

CLEAResult[®]

Mini-Split (MS) Check

David Parker, NEHVAC Program

June 18, 2019



MS CHECK

A Test Procedure to Verify Proper Charge and Amperage

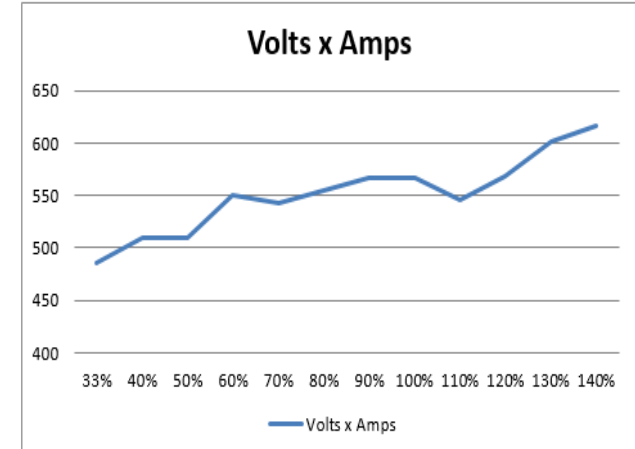
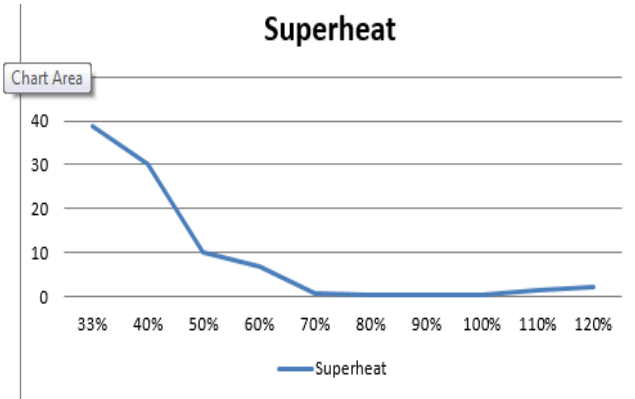
A Cooling Mode Diagnostic Procedure for MSHPs
Developed and Tested over 4 years

Uses Superheat and Amps to Determine

- Proper Charge
- Under Charge
- Over Charge
- Poor Evacuation

Lab Test Data

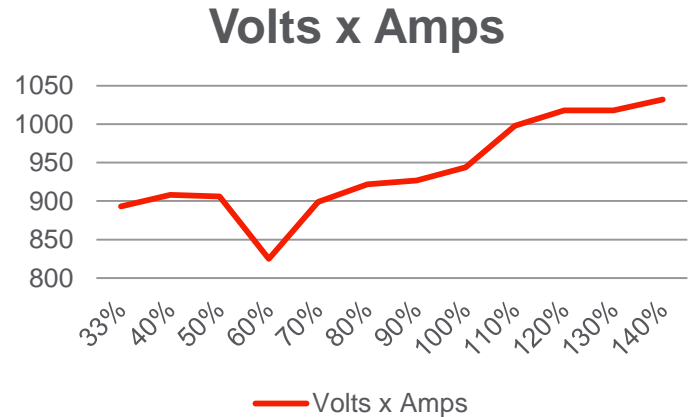
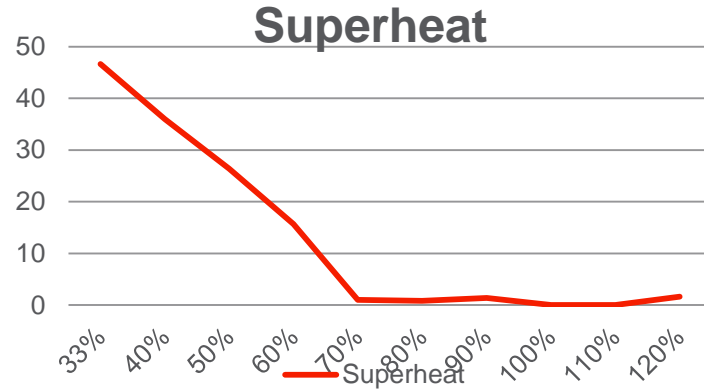
- Mitsubishi FH09
- MEA Training Center Southborough, MA
- November 24-25, 2014



Lab Test Data

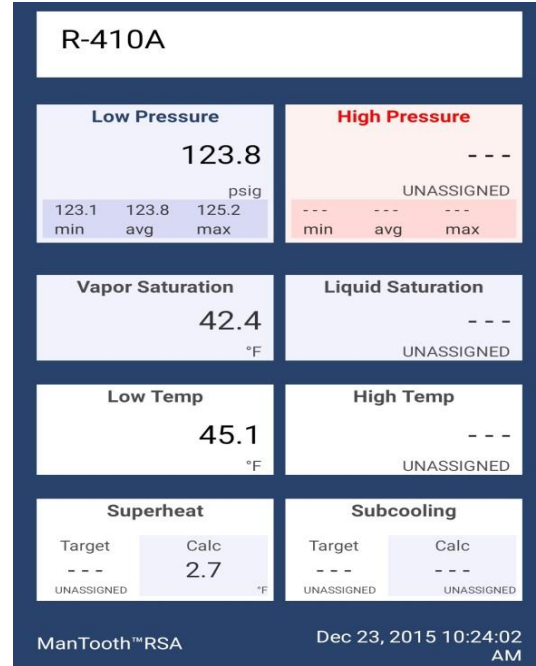
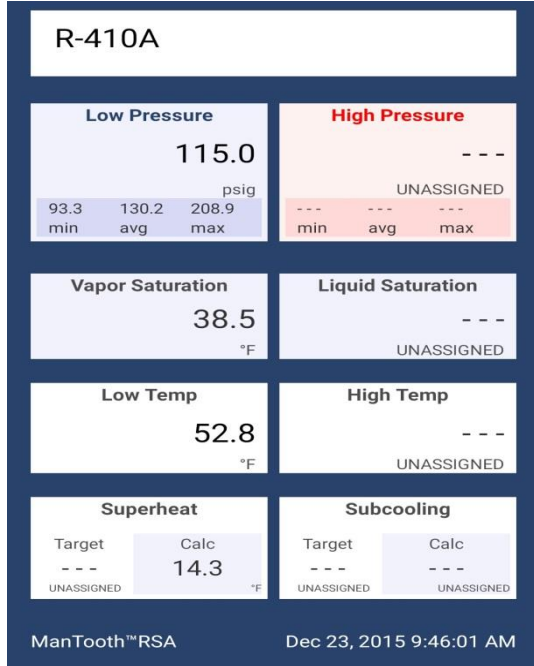
- Daikin RXS15LVJU
- Tested at FW Webb, Woburn MA
- December 9, 2014

Training system (on stand) with short line set, one anomaly in power measurement, otherwise consistent with Mitsubishi test results



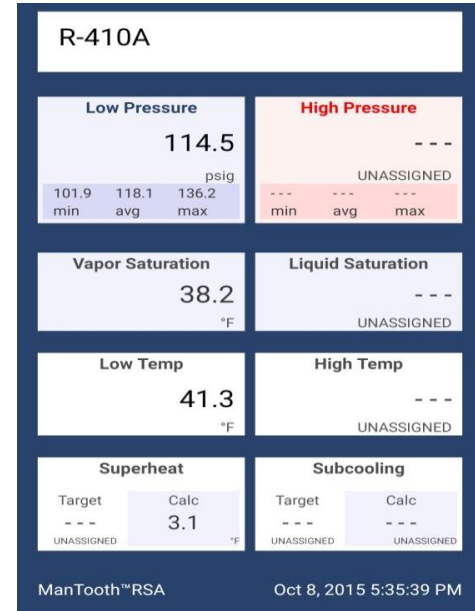
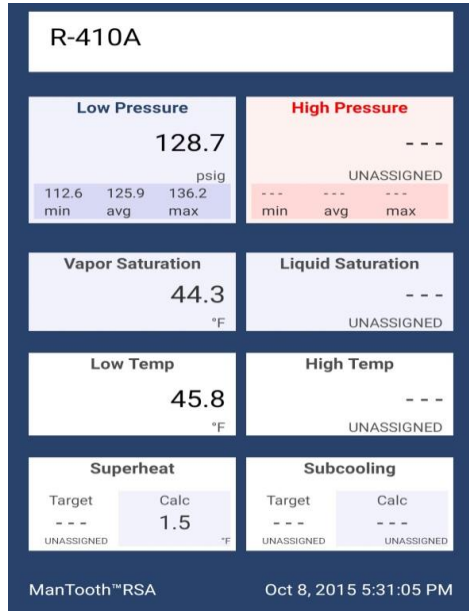
Undercharged MSHPs

- SH > 5F
- Note the time stamps in bottom right



Overcharged MSHP

- EEV “Hunts” until 8 oz removed, as tech “dumped his hoses” into system
- Note the time stamps in bottom right
- Proper charge reduced power from 8.1 amps to 6.8 amps



MS Check Diagnostic Matrix

<u>Status</u>	<u>Superheat</u>	<u>Amps</u> <u>(% of AHRI)</u>	<u>Typical Causes</u>
Correctly Installed	< 5 degrees F	< =110%	Correct installation
Undercharged	> 5 F (often >10)	N/A	Leaky flare connection No charge adjustment made
Overcharged	Fluctuating, 5-10F	> 110%	Too much refrigerant added
Line set contamination	Approx. 5F	> 110%	Incorrect vacuum applied/ moisture in line

Amperage from published AHRI rated conditions of
95/80/67F at 230 volts

MS Check

Installation Error or Operation Error?

2015 MSHP Inspection in Somerville MA

- Dual Zone Multihead MSHP installed by OEM certified contractor
- Customer is MIT technician & measured power at panel, **2000 watts** is too high
- MS Check trained tech observes SH bouncing, advises to remove and weigh
- He recovers 5 ½ # of overcharge!!
- **When correct charge installed**, drops from 2000 watts to 800 watts = **60% Savings**
- This is the **same savings as eliminating Night Setback (57%)** in Net Zero home

***MS Check* can diagnose Installation OR Operation error**

MS Check

Night Setback & Inverter MSHPs

Net Zero Housing Complex MSHP Installation, Easthampton MA

- Temperature setbacks (on/off operation)...
 - One homeowner complained of temperature unevenness
 - When the data were examined, it was clear that they operated their MSHP in an “on-off” manner rather than using a fixed set point.
 - This resulted in wide swings in interior temperature (between 60° F and 70° F+).
 - The electricity use showed many hours with the MSHP running at maximum capacity (~2000 W), followed by periods with the unit shut off.
 - Electricity consumption was by far the worst among all monitored houses; when compared with simulations, it was the worst-performing house
 - Heating use “57% higher than simulation.”

Ueno and Loomis, 2015 DOE-Building Science Corporation; Long Term Monitoring of Ductless MSHP in Northeast

Long-Term Monitoring of Mini-Split Ductless Heat Pumps in the Northeast

K. Ueno and H. Loomis
Building Science Corporation

November 2014

One homeowner complained of temperature unevenness; when the data were examined, it was clear that they operated their MSHP in an “on-off” manner, rather than using a fixed set point. This resulted in wide swings in interior temperature (between 60° F and 70° F+). The electricity use showed many hours with the MSHP running at maximum capacity, followed by periods with the unit shut off. When operated in this manner, the MSHP is heating at its least efficient (maximum output) state. Electricity consumption was a high consumption outlier; when compared with simulations, it was the worst-performing house (heating use 57% higher than simulation).

Multi Head MSHP Evaluation

LG 4 ton/5 zone MSHP RST Thermal, Westwood MA, 4.4.17

- Installed/Attached Capacity = 51,000 BTUh
- Rated BTU (from Engineering tables) = 49,241 BTUh
- Rated EER as Configured = 10.5 EER
- BTU / EER = Watts = 4,950 Watts
- Watts / 230 volts (AHRI) = 20.4 Amps
- Training Room Temp. = 71F
- Expected Amps = 14.5 A = 71% of 20.4 Amps
- Measured Amps OEM iPad = 12.5 Amps
- Measured Amps Multimeter = 13.6 Amps
- Measured Superheat = 3.1F
- **Passing Goal <5F Superheat and <110% AHRI Amps**

MSHP Evaluation - Existing System (2016)

Mitsubishi MUZ-GE18NA MSHP, Hudson MA, 2.22.18

- Installed/Attached Capacity = 17,200 BTUh (for specs...)
- Rated EER as Configured = 10.5 EER (ask Google)
- BTUh / EER = Watts = 1,638 Watts
- Watts / 230 volts (AHRI) = 7.1 Amps
- Training Room Temp. = 79F
- Expected Amps = 5.6 A = 79% of 7.1 Amps
- Measured Amps UEI meter = 5.3 Amps
- Measured Amps F/P meter = 5.8 Amps
- Measured Superheat = 4.3F
- Passing Goal <5F Superheat and <110% AHRI Amps