

SELECT INSTRUCTION

CHOOSING A MINIMUM OPERATING TEMPERATURE FOR YOUR HEAT PUMP



Introduction

The combination of a heat pump with a gas furnace provides homeowners with greater flexibility for choosing how to heat their home. Deciding which appliance to use at different times and outdoor temperatures depends on many factors:

- The customer's perceived level of comfort.
- The time to recover from a setback.
- Cost of gas and/or electric for fuel.

These points will be examined later; however, some information about the appliances is needed before we make any decisions.

Gas Furnace Operation

The efficiency that a furnace transfers the fuel's heat content to the home is often known as the Annual Fuel Utilization Efficiency (AFUE). If a furnace has an AFUE rating of 90%, it means that 90% of the fuel's available fuel energy is transferred to the house. Electric energy consumption is not included in this rating. The efficiency of a gas furnace is not changed by the outdoor temperature because the furnace is getting its heat from the fuel, not from outside. The cost for heating increases roughly in proportion to the outdoor temperature. Importantly, the supply temperature at the registers remains constant.

Heat Pump Operation

The efficiency that a heat pump operates in heating mode is usually expressed as the Coefficient of Performance (COP). A COP of 2 indicates that the heat pump transfers two times as much energy as it consumes for its operation. Heat pump efficiency (COP) in heating mode is dependent on the outdoor temperature because the heat pump is capturing and transferring heat from the outdoors, which becomes increasingly difficult as the outdoor temperature declines. Both the COP and the supply air temperature decline with outdoor temperature.

Operating Costs

The cost to heat a home depends on both the efficiency of the appliance and the energy cost charged by the utility company. Deciding which appliance to use will also depend on the cost of electric relative to the cost of the fuel gas as this can vary over a wide range across North America. In most regions, it will be more affordable to heat a home using the heat pump during moderate temperatures. However, as the outside temperature declines, the cost of heating with the heat pump increases faster than the cost of a gas furnace. So, if it is cold enough, it will cost less to heat with the furnace.

The method for determining the outdoor winter temperature that a furnace begins heating the home for a cost lower than the heat pump is known as the *economic balance point temperature*. Above the balance point, the heat pump will cost less to operate than the gas or oil furnace. Below the balance point, it is more affordable to use the gas furnace for heat. Instructions on how to calculate this temperature are provided on page 2 of this manual.

Comfort

Since the temperature of the supply air from a heat pump declines as it gets colder outside, many homeowners find that the heat pump feels drafty or not warm enough when it is very cold outside. The best solution is to use the furnace for heating until the outdoor temperature increases. This means you can choose the minimum operating temperature of the heat pump based on your customer's comfort level, rather than energy costs.

The amount of time needed to recover a cold house from a setback is also an important comfort issue. Generally, a gas furnace can deliver large quantities of heat more quickly than a heat pump. So if a large recovery is needed, it may be necessary to use the gas furnace temporarily.

Some thermostats automatically run the furnace if the room temperature is more than a fixed number of degrees below the desired setpoint or if the heat pump is taking too long to warm the room up. Consult your thermostat's programming instructions for setup directions.

NOTE: Nordyne's iQ control system uses a combination of time below setpoint and absolute number of degrees below setpoint to determine when to run the furnace for backup heat. This operation will depend on which heat pump and furnace model is part of your system.

Conclusions

Since energy costs vary throughout the US and Canada, the installer will know what makes sense in their area. For a majority of installations, the minimum temperature to operate the heat pump will not be set by cost. Instead, it will be set by the desire to maintain indoor comfort for the customer.

In areas where the cost of electricity is higher compared to natural gas or LP, the minimum operating temperature should be set to the Economic Balance Point Temperature. This temperature can be estimated using the methods outlined in the next section.

NOTE: If using Nordyne's iQ control thermostat, the economic balance point temperature or the otherwise desired minimum operating temperature can be adjusted in the Options Screen marked:

HEAT PUMP USAGE LIMIT NOT BELOW ____ ° F

How to Estimate the Economic Balance Point Temperature

The economic balance point temperature is based on four main variables:

- The efficiency of the heat pump in heating (COP).
- The efficiency of the furnace (AFUE).
- The cost of electric from local utilities.
- The cost of natural gas or LP from local utilities.

Since managing all four variables can be complicated, this procedure uses simple assumptions based on Nordyne products known performance:

- The COP of the different heat pump models are similar regardless of SEER.
- The performance of Nordyne's condensing furnace models can be represented as having an AFUE of 92% or more. One exception – there is a separate line for the MQ 97.1% furnace.

To estimate the economic balance point temperature, follow these steps:

1. Obtain the cost of electric and fuel gas from the local utility company.
2. Refer to Table 1 (for natural gas) or Table 2 (for LP). Find your electrical cost in the shaded column marked *Cost of electricity*. Follow across the row until you reach the column that represents your fuel gas cost. Make note of this ratio.
3. Refer to Figure 1 (for natural gas) or Figure 2 (for LP). Find the cost ratio from step 2 along the horizontal axis. Move vertically up the chart until you intersect the line that represents the AFUE of your furnace. Next, move horizontally to the left until you reach the temperature in the vertical axis. This is the economic balance point temperature.

If the outdoor temperature is lower than the economic balance point temperature, it will cost less to operate the furnace rather than the heat pump.

		Natural gas cost, \$ per cubic meter (Typical for Canadian Installations)																		
		0.25	0.28	0.32	0.35	0.39	0.42	0.46	0.49	0.53	0.56	0.60	0.64	0.67	0.71	0.74	0.78	0.81	0.85	0.88
		Natural gas cost, \$ per Therm (100 cubic feet) (Typical for U.S. Installations)																		
		0.70	0.80	0.90	1.00	1.10	1.20	1.30	1.40	1.50	1.60	1.70	1.80	1.90	2.00	2.10	2.20	2.30	2.40	2.50
Cost of electricity, \$ per kilowatt-hour	0.03	0.04	0.04	0.03	0.03	0.03	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01
	0.04	0.06	0.05	0.04	0.04	0.04	0.03	0.03	0.03	0.03	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
	0.05	0.07	0.06	0.06	0.05	0.05	0.04	0.04	0.04	0.03	0.03	0.03	0.03	0.03	0.03	0.02	0.02	0.02	0.02	0.02
	0.06	0.09	0.08	0.07	0.06	0.05	0.05	0.05	0.04	0.04	0.04	0.04	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.02
	0.07	0.10	0.09	0.08	0.07	0.06	0.06	0.05	0.05	0.05	0.04	0.04	0.04	0.04	0.04	0.03	0.03	0.03	0.03	0.03
	0.08	0.11	0.10	0.09	0.08	0.07	0.07	0.06	0.06	0.05	0.05	0.05	0.04	0.04	0.04	0.04	0.04	0.03	0.03	0.03
	0.09	0.13	0.11	0.10	0.09	0.08	0.08	0.07	0.06	0.06	0.06	0.05	0.05	0.05	0.05	0.04	0.04	0.04	0.04	0.04
	0.1	0.14	0.13	0.11	0.10	0.09	0.08	0.08	0.07	0.07	0.06	0.06	0.06	0.05	0.05	0.05	0.05	0.04	0.04	0.04
	0.11	0.16	0.14	0.12	0.11	0.10	0.09	0.08	0.08	0.07	0.07	0.06	0.06	0.06	0.06	0.05	0.05	0.05	0.05	0.04
	0.12	0.17	0.15	0.13	0.12	0.11	0.10	0.09	0.09	0.08	0.08	0.07	0.07	0.06	0.06	0.06	0.05	0.05	0.05	0.05
	0.13	0.19	0.16	0.14	0.13	0.12	0.11	0.10	0.09	0.09	0.08	0.08	0.07	0.07	0.07	0.06	0.06	0.06	0.05	0.05
	0.14	0.20	0.18	0.16	0.14	0.13	0.12	0.11	0.10	0.09	0.09	0.08	0.08	0.07	0.07	0.07	0.06	0.06	0.06	0.06
	0.15	0.21	0.19	0.17	0.15	0.14	0.13	0.12	0.11	0.10	0.09	0.09	0.08	0.08	0.08	0.07	0.07	0.07	0.06	0.06
	0.16	0.23	0.20	0.18	0.16	0.15	0.13	0.12	0.11	0.11	0.10	0.09	0.09	0.08	0.08	0.08	0.07	0.07	0.07	0.06
	0.17	0.24	0.21	0.19	0.17	0.15	0.14	0.13	0.12	0.11	0.11	0.10	0.09	0.09	0.09	0.08	0.08	0.07	0.07	0.07
	0.18	0.26	0.23	0.20	0.18	0.16	0.15	0.14	0.13	0.12	0.11	0.11	0.10	0.09	0.09	0.09	0.08	0.08	0.08	0.07
	0.19	0.27	0.24	0.21	0.19	0.17	0.16	0.15	0.14	0.13	0.12	0.11	0.11	0.10	0.10	0.09	0.09	0.08	0.08	0.08
	0.2	0.29	0.25	0.22	0.20	0.18	0.17	0.15	0.14	0.13	0.13	0.12	0.11	0.11	0.10	0.10	0.09	0.09	0.08	0.08
	0.21	0.30	0.26	0.23	0.21	0.19	0.18	0.16	0.15	0.14	0.13	0.12	0.12	0.11	0.11	0.10	0.10	0.09	0.09	0.08
	0.22	0.31	0.28	0.24	0.22	0.20	0.18	0.17	0.16	0.15	0.14	0.13	0.12	0.12	0.11	0.10	0.10	0.10	0.09	0.09
	0.23	0.33	0.29	0.26	0.23	0.21	0.19	0.18	0.16	0.15	0.14	0.14	0.13	0.12	0.12	0.11	0.10	0.10	0.10	0.09
	0.24	0.34	0.30	0.27	0.24	0.22	0.20	0.18	0.17	0.16	0.15	0.14	0.13	0.13	0.12	0.11	0.11	0.10	0.10	0.10
	0.25	0.36	0.31	0.28	0.25	0.23	0.21	0.19	0.18	0.17	0.16	0.15	0.14	0.13	0.13	0.12	0.11	0.11	0.10	0.10
	0.26	0.37	0.33	0.29	0.26	0.24	0.22	0.20	0.19	0.17	0.16	0.15	0.14	0.14	0.13	0.12	0.12	0.11	0.11	0.10
	0.27	0.39	0.34	0.30	0.27	0.25	0.23	0.21	0.19	0.18	0.17	0.16	0.15	0.14	0.14	0.13	0.12	0.12	0.11	0.11
0.28	0.40	0.35	0.31	0.28	0.25	0.23	0.22	0.20	0.19	0.18	0.16	0.16	0.15	0.14	0.13	0.13	0.12	0.12	0.11	
0.29	0.41	0.36	0.32	0.29	0.26	0.24	0.22	0.21	0.19	0.18	0.17	0.16	0.15	0.15	0.14	0.13	0.13	0.12	0.12	
0.3	0.43	0.38	0.33	0.30	0.27	0.25	0.23	0.21	0.20	0.19	0.18	0.17	0.16	0.15	0.14	0.14	0.13	0.13	0.12	
0.31	0.44	0.39	0.34	0.31	0.28	0.26	0.24	0.22	0.21	0.19	0.18	0.17	0.16	0.16	0.15	0.14	0.13	0.13	0.12	
0.32	0.46	0.40	0.36	0.32	0.29	0.27	0.25	0.23	0.21	0.20	0.19	0.18	0.17	0.16	0.15	0.15	0.14	0.13	0.13	
0.33	0.47	0.41	0.37	0.33	0.30	0.28	0.25	0.24	0.22	0.21	0.19	0.18	0.17	0.17	0.16	0.15	0.14	0.14	0.13	
0.34	0.49	0.43	0.38	0.34	0.31	0.28	0.26	0.24	0.23	0.21	0.20	0.19	0.18	0.17	0.16	0.15	0.15	0.14	0.14	
0.35	0.50	0.44	0.39	0.35	0.32	0.29	0.27	0.25	0.23	0.22	0.21	0.19	0.18	0.18	0.17	0.16	0.15	0.15	0.14	

Table 1. Cost Ratio for Natural Gas

Economic Balance Point Temperature

Natural Gas

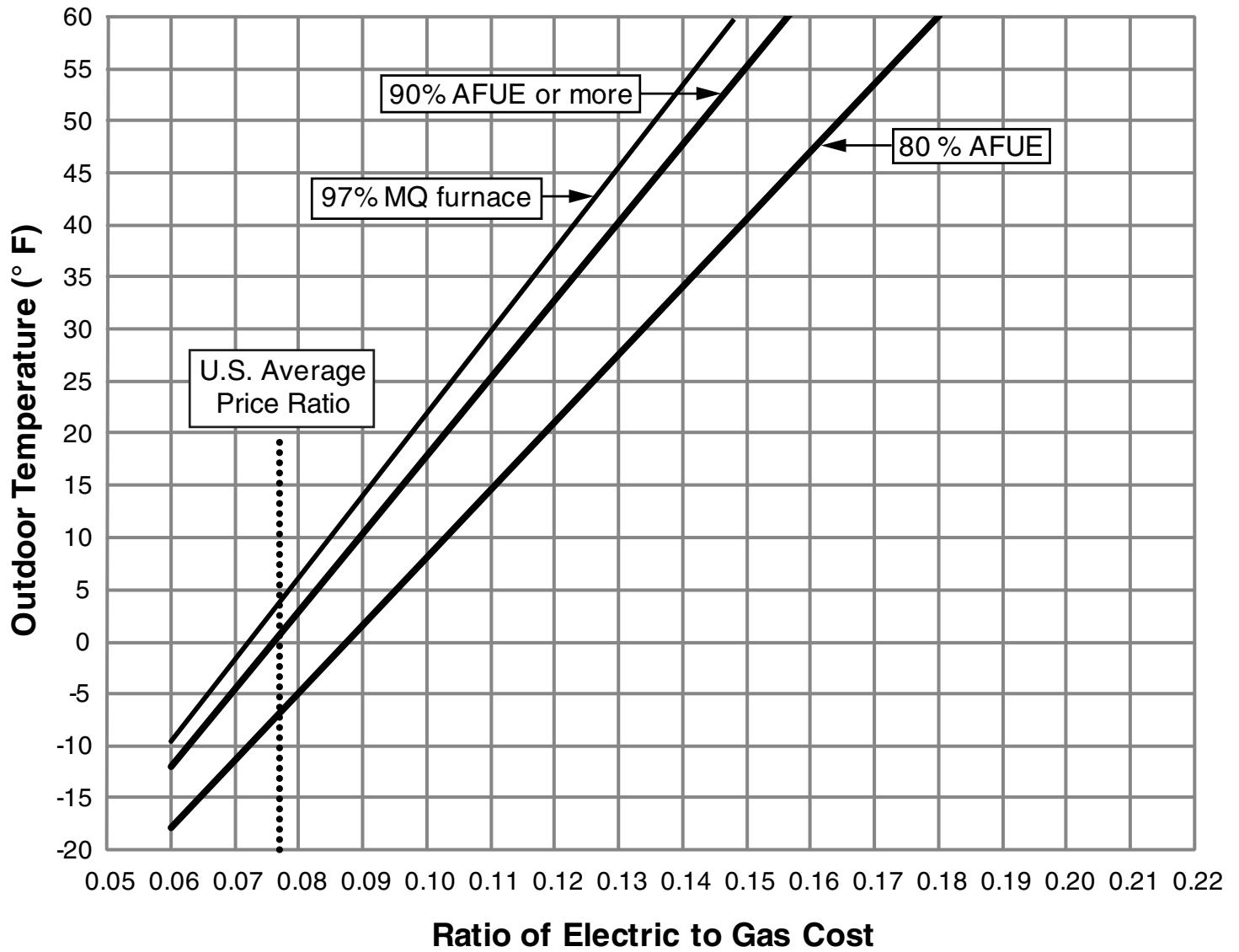


Figure 1

Economic Balance Point Temperature

Liquid Propane

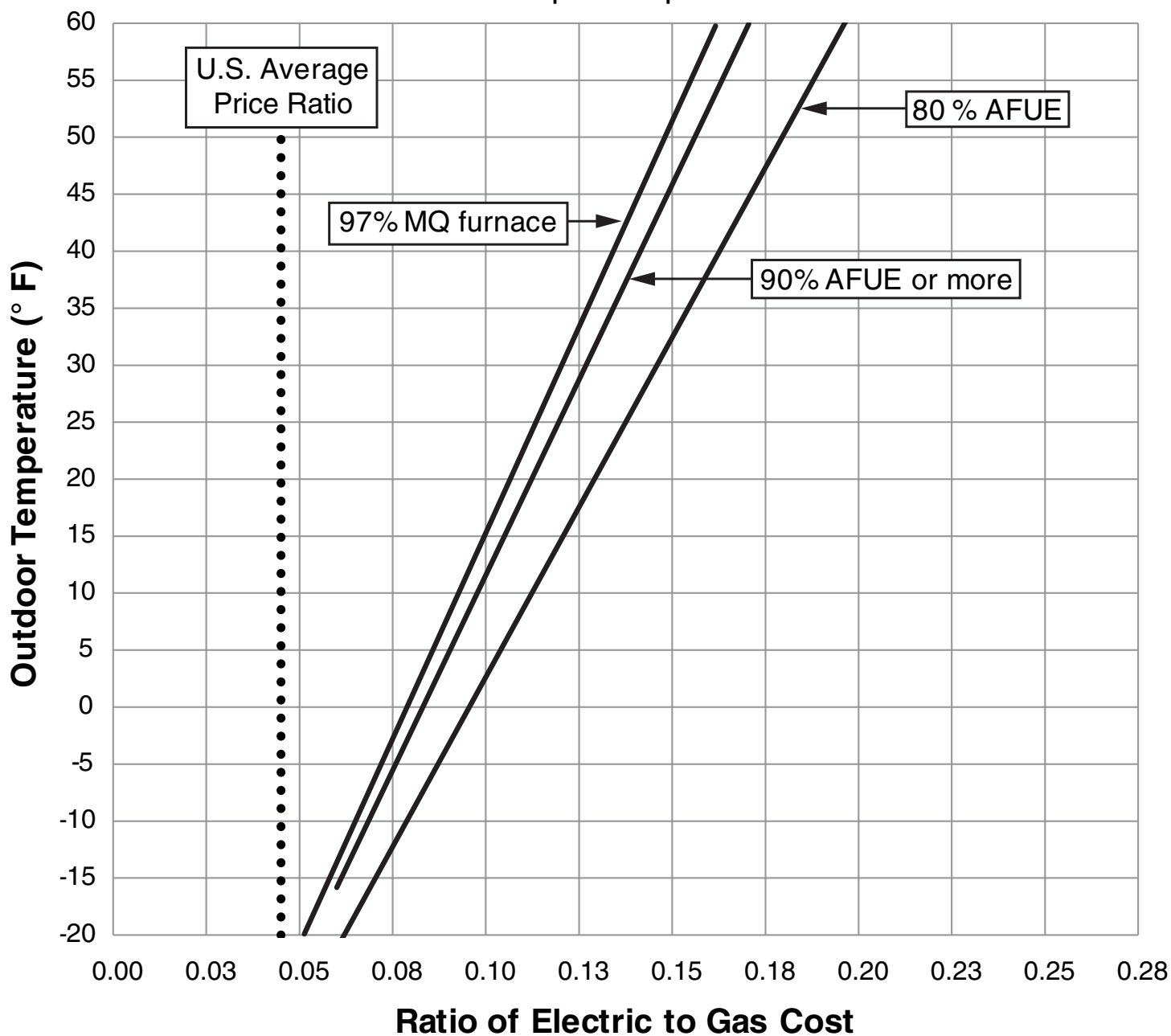


Figure 2

