the heating demand is, which control sequence is active and how the burner reacts to the demand. The gas valve will react with the heating demand following a linearization curve and the air blower will follow the gas valve feedback position with the correspondent value determined in the fan modulation table.
1	Heat	Heating demand signal (VDC).
2	Gas	Gas valve modulation position signal (VDC). Can be different than Heat demand.
3	Air	Combustion blower modulation position signal (%).
4	Step	Active sequence step. See ***Control Sequence*** section for details.
5	Arrow	Go to the next menu (Level 1).
6	Home	Go to the home page.

14.1. LEVEL 1: AIR/ GAS RELATION



Air/Gas relation window:

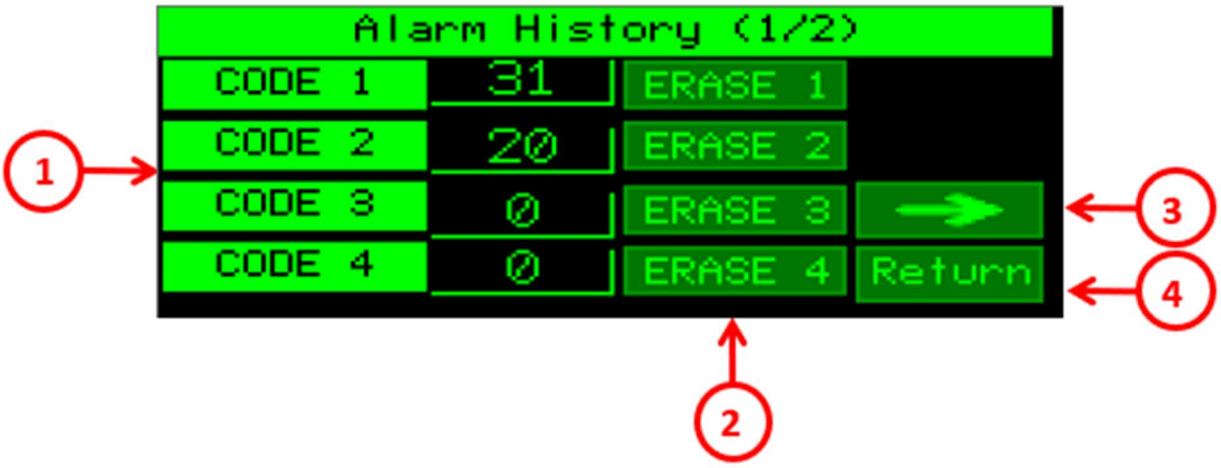
#	Item	Description
-	General	This section allows a qualified technician to adjust the 20 points air adjustment curve (air/gas relation) for each gas valve position range.
1	Gas feedback	Use ''+ '' or ''-'' to select the gas position where you want to modify the air ratio.
2	Air command*	Use ''+ '' or ''-'' to increase or decrease the air for the specific gas valve position.
3	Gas	When the unit is in RUN status, the actual value of the gas valve is displayed in real time.
4	Fan	When the unit is in RUN status, the actual value of the Fan is displayed in real time.
5	Graphic	Fan modulation curve for each 0.5 V of gas valve position. The vertical rectangle shows the position you have selected for modification. If the unit is running, vertical and horizontal dashed lines intersection will indicate the actual position of the unit modulation on the curve.
6	Home	Go back to Level 1 menu.

***Important:** Adjust fan slowly by 5% step maximum and wait for combustion stabilisation before adjusting again. Never go lower than 12% fan command.

WARNING!

All changes in this adjustment window will affect the combustion. Any modification must be performed by a qualified technician in respect of the gas codes and with the use of a gas analyser and instruments for combustion adjustments. Improper adjustment can cause serious injury, death or property damage.

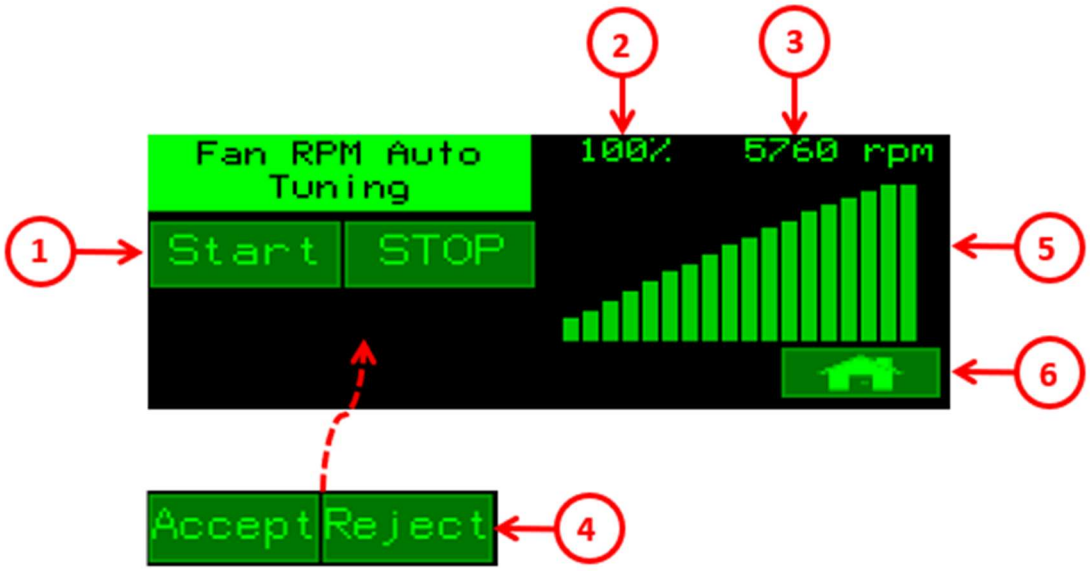
14.2. LEVEL 1: ALARM HISTORY



Air history window:

#	Item	Description
-	General	This section keeps a history of the last 8 alarm codes. The number 1 being the most recent code.
1	Code	The alarm code number is related to an alarm type (first digit) and in which steps it's happened (second digit). See ***PLC Alarms*** section for details.
2	Erase	Erase alarm code selected when pressing.
3	Arrow	Go to next alarm table (#5 to #8).
4	Home	Go back to Level 1 menu.

14.3. LEVEL 2: FAN RPM AUTO TUNING



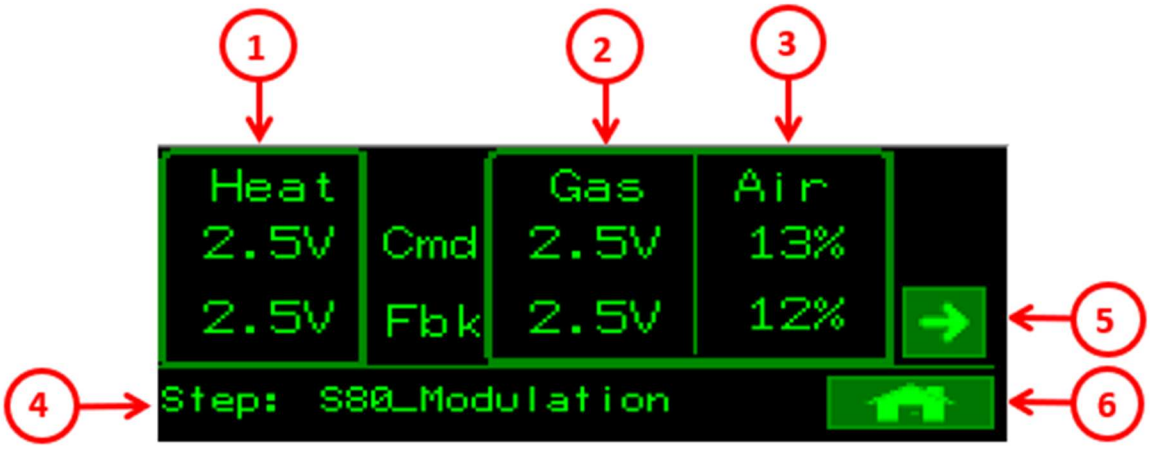
Fan RPM auto tuning window:

#	Item	Description
-	General	This section is to perform an automatic fan auto tuning. This is necessary (first start-up and fan replacement) to record the RPM feedback of each command level. The PLC will be able to match a real demand signal with a real RPM. The procedure takes approximately 4 minutes.
1	Start Stop	To start or stop the calibration process. IMPORTANT: This procedure is possible only if the demand contact (I5 on the PLC) is open (not activated). At the end of the process a confirmation will be asked (see item 4).
2	%	Fan command in %.
3	rpm	Fan rpm feedback during the process (RPM).
4	Accept/Reject	Press *accept* or *reject* at least 3 second to save or delete the values.
5	Graphic	Fan rpm feedback curve appears progressively during the process.
6	Home	Go back to Level 2 menu.

NOTICE!

- This procedure is suitable to be done once at the first start-up or after fan replacement.
- The fan auto tuning can be activated only id the demand contact (I5 on the PLC) is open (not activated).

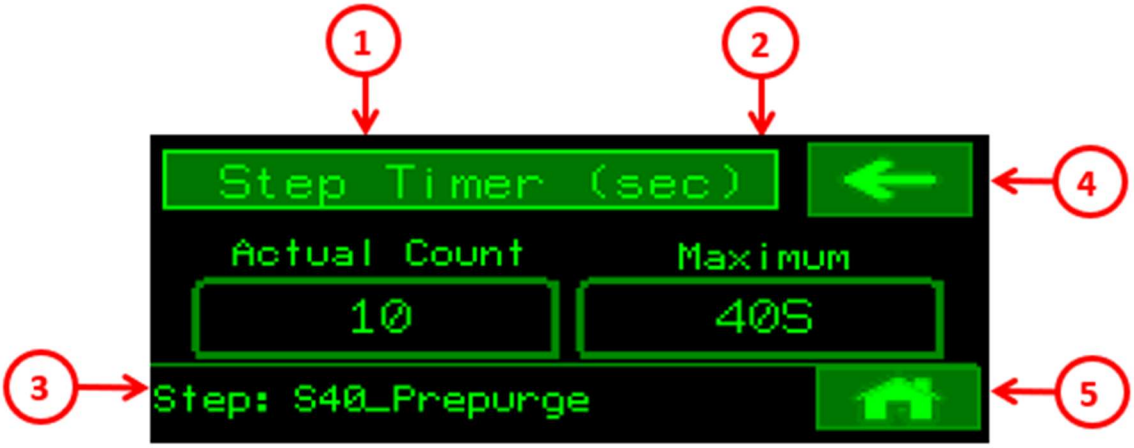
14.4. LEVEL 2: SIGNAL SUPERVISION



Signal Supervision window:

#	Item	Description
-	General	This section shows how the Air/Gas relation command (Cmd) and feedback (Fbk) reacts with the demand signal.
1	Heat	Direct heating demand signal in Volt.
2	Gas	Gas valve modulation signal demand (first row) and actual position feedback signal (second row). Expressed in volt (V). Can be different to Heat command.
3	Air	Burner air blower modulation demand (first row) and actual position feedback signal (second row). Expressed in percentage (%).
4	Step	Active sequence step. See ***Control Sequence*** section for details.
5	Arrow	Go to ***Step Timer*** window (see below).
6	Home	Go back to Level 2 menu.

14.5. LEVEL 2: STEP TIMER



Step timer window

#	Item	Description
-	General	This section shows the active timer in the actual step (see #3) of the burner sequence. Numbers can appear or disappear depending if a timer is active. In this example the prepurge step is now at 6 seconds on a 40 seconds timer.
1	Actual count	Timer count in real time (sec).
2	Maximum	Maximum value of the count. In some situation it's a goal or it's a limit before an alarm mode status or moving to another step.
3	Step	Active sequence step. See ***Control Sequence*** section for details.
4	Arrow	Go back to ***Signal Supervision*** window.
5	Home	Go back to Level 2 menu.

15. PLC ALARMS

The following table shows the different alarms configured in the PLC. Each alarm will be displayed on a red window with the description and an alarm number on the left corner.

ALARM	DESCRIPTION	POSSIBLE CAUSES
Gas feedback lost	The gas valve actuator feedback is missing during: #10: Pre-purge step (3) #11: Burner ignition step (4) #12: Modulation step (6) #13: Low fire step (7)	• Broken feedback wire from gas valve actuator. • Bad wiring connection. • Gas valve actuator defective. • PLC expansion TM3 defective.
Burner low air pressure	Burner air proving switch in alarm during: #20: Safety verification 1 step (2) #21: Safety verification 2 step (2) #22: Pre-purge step (3) #23: Pre-purge End step (3) #24: Burner ignition step (4) #25: Flame stabilization step (5) #26: Modulation step (6) #27: Low fire step (7)	• Air blower defect. • Pressure switch tubing broke. • Too much air pressure leakage. • Burner box leakage. • Too low minimum combustion fan adjustment. • Pressure switch defective.
Burner flame control	Flame safeguard in alarm or missing signal during: #30: Burner ignition step (4) #31: Flame stabilization step (5) #32: Modulation step (6) #33: Low fire step (7)	• No signal sent to the flame safeguard from the PLC. • No power on the flame safeguard. • Flame safeguard in alarm (see next section).
Fan feedback lost	Combustion air fan feedback signal is missing during: #40: Burner ignition step (4) #41: Flame stabilization step (5) #42: Modulation step (6) #43: Low fire step (7)	• Broken feedback wire from blower fan. • Blower fan defective. • No power on the blower fan. • Resistor (RE1) defective.
Flue vent back pressure limit	Too much back pressure in the flue vent or exchanger: #50: Burner ignition step (4) #51: Flame stabilization step (5) #52: Modulation step (6) #53: Low fire step (7)	• Blocked flue vent. • Too much restriction in flue vent. • Blocked exchanger or drain. • Pressure switch defective.
Air intake restriction limit	Too much restriction in the combustion air intake: #60: Burner ignition step (4) #61: Flame stabilization step (5) #62: Modulation step (6) #63: Low fire step (7)	• Blocked combustion air intake. • Too much restriction in the air intake or ducting. • Pressure switch defective.
Gas feedback deviation	Too much gap between the gas command and gas feedback during: #70: Modulation step (6) #71: Low fire step (7)	• Damaged feedback wire. • Blocked gas valve. • Defective gas valve actuator.
Fan feedback deviation	Too much gap between the fan command and fan feedback during: #80: Modulation step (6) #81: Low fire step (7)	• Damaged feedback wire. • Bad blower calibration (see **Start-up** section) • Defective blower fan.

Note: If an alarm is active on the PLC, a manual reset on the touch screen panel is required before the alarm can be cleared and the unit restarted.

16. FLAME SAFEGUARD ALARMS

Flame safeguards warning lights status:

The table below lists the most common and important operational fault codes in the flame safeguard relay. (Refer to flame safeguard instructions manual for other codes not listed in this table)

Trouble code	Trouble description (alarms)	Red Lights				
		OPR CTRL	Air flow	PTFI	Flame	Alarm
6	Frequency noise	•	O	O	•	*
7	Pilot flame failure (PTFI)	O	•	•	•	*
19	Burner flame failure (MTFI)	O	O	•	•	*
21	Lockout Interlock open	•	•	•	O	*
54	Ground fault	O	O	O	•	*
55	Faulty programmer	O	O	•	O	*
56	Faulty amplifier	•	O	O	O	*

Lights: ● = ON

O = OFF

* = Flashing

NOTICE!

A manual reset is needed on the flame safeguard before resetting the alarm on the touch screen panel of the PLC and be able to restart the burner.

17. FLAME SAFEGUARD TROUBLESHOOTING

Refer to the **flame safeguard alarms** section to get the right trouble description.

<table>
<tr><th colspan="3">Troubleshooting table</th></tr>
<tr><th>Trouble description</th><th colspan="2">Corrective action</th></tr>
<tr><td>• Flame failure (code 7 and 19)
(see flame sensor lights code)</td><td colspan="2">• Verify gas supply as well as the pressure
• Verify ignition transformer
• Verify flame signal strength
• Verify electric and manual valves opening
• Verify flame ceramic detection probe and change the probe if necessary
• Verify or replace the flame supervision relay amplifier
• Verify and take a burner combustion test over the entire modulation range
• Consult manufacturer</td></tr>
<tr><td rowspan="3">• Interlock alarms on flame safeguard (code 21).
(see flame sensor lights code)</td><td colspan="2">There are two possible safety devices in series on the flame safeguard</td></tr>
<tr><td>1 Maximum temperature (high limit) safety switch (set to 160°F).

Its contact is normally closed (NC) and opens if the exchanger air temperature downstream higher than 160°F. The switch is automatically reset when temperature reduce.
Note: A cool down is needed before resetting the alarm on flame safeguard.</td><td>During start-up or when running the unit

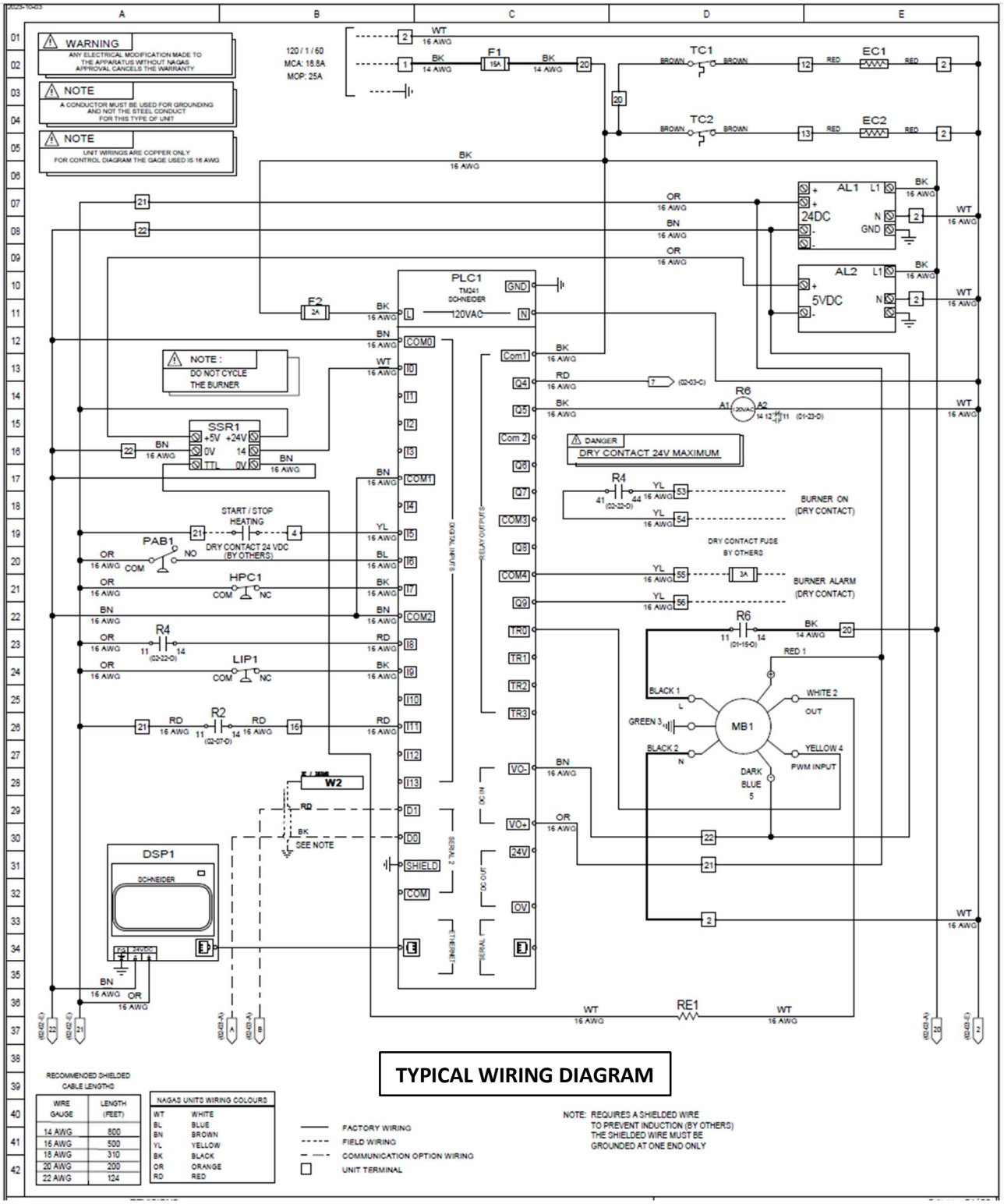
• Verify air fan downstream temperature (maximum temperature safety switch opens at 160°F).
• Verify the temperature sensor position (need to read average temperature).
• Verify burner modulation, all controls and temperature signal.
• Verify supply gas pressure.
• Consult manufacturer.</td></tr>
<tr><td>2 High or Low gas safety switch (gas train option FM or IRI)

If the gas pressure goes over the high or lower the Low limit settings the burner will stop or not start.
Note: Need to reset the switch before resetting the alarm on flame safeguard.</td><td>During start-up or when running the unit

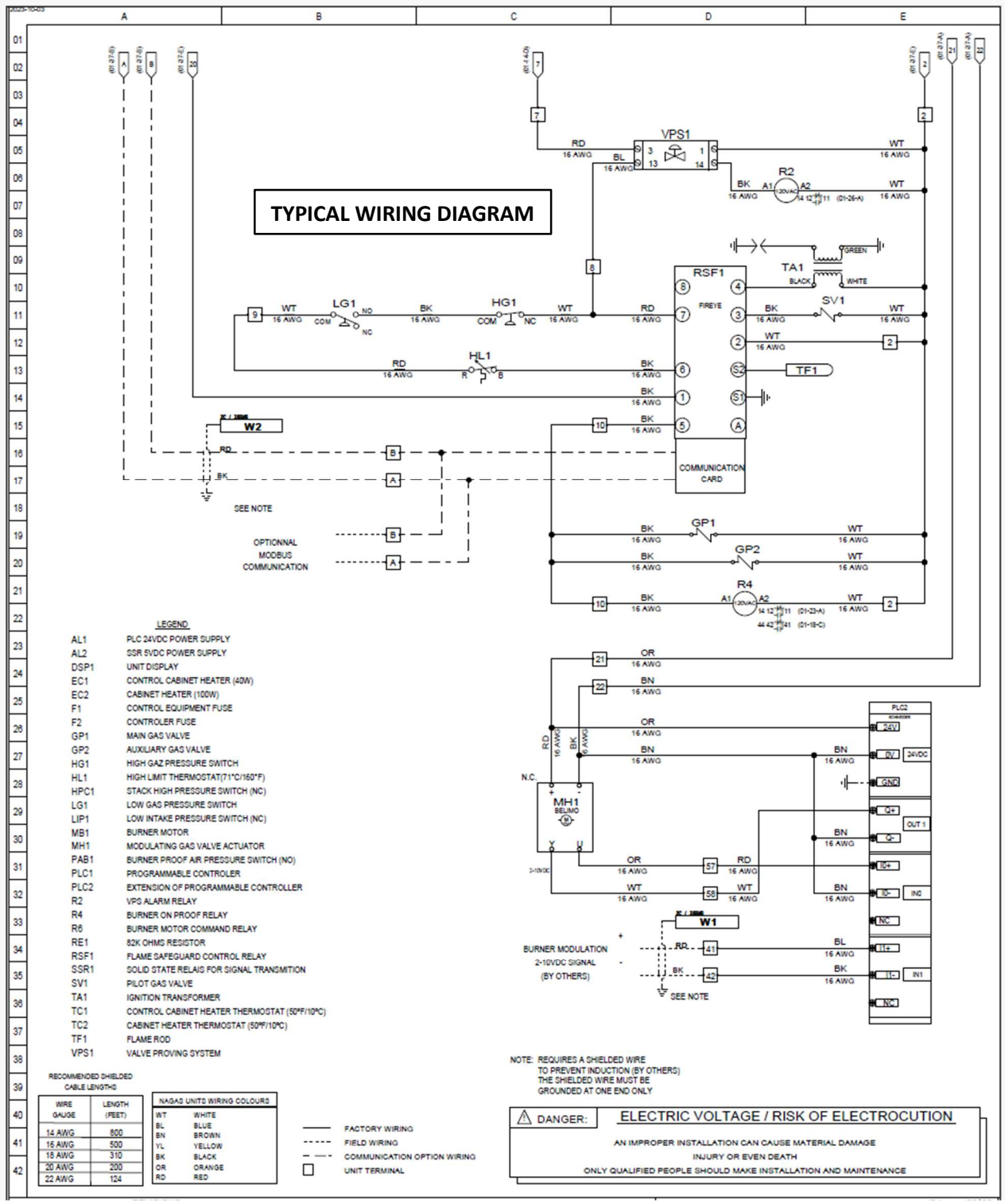
• Measure the inlet gas pressure and adjust as request on the name plate.
• Measure the manifold gas pressure and adjust as request on the name plate.</td></tr>
<tr><td>• Improper grounding (code 54)
(see flame sensor lights code)</td><td colspan="2">• Verify the unit frame grounding and the flame supervision relay
• Verify the grounding between the unit and the electrical distribution panel
• Verify relay grounding
• Mainstream wire and neutral wire are inverted.
• Consult the manufacturer</td></tr>
<tr><td>• Improper grounding
(see flame sensor lights code)</td><td colspan="2">• Verify relay grounding
• Mainstream wire and neutral wire are inverted.
• Consult manufacturer</td></tr>
</table>

The table above lists the most common and important operational fault codes in the flame safeguard relay. (Refer to flame safeguard instructions manual for other codes not listed in this table)

18. TYPICAL WIRING DIAGRAM



TYPICAL WIRING DIAGRAM


TYPICAL WIRING DIAGRAM
VPS1
R2
RSF1
TA1
SV1
LG1
HG1
HL1
TF1
GP1
GP2
R4
W2
W1
COMMUNICATION CARD
SEE NOTE
OPTIONNAL MODBUS COMMUNICATION
BURNER MODULATION 2-10VDC SIGNAL (BY OTHERS)
MH1
PLC2
LEGEND
AL1 PLC 24VDC POWER SUPPLY
AL2 SSR 5VDC POWER SUPPLY
DSP1 UNIT DISPLAY
EC1 CONTROL CABINET HEATER (40W)
EC2 CABINET HEATER (100W)
F1 CONTROL EQUIPMENT FUSE
F2 CONTROLER FUSE
GP1 MAIN GAS VALVE
GP2 AUXILIARY GAS VALVE
HG1 HIGH GAZ PRESSURE SWITCH
HL1 HIGH LIMIT THERMOSTAT(71°C/160°F)
HPC1 STACK HIGH PRESSURE SWITCH (NC)
LG1 LOW GAS PRESSURE SWITCH
LIP1 LOW INTAKE PRESSURE SWITCH (NC)
MB1 BURNER MOTOR
MH1 MODULATING GAS VALVE ACTUATOR
PAB1 BURNER PROOF AIR PRESSURE SWITCH (NO)
PLC1 PROGRAMMABLE CONTROLER
PLC2 EXTENSION OF PROGRAMMABLE CONTROLLER
R2 VPS ALARM RELAY
R4 BURNER ON PROOF RELAY
R6 BURNER MOTOR COMMAND RELAY
RE1 82K OHMS RESISTOR
RSF1 FLAME SAFEGUARD CONTROL RELAY
SSR1 SOLID STATE RELAIS FOR SIGNAL TRANSMITION
SV1 PILOT GAS VALVE
TA1 IGNITION TRANSFORMER
TC1 CONTROL CABINET HEATER THERMOSTAT (50°F/10°C)
TC2 CABINET HEATER THERMOSTAT (50°F/10°C)
TF1 FLAME ROD
VPS1 VALVE PROVING SYSTEM
RECOMMENDED SHIELDED CABLE LENGTHS
WIRE GAUGE
LENGTH (FEET)
14 AWG 800
16 AWG 500
18 AWG 310
20 AWG 200
22 AWG 124
NAGAS UNITS WIRING COLOURS
WT WHITE
BL BLUE
BN BROWN
YL YELLOW
BK BLACK
OR ORANGE
RD RED
FACTORY WIRING
FIELD WIRING
COMMUNICATION OPTION WIRING
UNIT TERMINAL
NOTE: REQUIRES A SHIELDED WIRE TO PREVENT INDUCTION (BY OTHERS) THE SHIELDED WIRE MUST BE GROUNDED AT ONE END ONLY
DANGER: ELECTRIC VOLTAGE / RISK OF ELECTROCUTION
AN IMPROPER INSTALLATION CAN CAUSE MATERIAL DAMAGE
INJURY OR EVEN DEATH
ONLY QUALIFIED PEOPLE SHOULD MAKE INSTALLATION AND MAINTENANCE

19. START / STOP RECOMMENDATIONS

19.1. IN EMERGENCY SITUATION

When it is necessary to stop the heater in case of emergency, turn the main switch to the **OFF** position and close the gas supply by closing the manual supply valve on the outside of the heater.

19.2. EXTENDED SHUTDOWN

When the duct furnace is not to be used for a long period of time, it is recommended to cut and plug the gas supply.

Before starting the unit after a shutdown, it is recommended to do an inspection to make sure everything is in order.

19.3. RESTARTING AFTER AN EXTENDED SHUTDOWN

- **Ventilation section (fan by other)**

  1. Make sure the disconnect switch in **OFF** position.
  2. Check fan belts and adjust or replace if necessary.
  3. Check the condition of filters and replace if necessary.
  4. Make sure nothing partially or completely obstructs the air inlet and air outlet of duct furnace.
  5. Ensure that nothing stops the proper functioning of the inlet damper and/or air outlet (if applicable).
  6. Place the ventilation disconnect switch in **ON** position.

- **Burner**

  1. Make sure that all manual gas valves are open.
  2. Check for alarms on the flame safeguard (see **Flame safeguard alarms** section).
  3. Check alarm message on HMI touch screen panel.
  4. Create a heat demand (heating contact **ON** and modulation signal over 2.5Vdc)
  5. Make sure that the burner fan motor operates.
  6. Make sure the burner ignites correctly.
  7. Repair if necessary.
  8. Repeat the start-up procedure.

20. UNIT MAINTENANCE

Perform the following verifications to the necessary prescribed frequency to keep the unit in good working condition. Do not limit the inspection to this list as some environmental conditions may require other or more frequent inspections.

Verification list	Recommended audit frequency			
	Weekly	Monthly	Semi-Annual	Annual
Make sure there are no flammable materials near the unit	•			
Make sure that the combustion air inlet and flue vent are not blocked or obstructed	•			
Verify flame state and combustion		•		
Verify that all safety controls are operational			•	
Verify that high temperature limit thermostat proper functioning				•
Make sure there's no gas leak in the burner and supply line				•
Inspect all electrical connection				•
Inspect flame sensor and igniter, replace if necessary				•
Verify the burner installation and tighten bolts and screws if necessary				•
PLC battery back-up replacement				**2 Years**
Check heat exchanger for cracks or deformations.				•

21. WARRANTY

Subject to the terms and conditions hereof, during the first (1) year after the original installation of the product or eighteen (18) months from date of shipment by **Nagas Innovation Inc.** whichever occurs first, we will supply free of charge any component part(s) of our product found to be defective in material or workmanship. Any replacement part(s) so supplied will be warranted for the balance of our product's original warranty. The part(s) to be replaced must be available in exchange for the replacement part(s). Any labor, material, transportation, freight or other charges incurred in connection with the performance of this warranty will be the responsibility of the owner at the hourly rates and prices then in force. This limited warranty is only applicable to new and unused products purchased from us or from our authorized distributors, provided that our user instructions contained in our user guide have been adhered to. You recognize and understand that our obligation is limited to replacing the part found to be defective and that you have no further recourse against us.

In addition, if in the five (5) years that follows the initial installation of the device, the guarantor states that the heat exchanger perforated for reasons of improper assembly or of manufacturing defects, it will be replaced or repaired under the terms of the guarantee.

THIS WARRANTY DOES NOT COVER:

(a) damages caused by accident, abuse, negligence, misuse, riot, fire, flood or Acts of God (b) damages caused by operating the product in a corrosive atmosphere (c) damages caused by any unauthorized alteration or repair of the system affecting the product's reliability or performance (d) damages caused by improper matching or applications of the product or the product's components (e) damages caused by failing to provide routine and proper maintenance or service to the product (f) expenses incurred for erecting, disconnecting or dismantling the product (g) parts used in connection with normal maintenance, such as filters or belts (h) products no longer at the site of the original installation (i) products installed or operated other than in accordance with the printed instructions, with the local installation or building codes or with good trade practices (j) products lost or stolen.
No one is authorized to change this WARRANTY or to create for us or on our behalf any other obligation or liability in connection with our product(s). There is no other representation, warranty or condition in any respect, expressed or implied, made by or binding upon us other than the above, nor will we be liable in any way for incidental, consequential, or special damages however caused such as but not limited to: loss of productivity, damages caused by delays, loss of profits and management time.

In order to obtain replacement parts under this product's warranty, contact the dealer or contractor who installed or services our products. Only dealers or contractors who are registered with us are authorized to perform this warranty. Should the dealer or the contractor need assistance, the authorized agent for **Nagas Innovation Inc.** is available for support, and we, at **Nagas Innovation Inc.**, in turn, support our agent's efforts.

RETAIN THIS WARRANTY IN YOUR FILES FOR FUTURE REFERENCE

This warranty is expressly given and accepted in lieu of any and all other warranties, expressed or implied, including without any limitation any warranty of merchantability or fitness for a particular purpose. Some states/provinces do not allow for the disclaimers, limitations and exclusions identified above; as a result, they may not apply to you.

22. START-UP REPORT

Unit tag: _____ Project: _____

Technician: _____ Address: _____

Contractor: _____ email: _____

Phone #: _____

Manufacturer information

Model number: _____ Serial number: _____

Inspection

Unit casing:	☐	Combustion air proving switch:	☐	Airflow switch:	☐
Gas leak:	☐	Control panel installed (by other):	☐	Gas vents if applicable:	☐
Combustion air openings:	☐	High limit adjustment:	☐	Flue vent:	☐
Top air baffle installed:	☐	Low limit installed:	☐	Condensate drain:	☐

Note: _____

Start-up

Flame signal: _____ VDC pilot

Flame signal: _____ VDC main flame

Gas inlet pressure: _____ _____
LOW FIRE HIGH FIRE

Gas manifold pressure: _____ _____ _____
LOW FIRE HIGH FIRE PILOT

Unit CFM: _____

Natural gas: ☐ Propane gas: ☐

Adjustment

Start-up completed: ☐ If not, why? (Or other):

_____

_____

_____

_____

Combustion

Ambient temperature: _____°F

Signal	CO^2 %	Oxygen %	Gas flue Temp. °F	Room Temp. °F	Efficiency %	Excess air %	PPM CO	PPM CO* (Air free)
2.5V								
4.0V								
6.0V								
8.0V								
9.0V								
10.0V								

*This value must be as low as possible and must never exceed 400 ppm.

Note:

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Signature: _____ Date: _____