mQ Service Heating 12/16/2022 1:25:16 PM

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Date of Service: 12/16/2022
Time of Service: 1:25:16 PM

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Jimmy Emrick

Heating System Vitals

Jim Beegmann
3425 Gilchrist Road
Mogadore, OH 44260

Date of Service: 12/16/2022
Time of Service: 1:56:04 PM

What Are Your System Vitals?
Just like your health vitals, temperature, pulse, and blood pressure etc, for Heating System vitals represent the overall health of your heating system. These vitals account for age, safety and efficiency, fuel input as well as the airside performance of the system. System targets that are out of range are typically related to system diagnostics below. Correcting the system faults should put the system back into the normal range.

YOUR SYSTEM SCORE

79% C+

Combustion Safety & Efficiency

In Range ✓ Out of Range !

COaf: 22.0 ppm

Low (0-100)	High (100-400)	Dangerous (>400)

Efficiency: 85.7

Low (70+)	Standard (80+)	High (90+)

Fuel Input Rate & Heat Transfer

Manifold Pressure: 3.2 inH2O

Low	Normal (3.1 - 3.8)	High

Temperature Split: 34.2 °F

Low	Normal (15.0 - 45.0)	High

Air Distribution & Filtration

Total External Static Pressure: 0.92 inH2O

Low	Normal (< 0.7)	High

Filter Face Velocity: 480.8 FPM

Low	Normal (< 500.0)	High

Subsystem Review

Ambient CO	✓	Fuel delivery system	!
Control system (thermostat)	✓	Make up air (CAZ)	✓
Electrical system	✓	Heat exchanger	✓
Air distribution system	!	Safety system	✓
Air filtration system	✓	Heating operation	✓
Condensate drain system	✓	Combustion Safety	✓
Indoor equipment	✓	Combustion efficiency	✓
Venting system	!		

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Score Breakdown

Age & Efficiency Losses

Combustion Safety and Efficiency: The system age scoring is based upon the initial system AFUE, installation date and climate zone. From the combustion efficiency measureQuick also deducts points for standby losses from draft hoods, standing pilots and uninsulated cabinets.

0

Safety (COaf) Losses

The ambient air, furnace exhaust, and the supply and rerun air are sampled for carbon monoxide. The exhaust CO is measured as COaf (CO air free) Elevated COaf readings in the exhaust could automatically fail the equipment/installation even if the equipment is new.

0

Fuel Input Losses

To assure a long equipment life, correct fuel input is critical. Overfiring is a primary reason for heat exchanger failure due to thermal stresses.

0

Heat Transfer Losses

To assure a long equipment life, correct temperature rise is critical. Excessive temperature rise is a primary reason for heat exchanger failure due to thermal stresses.

-10

Air Distribution and Filtration Losses

High system static pressure can result in high fan watt draw (electrical usage) and/or low airflow as well as premature blower motor failure, especially with ECM/Constant Torque motors. The system can have high total static, supply static, return static or a combination of all three. High static can also exacerbate return air duct leakage and contribute to poor indoor air quality. Excessive filter face velocity can result in blower, secondary heat exchanger and evaporator coil dirt fouling due to filter bypass or dirt sifting through the filter.

-11

Your System Score

Using data from several studies that correlate system faults, and system degradation due to age, measureQuick uses a proprietary scoring system to grade the system based upon age and system fault intensity. New systems when properly installed should easily score 95-100%.

79% C+

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Test In Measurement Details

Jim Beegmann
3425 Gilchrist Road

Mogadore, OH 44260

Date of Service: 12/16/2022
Time of Service: 1:34:48 PM

What Are Your System Vitals?
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YOUR SYSTEM SCORE

79% C+

Combustion

	1st/2nd
Ambient CO (ppm)	0.0
Return CO (ppm)	0.0
Supply CO (ppm)	0.0
CO (ppm)	12 / 12
O2 (%)	12.8 / 9.5
Air Temp. (F)	73.2 / 74.2
Stack Temp. (F)	229.5 / 203.9
COaf (ppm)	31 / 22
Excess Air (%)	156 / 83
Eff., Gross (%)	83 / 85.7
Eff., Net (%)	83 / 85.7
Dew Pt (F)	109.6 / 119.2
Outdoor Air (F)	67.7

Electrical Measurements

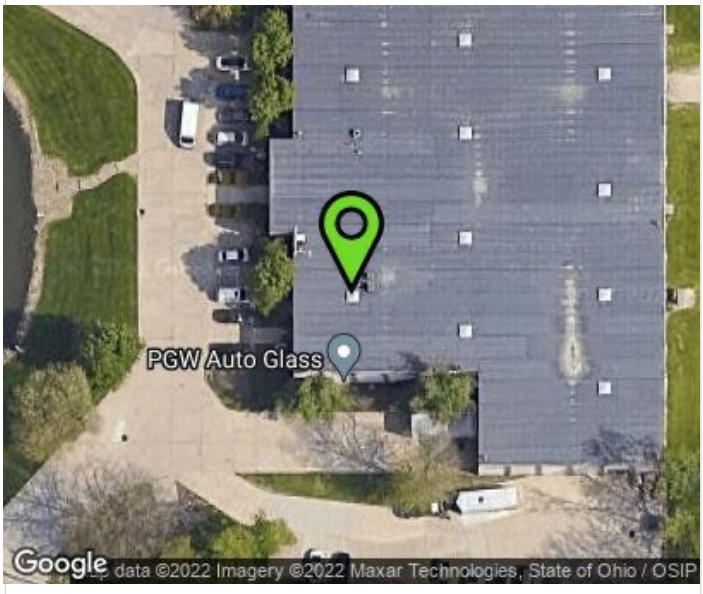
Incoming Voltage (V)	121.8
Low Voltage (V)	26.2
Polarity	95.4
Comb. Blower (Amps)	0.4
Indoor Fan (Amps)	7.13
Indoor Fan Power Factor	0.68
Indoor Fan Power (W)	584.0

System Info & Weather

Atmos. Pressure (psi	14.102
Elevation (ft)	1138
Temperature (F)	34.48
Humidity (%)	0.76
Dew Point (F)	27.61

Performance Calculations

	1st/2nd
Inlet Pressure (inH2O)	7.51
Manifold Pressure (inH2O)	1.62 / 3.18
TESP (inH2O)	0.12 / 0.92
Temp Rise (F)	31.2 / 34.2
Temp Rise Target (F)	30.0 / 30.0
Return Air (F)	67.2 / 67.2
Supply Air (F)	98.4 / 101.4
Airflow (SCFM)	1012 / 1336
Rated Input	42000 / 60000
Meter Input	41085 / 57562
Heat Output	34100 / 49331



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Jimmy Emrick

Heating System Vitals

Jim Beegmann
3425 Gilchrist Road
Mogadore, OH 44260

Date of Service: 12/16/2022
Time of Service: 1:56:06 PM

What Are Your System Vitals?
Just like your health vitals, temperature, pulse, and blood pressure etc, for Heating System vitals represent the overall health of your heating system. These vitals account for age, safety and efficiency, fuel input as well as the airside performance of the system. System targets that are out of range are typically related to system diagnostics below. Correcting the system faults should put the system back into the normal range.

YOUR SYSTEM SCORE
100% A+

Combustion Safety & Efficiency

In Range ✓ Out of Range !

COaf: 25.0 ppm

Low (0-100)	High (100-400)	Dangerous (>400)

Efficiency: 84.6

Low (70+)	Standard (80+)	High (90+)

Fuel Input Rate & Heat Transfer

Manifold Pressure: 3.3 inH2O

Low	Normal (3.0 - 3.7)	High

Temperature Split: 34.8 °F

Low	Normal (15.0 - 45.0)	High

Air Distribution & Filtration

Total External Static Pressure: 0.41 inH2O

Low	Normal (< 0.7)	High

Filter Face Velocity: 483.9 FPM

Low	Normal (< 500.0)	High

Subsystem Review

Ambient CO	✓	Fuel delivery system *	✓
Control system (thermostat)	✓	Make up air (CAZ)	✓
Electrical system	✓	Heat exchanger	✓
Air distribution system *	✓	Safety system	✓
Air filtration system	✓	Heating operation	✓
Condensate drain system	✓	Combustion Safety	✓
Indoor equipment	✓	Combustion efficiency	✓
Venting system *	✓		

Score Breakdown

Age & Efficiency Losses

Combustion Safety and Efficiency: The system age scoring is based upon the initial system AFUE, installation date and climate zone. From the combustion efficiency measureQuick also deducts points for standby losses from draft hoods, standing pilots and uninsulated cabinets.

0

Safety (COaf) Losses

The ambient air, furnace exhaust, and the supply and rerun air are sampled for carbon monoxide. The exhaust CO is measured as COaf (CO air free) Elevated COaf readings in the exhaust could automatically fail the equipment/installation even if the equipment is new.

0

Fuel Input Losses

To assure a long equipment life, correct fuel input is critical. Overfiring is a primary reason for heat exchanger failure due to thermal stresses.

0

Heat Transfer Losses

To assure a long equipment life, correct temperature rise is critical. Excessive temperature rise is a primary reason for heat exchanger failure due to thermal stresses.

0

Air Distribution and Filtration Losses

High system static pressure can result in high fan watt draw (electrical usage) and/or low airflow as well as premature blower motor failure, especially with ECM/Constant Torque motors. The system can have high total static, supply static, return static or a combination of all three. High static can also exacerbate return air duct leakage and contribute to poor indoor air quality. Excessive filter face velocity can result in blower, secondary heat exchanger and evaporator coil dirt fouling due to filter bypass or dirt sifting through the filter.

0

Your System Score

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100% A+

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Jimmy Emrick

Test Out Measurement Details

Jim Beegmann
3425 Gilchrist Road

Mogadore, OH 44260

Date of Service: 12/16/2022
Time of Service: 1:55:14 PM

What Are Your System Vitals?
Just like your health vitals, temperature, pulse, and blood pressure etc, for Heating System vitals represent the overall health of your heating system. These vitals account for age, safety and efficiency, fuel input as well as the airside performance of the system. System targets that are out of range are typically related to system diagnostics below. Correcting the system faults should put the system back into the normal range.

YOUR SYSTEM SCORE

100% A+

Combustion

	1st/2nd
Ambient CO (ppm)	0.0
Return CO (ppm)	0.0
Supply CO (ppm)	0.0
CO (ppm)	15 / 15 ✓
O2 (%)	8.8 / 8.8 ✓
Air Temp. (F)	72 / 71.6 ✓
Stack Temp. (F)	241.5 / 241.3 ↓
COaf (ppm)	25 / 25 ✓
Excess Air (%)	72 / 72 ✓
Eff., Gross (%)	84.6 / 84.6 ✓
Eff., Net (%)	84.6 / 84.6 ✓
Dew Pt (F)	121 / 121
Outdoor Air (F)	67.6

Electrical Measurements

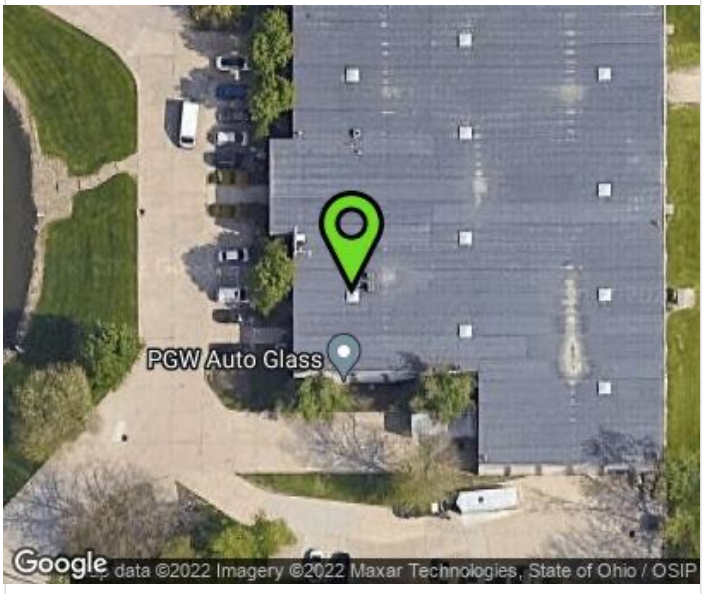
Incoming Voltage (V)	121.8
Low Voltage (V)	26.2
Polarity	95.4
Comb. Blower (Amps)	0.4
Indoor Fan (Amps)	7.13
Indoor Fan Power Factor	0.68
Indoor Fan Power (W)	584.0

System Info & Weather

Atmos. Pressure (psi	14.102
Elevation (ft)	1138
Temperature (F)	34.48
Humidity (%)	0.76
Dew Point (F)	27.61

Performance Calculations

	1st/2nd
Inlet Pressure (inH2O)	7.44
Manifold Pressure (inH2O)	1.62 / 3.30
TESP (inH2O)	0.24 / 0.41
Temp Rise (F)	31.2 / 34.8
Temp Rise Target (F)	30.0 / 30.0
Return Air (F)	67.2 / 67.0
Supply Air (F)	98.4 / 101.8
Airflow (SCFM)	1051 / 1344
Rated Input	42000 / 60000
Meter Input	41844 / 59721
Heat Output	35400 / 50524



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Visual Inspection

System Information

Coords: 41.05685, -81.40253

Condenser

GOODMAN GSZC160241CA

S/N 2001161007

Evaporator

GOODMAN CAPF3137B6AA

S/N 1907306370

Air Handler

GOODMAN GMVC80603BNCA

S/N 1907051552

System Profile

Heating Type	80+ Furnace
Fuel Type	Natural Gas
Min Gas Supply Pres	5
Max Gas Supply Pres	7
Rated Manifold Pres	23842533
Rated Efficiency	80
Heat Profile Info 7	Split

Test In Score

79% C+

Test Out Score

100% A+

Visual Inspection

Control System (Thermostat)
- Plugged wire penetration

Electrical System
- Repaired/tightened connections

Air Distribution System
- Cleaned blower
- Cleaned evaporator
- Adjusted fan speed
- Adjusted dampers/registers

Air Filtration System
- No action required

Condensate Drain System
- Cleaned/flushed drain line
- Added auxiliary drain line

Indoor Equipment
- Cleaned evaporator
- Adjusted blower

Venting System
- Verified vent system sizing
- Verified proper vent pitch
- Verified proper vent termination
- Verified proper vent system support
- Verified vent system is free of corrosion
- Verified vent terminates 12" min. above snow line
- Checked vent system for blockages/restrictions
- Checked flue liner condition if equipped

Fuel Delivery System
- Checked for fuel gas leaks

Fuel Delivery System (Cont.)
- Cleaned/inspected burners
- Verified correct burner alignment/cleaned burners

Make Up Air System (CAZ)
- Determined system is installed in a confined space with provisions for combustion*and ventilation through ducted openings to outside per code requirements

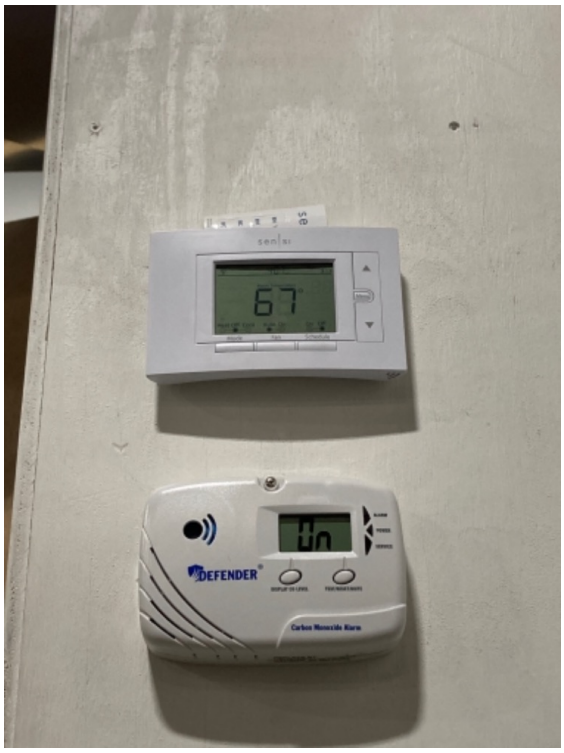
Heat Exchanger
- Inspected for rust/cracks/corrosion/warping (required)

Safety System
- Verified safe ambient CO levels

Heating Operation
- Operation satisfactory

Combustion Safety/Ambient CO
- System operation determined safe at inspection, stack CO below 100 ppm.

Project Photos



Control System (Thermostat)

Electrical System

Project Photos

Air Distribution System

Air Filtration System

Project Photos

Condensate Drain System

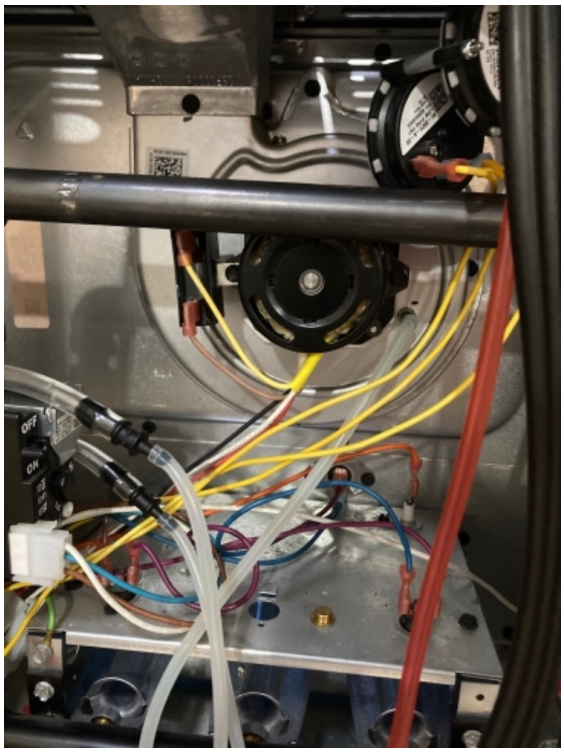
Indoor Equipment

Project Photos

Venting System

Make Up Air System (CAZ)

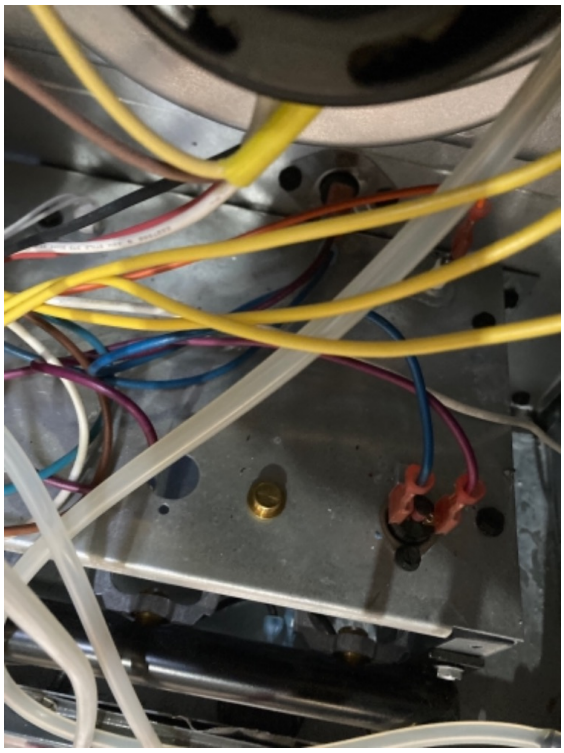
Project Photos



Heat Exchanger

Fuel Delivery System

Project Photos



Safety System

Heating Operation

Equipment Photos

Equipment Models & Serials

Equipment Models & Serials

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Report Information

Heating System Vitals Report

The Heating System Vitals report and scoring: This measureQuick Heating System Vitals Score is reflective of the system safety, heating performance, degradation due to age, initial rated AFUE, fuel input, temperature split and duct system static pressures. Each element of the calculation is data driven and has a direct or indirect bearing on the equipment safety efficiency, heating performance, and longevity.

Your system is not only composed of the mechanical equipment, but there are also many subsystems including a control system, electrical system, air distribution system, air filtration system, condensate disposal system, venting system, fuel delivery system, and provisions for make-up air. Servicing and or replacing the equipment without addressing issues with the subsystems will assure premature equipment failure.

When properly installed and maintained, modern furnace systems are designed to last up to 20 years.* When there are system installation issues or maintenance that has been long deferred, the system life can be decreased dramatically. Systems scoring at or above 80% are typically considered excellent candidates for repair. Systems scoring less than 50% may require significant repairs, and due to age may be better candidates for equipment early retirement and replacement.

Combustion Safety and Efficiency

Combustion safety is measured with a combustion analyzer. It is determined by the COaf (Carbon Monoxide Air Free) reading. Appliances that are adjusted for proper input will typically have a COaf reading of 100 ppm or less. The maximum permissible COaf reading is 400 ppm at steady state. Systems producing COaf readings above Systems between 100 and 400 ppm COaf should be serviced and or adjusted to reduce the COaf reading below 100 ppm. An appliance with CO readings above 400 ppm COaf that cannot be fixed should be removed from service. Please see specific recommendations further down in this report under combustion safety.

The efficiency of gas appliances remains consistent over the life of the appliance with limited maintenance provided they are set up properly at the time of installation. These appliances require annual service to assure their continued safety and longevity. Many non-condensing (mid and low efficiency) appliances can have combustion efficiencies approaching 80%. Combustion efficiency however is not representative of the actual efficiency of the appliance due to standby losses from continuous pilots, draft hoods, and installation in an unconditioned space. These standby losses can decrease overall appliance efficiency (AFUE) as much as 25%.

Fuel Input and Heat Transfer

Fuel input and temperature split are of primary importance when it comes to equipment longevity and efficiency. It is critical that the appliance is on rate (proper fuel input) and operating near the center of the desired temperature rise at or below the designed duct air pressure for the system. Incorrect input and high temperature rise are primary contributors to premature heat exchanger failure.

Air Distribution and Filtration (TESP and Filter Face Velocity)

Total External Static Pressure (TESP) is a measure of the resistance to airflow in an air conditioning system by components external to the rated appliance. Typically, the components that create resistance to airflow are the evaporator coil, the air filter and/or filter grill, and the supply and return duct system including the registers. A high total external static pressure will cause low airflow for a PSC motor and high electrical consumption and or low airflow for an ECM. In both cases, this can cause premature failure of the blower motor, an expensive repair.

Filter face velocity is measured to assure proper air filtration and to prevent the sifting of dirt through the filter causing the evaporator coil to foul and or the condensate line to plug with dirt. A system that has undersized filtering will also typically have a high TESP. While coil fouling does naturally occur over time, when accelerated, it can lead to significant system efficiency losses.