

The Lennox logo is displayed in a large, light gray, semi-transparent font. It features the word "LENNOX" in a bold, italicized, sans-serif typeface, enclosed within a thin, light gray oval border. A registered trademark symbol (®) is positioned to the right of the oval.

**LENNOX**

# Automated Verification Systems

John Whinery, VP Product Management – Lennox International



# Start Up Procedure

# Electrical Checks

Starting the Furnace  
Electrical Checks

**Check wiring connections  
are tight**



**Check correct supply  
voltage**

ELECTRICAL RATING/ CARACTERISTIQUE ELECTRIQUE					
VOLTS	HERTZ	PHASE	MAX AMPS/ AMP MAX	INDOOR BLOWER MOTOR	
				FLA	HP
120	60	1	12.0	8.4	3/4

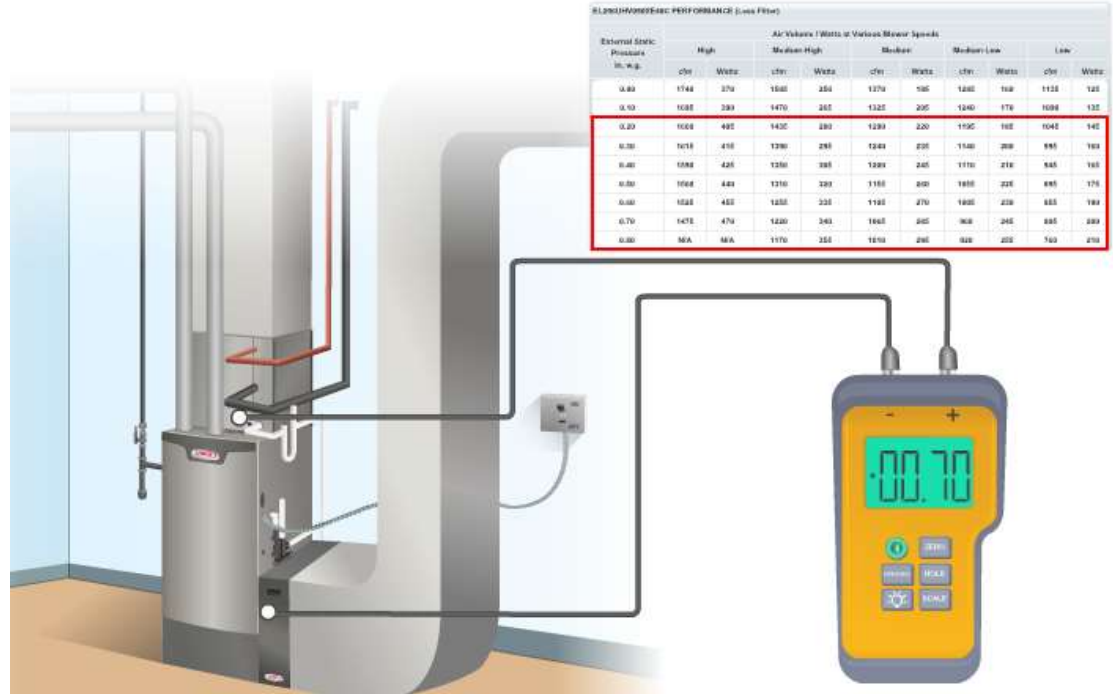
**Check for correct polarity  
of supply voltage**



# External Static Pressure

Starting the Furnace  
Measuring External Static Pressure

1. Set supply-side probe between outlet and evaporator coil.
2. Set return-side probe between furnace inlet and filter.
3. Run the Blower at cooling speed.
4. Measure and compare the measured ESP value to the Blower table.



# External Static Pressure

Starting the Furnace  
Measuring External Static Pressure

## Too High ESP

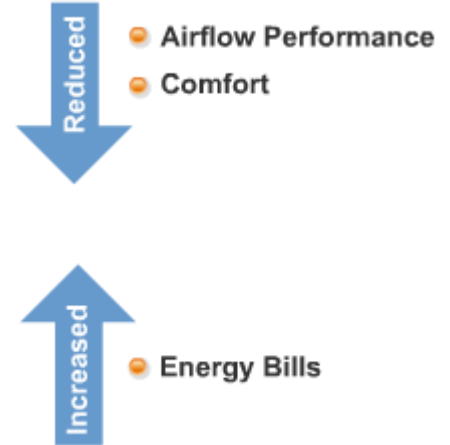
Check the following:

- Dirty A-coil,
- Dirty Filter
- Closed or blocked Registers
- Blocked Return Grilles
- Closed Dampers
- Undersized Duct System

## Industry-Approved Standards

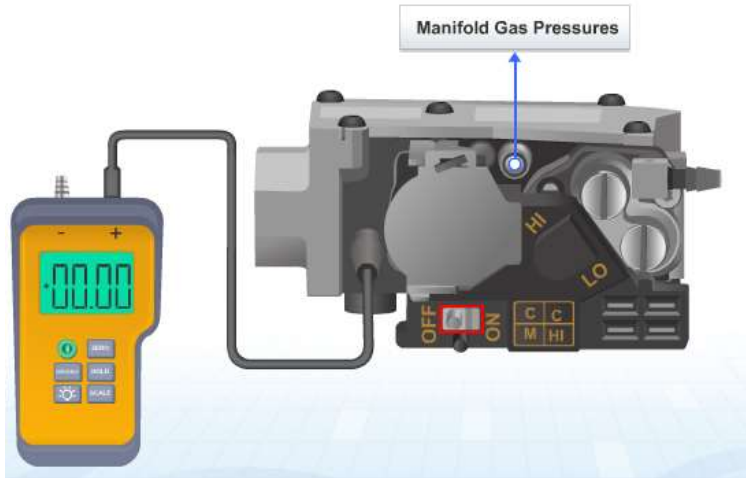


## System Performance



# Measuring Gas Supply Pressure

Starting the Furnace  
Measuring Gas Supply Pressure



## HEATING DATA

EQUIPPED FOR USE WITH NATURAL GAS

INPUT (BTUH)	88,000/57,200
OUTPUT (BTUH)	70,400/45,760
MANIFOLD PRESSURE (IN. W.C.)	3.5/1.7
GAS SUPPLY LINE PRESS (MAX/MIN/ IN. W.C.)	13.0/4.5

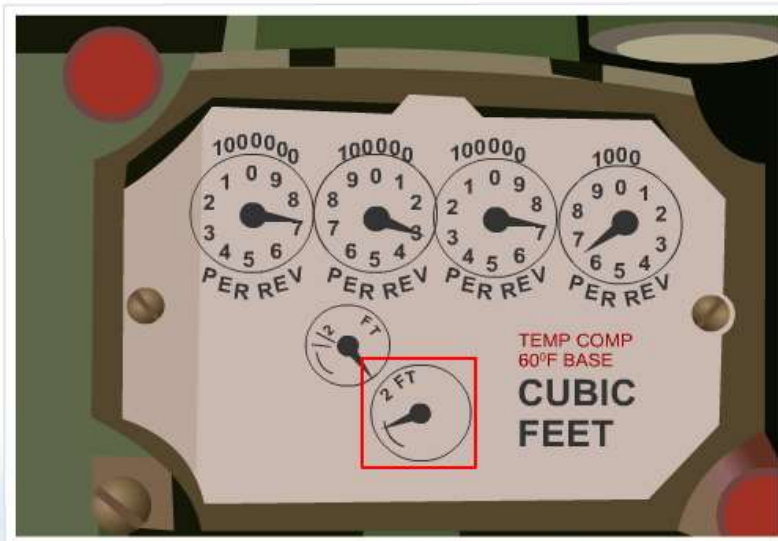
Gas	Min	Max
Natural	4.5	10.5
LP/propane	11.0	13.0



# Checking Firing Rate

Starting the Furnace  
Checking Firing Rate

- Determine time in seconds for two revolutions of gas through the meter.
- Divide by two and compare to time on the Gas Meter Clocking Chart table.



GAS METER CLOCKING CHART

	Seconds for One Revolution			
	Natural		LP	
	1 cu ft Dial	2 cu ft Dial	1 cu ft Dial	2 cu ft Dial
-045	80	160	200	400
-070	55	110	136	272
-090	41	82	102	204
-110	33	66	82	164
-135	27	54	68	136

Natural - 1000 btu/cu ft                      LP - 2500 btu/cu ft



# Measuring CO and CO<sub>2</sub> in Exhaust

Starting the Furnace  
Measuring CO and CO<sub>2</sub> in Exhaust



	CO <sub>2</sub> % For Nat		CO <sub>2</sub> % For LPG	
	Low Fire	High Fire	Low Fire	High Fire
<b>045</b>	5.4 – 6.4	7.5 – 8.5	6.4 – 7.4	8.8 – 9.8
<b>070</b>	5.3 – 6.3	7.4 – 8.4	6.3 – 7.3	8.7 – 9.7
<b>090</b>	5.8 – 6.8	7.6 – 8.6	6.8 – 7.8	8.9 – 9.9
<b>110</b>	6.1 – 7.1	8.0 – 9.0	7.1 – 8.1	9.3 – 10.3
<b>135</b>	6.1 – 7.1	7.8 – 8.8	7.1 – 8.2	9.1 – 10.1

The maximum carbon monoxide reading should not exceed 50 ppm.





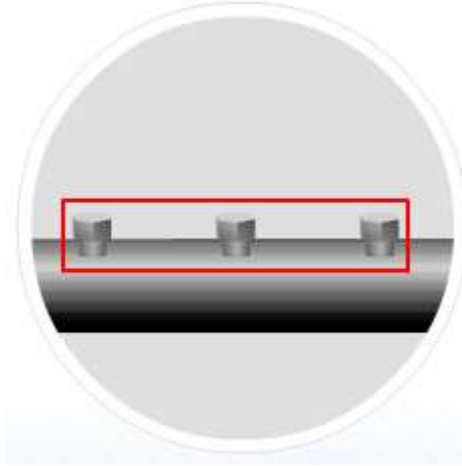
# Reducing CO and CO<sub>2</sub> Levels in Exhaust

Starting the Furnace  
Checking Products of Combustion

## Flame impingement



## Over firing

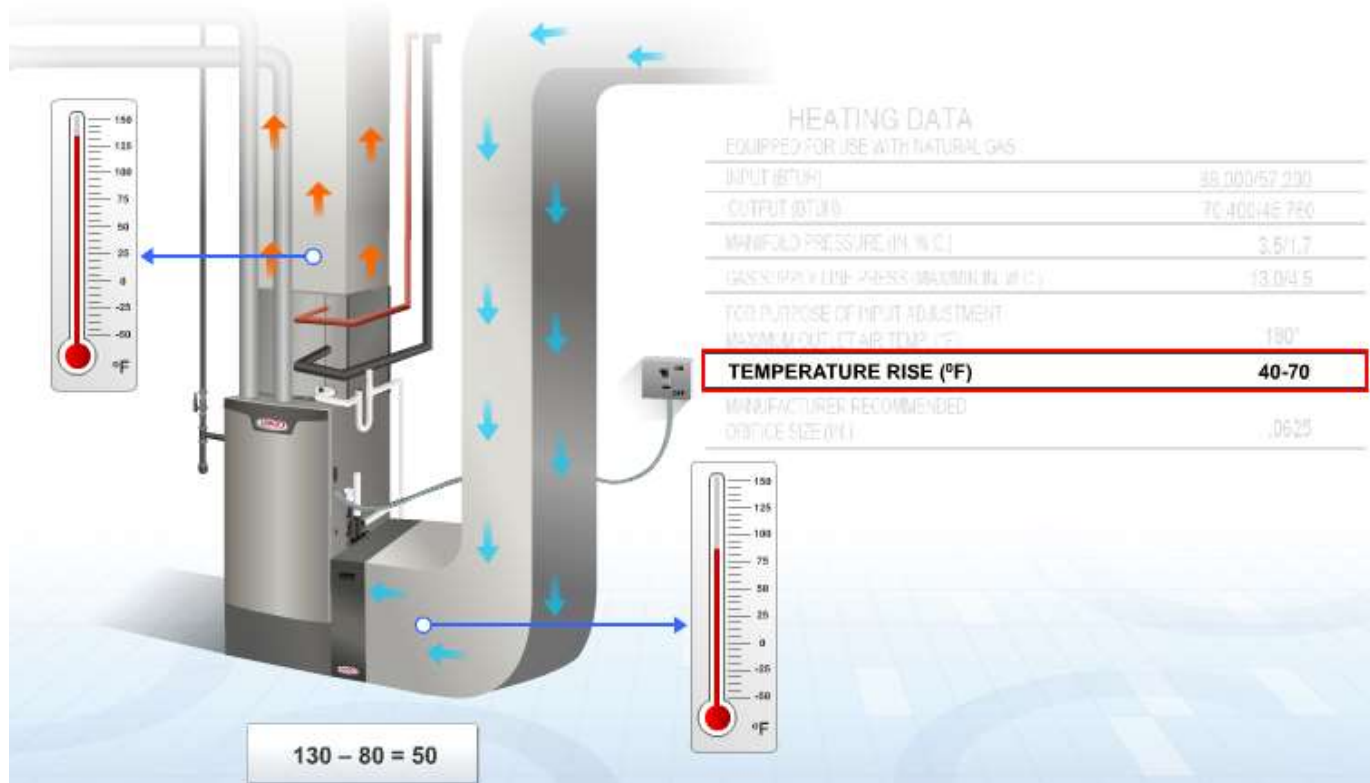


## Oversized gas orifices



# Temperature Rise Measurement

Starting the Furnace  
Measuring Temperature Rise



# Charging Methods

Charging  
Charging Methods

## Weigh In



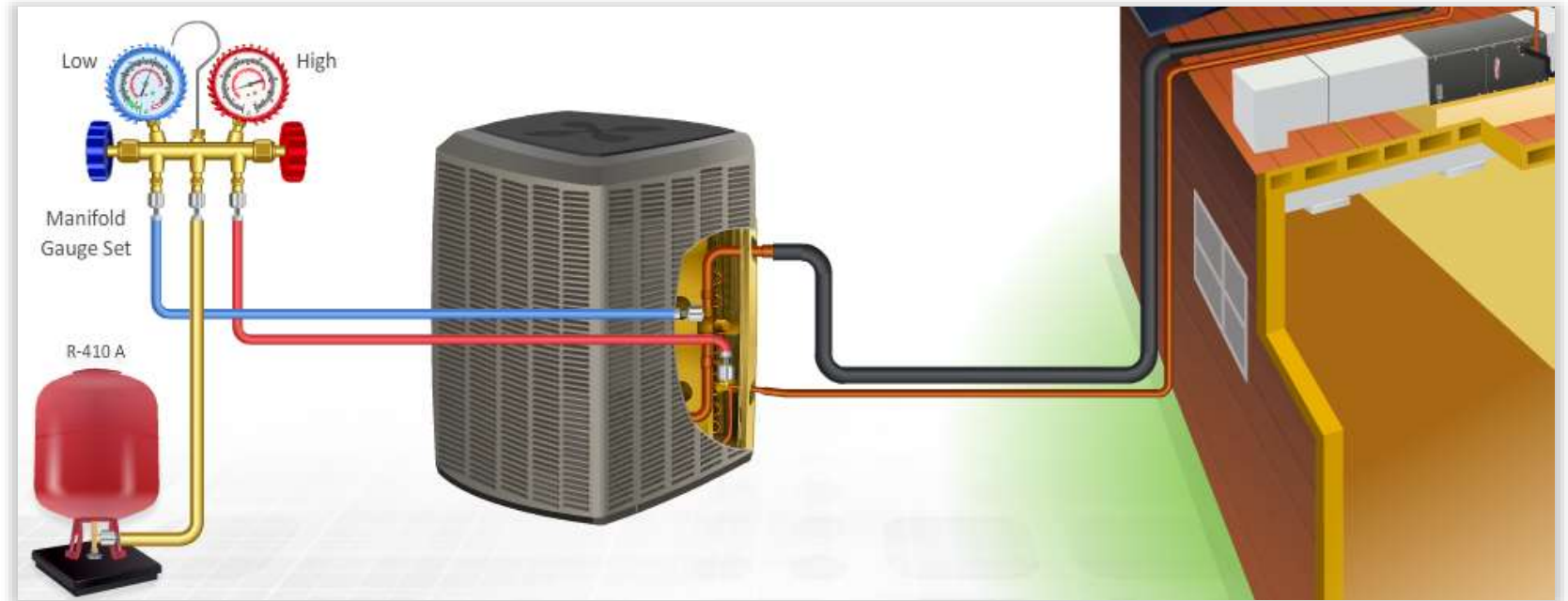
## Subcooling and Superheat



Temperature °F	°C	R22	R407C		R410A
			Liquid Press	Vapor Press	
-40	-40.0	0.5	3.0	4.4	11.6
-35	-37.2	2.6	5.4	0.6	14.9
-30	-34.4	4.9	8.0	1.8	18.5
-25	-31.7	7.4	10.9	4.1	22.5
-20	-28.9	10.1	14.1	6.6	26.9
-15	-26.1	13.2	17.6	9.4	31.7
-10	-23.3	16.5	21.3	12.5	36.8
-5	-20.6	20.1	25.4	15.9	42.5
0	-17.8	24.0	29.9	19.6	48.6
5	-15.0	28.2	34.7	23.6	55.2
10	-12.2	32.8	39.9	28.0	62.3
15	-9.4	37.7	45.6	32.8	70.0
20	-6.7	43.0	51.6	38.0	78.3
25	-3.9	48.8	58.2	43.6	87.3
30	-1.1	54.9	65.2	49.6	96.8
35	1.7	61.5	72.6	56.1	107
40	4.4	68.5	80.7	63.1	118
45	7.2	76.0	89.2	70.6	130
50	10.0	84.0	98.3	78.7	142
55	12.8	92.6	108	87.3	155
60	15.6	102	118	96.8	170
65	18.3	111	129	106	185
70	21.1	121	141	117	201
75	23.9	132	153	128	217
80	26.7	144	166	140	235
85	29.4	156	180	153	254
90	32.2	168	195	166	274
95	35.0	182	210	181	295
100	37.8	196	226	196	317
105	40.6	211	243	211	340
110	43.3	226	261	229	365
115	46.1	243	280	247	391
120	48.9	260	300	266	418
125	51.7	278	321	286	446
130	54.4	297	342	307	476
135	57.2	317	365	329	507
140	60.0	337	389	353	539
145	62.8	359	-	-	573
150	65.6	382	-	-	608

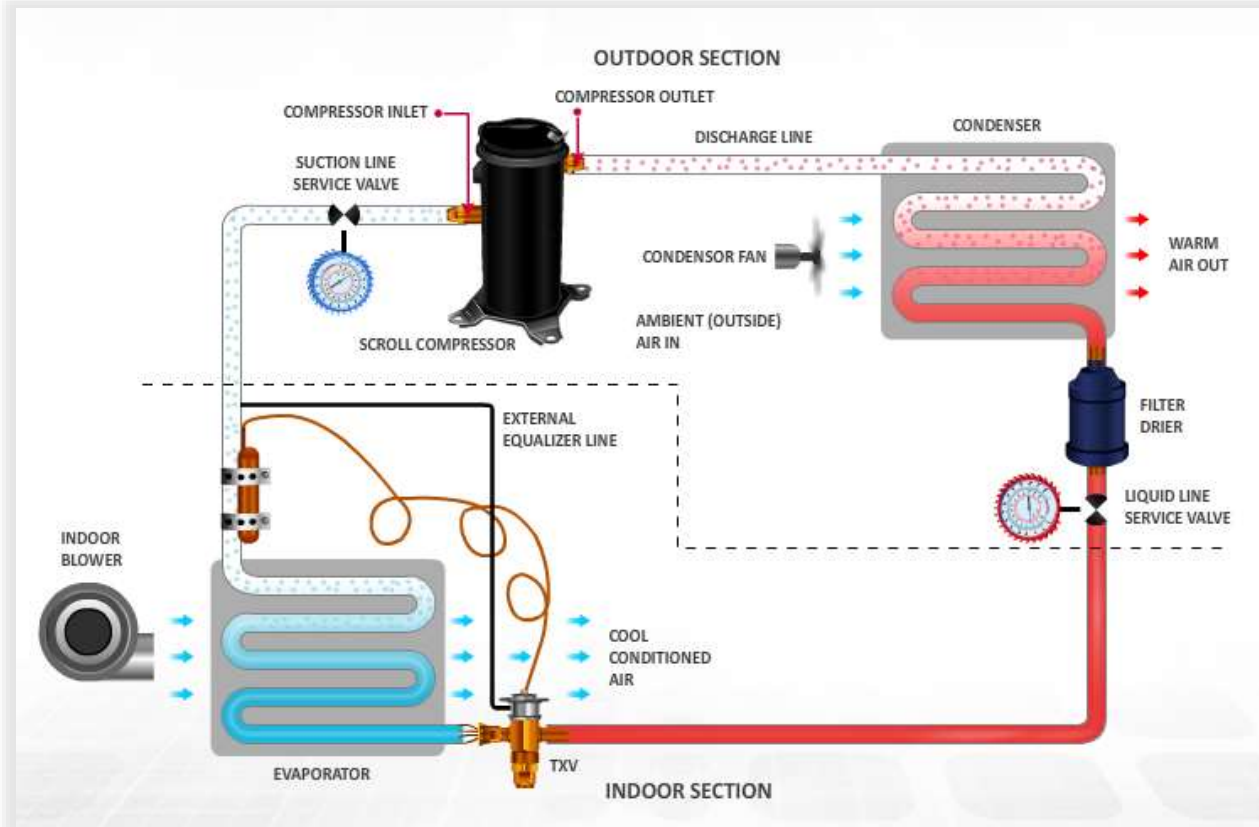
# Weigh in Charge

Charging  
Weigh In Charge Calculation



# Subcooling & Superheat Charging Method

Charging  
Subcooling



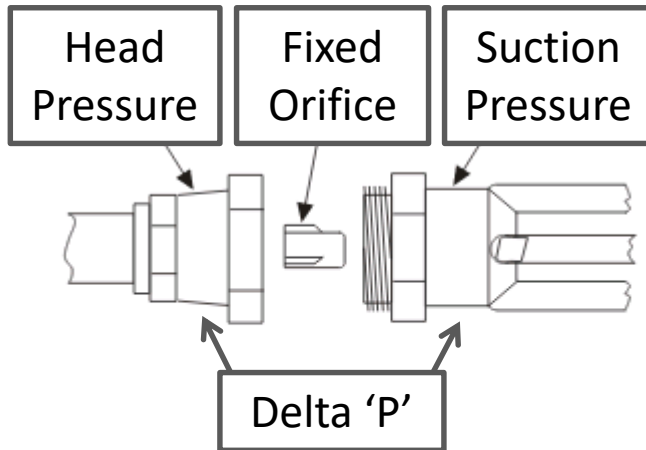
Temperature °F	°C	R407C		
		R22	Liquid Press	Vapor Press
-40	-40.0	0.5	3.0	4.4
-35	-37.2	2.6	5.4	0.6
-30	-34.4	4.9	8.0	1.8
-25	-31.7	7.4	10.9	4.1
-20	-28.9	10.1	14.1	6.6
-15	-26.1	13.2	17.6	9.4
-10	-23.3	16.5	21.3	12.5
-5	-20.6	20.1	25.4	15.9
0	-17.8	24.0	29.9	19.6
5	-15.0	28.2	34.7	23.6
10	-12.2	32.8	39.9	28.0
15	-9.4	37.7	45.6	32.8
20	-6.7	43.0	51.6	38.0
25	-3.9	48.8	58.2	43.6
30	-1.1	54.9	65.2	49.6
35	1.7	61.5	72.6	56.1
40	4.4	68.5	80.7	63.1
45	7.2	76.0	89.2	70.6
50	10.0	84.0	98.3	78.7
55	12.8	92.6	108	87.3
60	15.6	102	118	96.8
65	18.3	111	129	106
70	21.1	121	141	117
75	23.9	132	153	128
80	26.7	144	166	140
85	29.4	156	180	153
90	32.2	168	195	166
95	35.0	182	210	181
100	37.8	196	226	196
105	40.6	211	243	211
110	43.3	226	261	229
115	46.1	243	280	247
120	48.9	260	300	266
125	51.7	278	321	286
130	54.4	297	342	307
135	57.2	317	365	329
140	60.0	337	389	353
145	62.8	359	-	-
150	65.6	382	-	-



# Superheat Calculation - RFC

- Outdoor Dry Bulb
- Indoor Wet Bulb

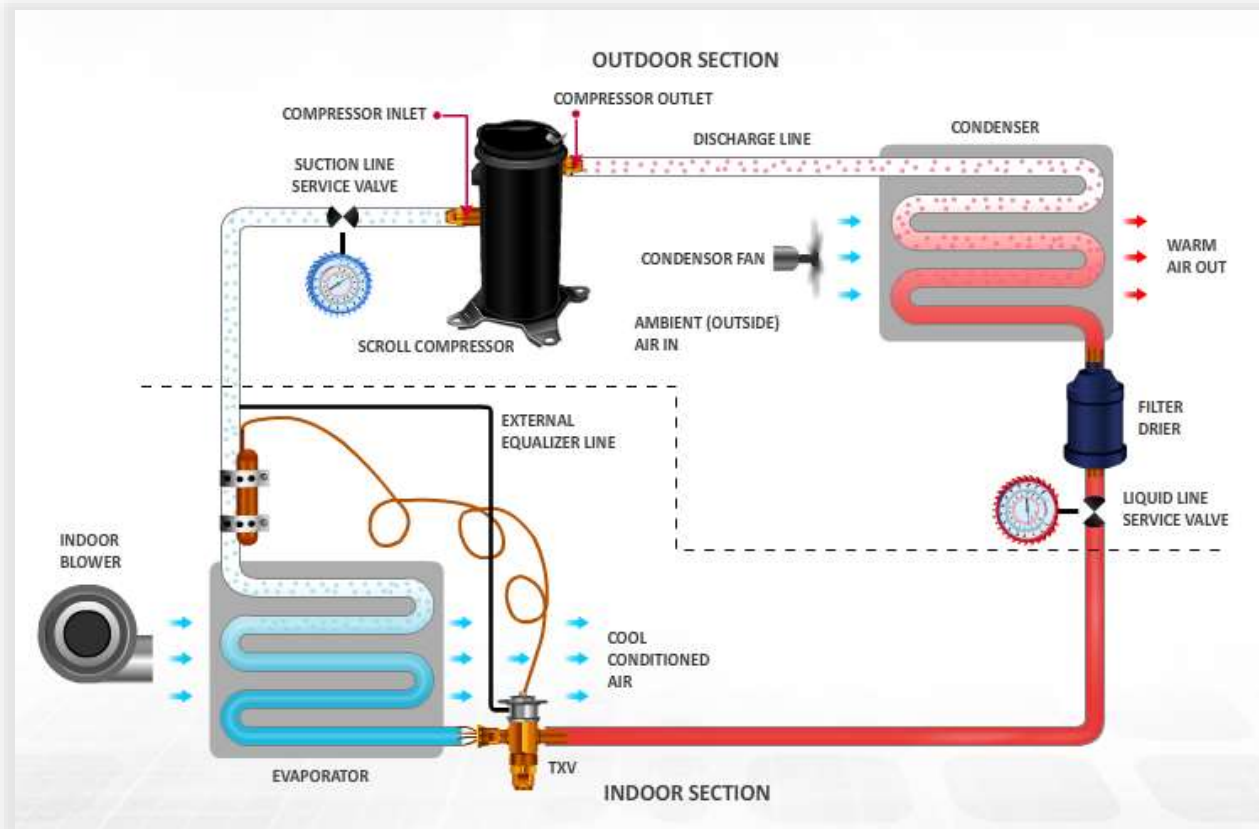
Dry bulb temperature of ambient air entering outdoor unit (°F)



40	15	18	20	23	26	29	32	34	38	41	43	46	48	51
45	13	16	18	21	24	27	30	33	36	39	41	44	46	49
50	11	14	16	19	22	25	28	31	34	37	39	42	44	47
55	9	12	14	17	20	23	27	29	33	36	38	40	42	44
66	7	10	12	15	18	21	24	27	30	33	35	38	40	43
65	-	6	10	13	16	19	21	24	27	30	33	36	38	41
70	-	-	7	10	13	16	19	21	24	27	30	33	36	39
75	-	-	-	6	9	12	15	18	21	24	28	31	34	37
80	-	-	-	-	5	8	12	15	18	21	25	28	31	35
85	-	-	-	-	-	-	8	11	15	19	22	26	30	33
90	-	-	-	-	-	-	5	9	13	16	20	24	27	31
95	-	-	-	-	-	-	-	6	10	14	18	22	25	29
100	-	-	-	-	-	-	-	-	8	12	16	21	24	28
105	-	-	-	-	-	-	-	-	5	9	13	17	22	26
110	-	-	-	-	-	-	-	-	-	6	11	15	20	25
115	-	-	-	-	-	-	-	-	-	-	8	14	18	24
°F	50	52	54	56	58	60	62	64	66	68	70	72	74	76
	[ Wet bulb temperature of air entering indoor coil ]													

# Superheat - RFC

Charging  
Superheat Calculation



Head  
Pressure

Super  
Heat



# Installation Check List

14ACX Start-Up and Performance Checklist	
Customer _____	Address _____
Indoor Unit Model _____	Serial _____
Outdoor Unit Model _____	Serial _____
Notes: _____	
<b>START UP CHECKS</b>	
Refrigerant Type: _____	
Rated Load Amps: _____	Actual Amps _____ Rated Volts _____ Actual Volts _____
Condenser Fan Full Load Amps _____	Actual Amps: _____
<b>COOLING MODE</b>	
Suction Pressure: _____	Liquid Pressure: _____
Supply Air Temperature: _____	Ambient Temperature: _____ Return Air Temperature: _____
System Refrigerant Charge (Refer to manufacturer's information on unit or installation instructions for required subcooling and approach temperatures.)	
Subcooling:	A — B = SUBCOOLING
Saturated Condensing Temperature (A) minus Liquid Line Temperature (B)	
Approach:	A — B = APPROACH
Liquid Line Temperature (A) minus Outdoor Air Temperature (B)	
Indoor Coil Temperature Drop (18 to 22°F)	A — B = COIL TEMP DROP
Return Air Temperature (A) minus Supply Air Temperature (B)	





The image features the LENNOX logo in a dark red color, set against a lighter red background. The logo consists of the word "LENNOX" in a bold, italicized, sans-serif font, enclosed within a dark red oval shape. A registered trademark symbol (®) is located at the bottom right of the oval.

***LENNOX***

**Automated Start Up**

# Technologies Available

- ✓ Voltage measurement
- ✓ Air flow measurement
- ✓ Gas pressure measurement
- ✓ Combustion measurement
- ✓ Temperature rise measurement
- ✓ Refrigerant temperature & pressure measurement
- ✓ Communicating controls
- ✓ Cloud connectivity



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***LENNOX***

Monitoring Operation

# Available Technologies

- Self Monitoring by Homeowner
  - Thermostat alerts or reports
  - Smart phones alerts or reports via Wi-Fi thermostat
  - Email alerts or reports via Wi-Fi thermostat
  - Alerts or reports via Home Automation System
  
- Professional Monitoring by Dealer
  - Include in homeowner alerts
  - Web portal





Systems Today

# Lennox Example

  
So simple. So smart. So comfortable.









Intelligent comfort backed by professional service



# Information for the Homeowner



Intuitive User Interface

 4 Alerts	 0 Warnings	 2 Reminders
<input type="checkbox"/> Show Cleared Alerts		
Time ▼	Code/Description	Status 
03/10/2015 12:06:00	replace humidifier pad	
03/10/2015 12:06:00	replace filter 2	

Know When Their System Needs Service



# Installation Report

## Installation Report

### Overview

#### Dealer Information

Dealer Name Crawford Services Inc  
Email <http://www.lennoxdealer.com/>  
Phone 12142718800  
Website <http://www.crawford-services.com>  
Country US  
Address 999 Regal Row  
Dallas, TX 75247-4402

#### Customer Information

First Name John  
Last Name Whinery  
Email [john.whinery@lennoxintl.com](mailto:john.whinery@lennoxintl.com)  
Phone 214-675-0552

#### System Information

Home Name Peaceful Cove  
5109 Peaceful Cv  
Flower Mound, Texas  
75022  
System Name system  
Thermostat Model Number iComfort S30  
Thermostat Serial Number GD15E00095

#### Installation Date

Date 02/05/2016  
Time 5:08 am  
Outdoor Temperature 77 °F  
Indoor Temperature --  
Indoor Humidity --

#### Equipment

	Model Number	Serial Number	Firmware
Thermostat	iComfort S30	GD15E00095	3.1.178
System	12X98000000000	WL15E3001600	03.02.0393
Air Conditioner	XC21-060-230-11	5814M01980	2.6
Furnace	SLP98UH090XV60C-06	5914B18956	1.31
Zoning Controller (zone 1 to 4)	103916-01	CC15D00521	01.00.0179

## Installation Report

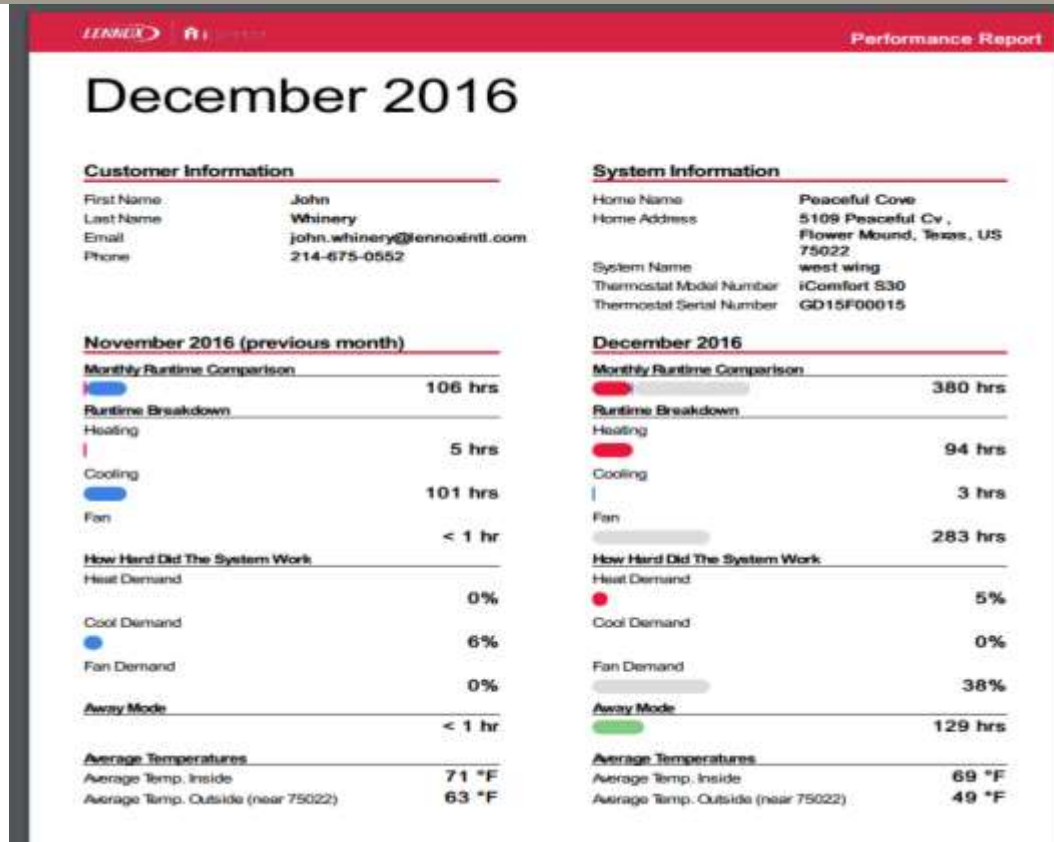
### System

#### System

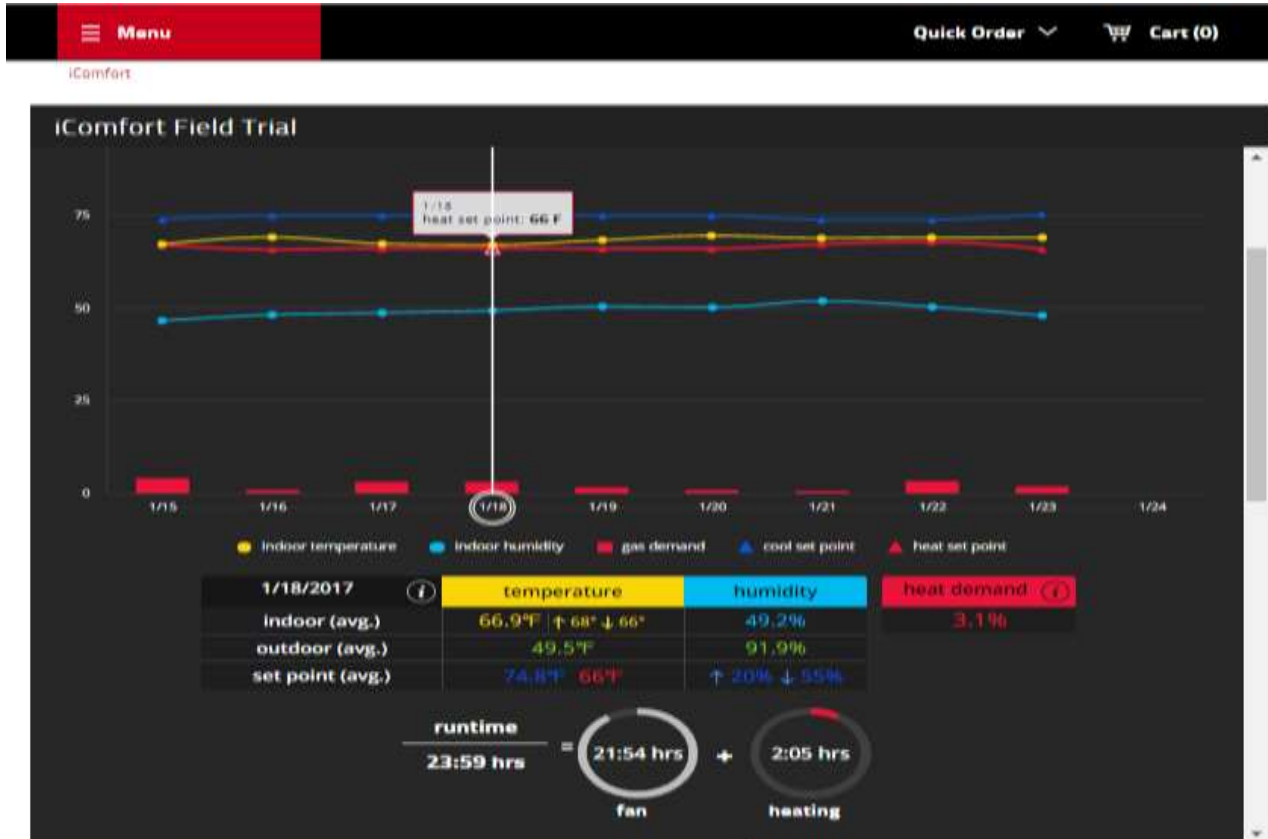
name	System
model number	12X98000000000
serial number	WL15E3001600
software version	03.02.0393
Equipment Name	Subnet Controller
Temp Reading Calibration	0 F
Humidity Reading Calibration	0 %
Min Dehumidification Setpoint	40 %
Smooth Setback Recovery	Enabled
Gas Heat Control Mode	Load Tracking Variable Capacity
Modulating Gas Heating Steady State PI Gain	Standard
Modulating Gas Heating Step Change PI Gain	Standard
Modulating Gas Heating Cycles Per Hour	6
Cooling Mode	Comfort
Comfort Cooling - Minimum Stage Runtime	180 sec
Modulating Cooling Steady State PI Gain	Standard
Modulating Cooling Step Change PI Gain	Standard
Modulating Cooling Cycles Per Hour	4
Temperature Control Mode	Comfort
Wall Insulation	Average



# Homeowner Monthly Performance Report



# Homeowner Web Portal – Daily Performance Report



# Homeowner Web Portal – Hourly Performance Report



# Dealer Web Portal Dashboard

The dashboard features the LennoxPROs logo and a search bar at the top. A navigation bar includes a menu icon, 'Quick Order', and 'Cart (0)'. The main section is titled 'iComfort' and contains several key metrics and data tables.

### iComfort Customers at a Glance

**All Status Updates**

5 Alerts	5 Warnings	2 Reminders
5 No Issues	14 No Internet	27 No Sharing

**Key Metrics:**

- 80 Total iComforts** (90 iComfort 900 / 10 iComfort 530)
- 205 Truck Rolls Avoided**

**Tools:** iCOMFORT DEMO TOOLS, RECOMMENDED ROUTERS

**Search Home Owner's Name:** Home Owner's Name | in: Name, equipment, serial number

Full Name	Address	Status
Aaron Mathews	2805 Matlock Ln Plano TX US	▲
ajfd adf	4634 us9 plano CA US	▲
Anusika Chatterjee	43 Judney AK US	▲
ashwin upposi	2202 Thornbury Lane Allen TX US	▲
Bobby DeFulgencis	1001 Whittier Ln Prosper TX US	▲
Bruce Grude	918 S Brookside Dr Dallas Texas US	▲
Carlie Morgan	6342 beetle dr Watauga TX US	▲
Chandrasekhar Rukmani	1904 Moorpark Dr Plano AK US	▲

**Customer Map:** A map showing the geographic distribution of iComfort customers with various status icons overlaid on the map.



