

**A Result Demonstration in Residential Air Conditioning Servicing**

**Sponsored by**

**Louisiana Cooperative Extensive Service  
LSU Agriculture Center  
and  
Gulf States Utility Company**

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### **A Result Demonstration in Residential Air Conditioning Servicing**

Preventative maintenance of residential air conditioning units is known to restore performance capacity, improve comfort and has been thought for years to lower utility costs. Extensive search of air conditioning manufacturers, service personnel, university research and trade associations failed to provide information on the magnitude of restoration of Btu capacity, whether it was latent or sensible heat, how much comfort was improved, or to what extent if any utility bills could be lowered. Several trade articles dealt with the increase of energy consumption from dirty condenser coils. Some of these articles indicated that head pressures were increased from 50 – 100 psi because of dirty condenser coils, thereby increasing energy consumption by the compressor by 10 – 20% to overcome these pressures. Likewise airflow across the evaporator coil was restricted by dirty filters, dirty blower wheels, and with time dirty evaporator coils themselves, to reduce heat transfer to the coil.

This prompted personnel from the Louisiana Cooperative Extension Service to develop an air conditioning maintenance demonstration that would illustrate what would happen to the head pressures and amp draw when the condenser coils or evaporator coils were partially blocked. These demonstrations showed that energy consumption could be increased 30 – 40% for the same amount of cooling when the coils were artificially blocked. This demonstration, however, did not answer the ultimate question of the consumer. “How much can I save with preventative maintenance?”

The homes were selected by personnel from the Cooperative Extension Service and Gulf States Utilities Company. The following homes were selected.

Home #1 – 1211 Rue Crozat. Unit was thought to perform satisfactory, but cycled too frequently.

Home #2 – 1528 Louray. Heat Pump. No complaint, thought to be in average condition.

Home #3 – 549 Rodney Drive. No complaint. Unit thought to be in above average condition. Was serviced less than a month before evaluation.

Home #4 – 563 Rodney Drive. Unit ran a lot and was selected because of a known dirty condenser coil.

Home #5 – 640 Broadmoor Avenue. Was selected because of excessive complaints of poor performance. Unit had been serviced 2 – 3 times before evaluation with no results. It was known to be in very poor condition.

## **SERVICES PERFORMED**

The following services were performed at all 5 residences.

1. Condenser coils chemically cleaned.
2. Evaporator coils chemically cleaned.
3. Filters cleaned or replaced.
4. Blower wheels cleaned.
5. Freon charged to factory specifications.
6. Inspected for return air leak.
7. Inspected and stopped duct leaks at the plenum chamber and return air.

## **METHODOLOGY**

Homeowners were asked to set their thermostats at a comfortable level and leave it unchanged for the duration of the evaluation. In addition they were asked to operate their homes in the usual manner. If parties and other activities that were planned that would increase energy consumption, they were to advise the investigators so that the evaluation period would avoid these times.

The technique used for the evaluation was to evaluate a home for a 24-hour period with outdoor conditions of 88 – 92 °F. On the second day the unit would be serviced and on the third day a second 24-hour evaluation would take place. In the event of rain or heavy cloud cover, the second evaluation would be delayed until a similar day was available for the follow-up evaluation. The time of service was coordinated with the service professional on a time available basis.

## **DATA COLLECTION**

The following data was collected before and after service at each of the five residences.

1. Outside dry and wet bulb temperatures.
2. Inside dry and wet bulb temperatures.
3. Temperature at the return air grill, wet and dry bulb.

4. Temperature of the air discharged from the closest grill to the evaporator coil, both dry and wet bulb.
5. Air velocities at and cross sectional area of return grill-filters.
6. Dry bulb temperature increase across condenser coils.
7. Running time meter on compressor.
8. Cycle patterns.
9. Power consumption.

**TABLE 1**  
**RESULT DEMONSTRATION IN A/C SERVICING**  
**1121 Rue Crozat – 44,000 Btu A/C**

ITEM	BEFORE SERVICE	AFTER SERVICE	AFTER THERMOSTAT INSULATION
1. Inside Temperature °F	77	75	75
2. Inside RH %	57	58	55
3. Delta T Across Coil	15	17.9	17.9
4. Sensible Heat Flow	27,600	33,581	33,581
5. Capacity Restored Btu/hr	-	5,981	5,981
6. Cycles/24 hrs	83	78	44
7. Cycles Less Than 3 Min.	37	24	1.0
8. Running Time 2-6 P.M. hrs.	3.28	2.5	2.15
9. Running Time Saved 2-6 P.M. Hrs	-	.78	1.13
10. Running Time/24 hrs.	10.9	10.4	8.9
11. Estimated Kwh/24 hrs.	65.4	57.8	48.9
12. Amps -	26.0	24.0	24.0
13. Kwh Saved/24 hrs	-	7.6	16.5
14. Saving \$/24 hrs @ 8¢/Kwh	-	0.61	1.32
15. Saving \$/Month	-	18.24	39.60

**TABLE 2**  
**Result Demonstrations in A/C Servicing**  
**1528 Louray – Heat Pump – 48,000 Btu**

ITEM	BEFORE SERVICE	AFTER SERVICE*
1. Inside Temperature °F	75	69
2. Inside RH %	57	56
3. Delta T Across Evap. Coil °F	13.5	15
4. Sensible Heat Flow, Btu/hr	22,584	27,086
5. Latent Heat Flow, Btu/hr	6,530	8,754
6. Total Heat Flow, Btu/hr	29,114	35,840
7. Capacity Restored Btu/hr	-	6,725
8. Cycles/24 hrs	31	38
9. Running Time/24 hrs	15.25	15.2
10. Running Time 2-6 PM Hrs.	3.57	4.0
11. Running Time Saved 2-6 PM hrs	-	-
12. Kwh/24 hrs	97	84
13. Amps	27.5	24
14. Kwh Saved/24 hrs	-	13
15. Savings \$/24 hrs @ 8¢/Kwh	-	1.04
16. Savings \$/Month	-	31.20

\*3 Extra Youth in Household

**TABLE 3**  
**Result Demonstrations in A/C Servicing**  
**549 Rodney – 38,000 Btu A/C**

ITEM	BEFORE SERVICE*	AFTER SERVICE
1. Inside Temperature °F	80	76
2. Inside RH %	55	56
3. Delta T Across Evap. Coil °F	18	18
4. Sensible Heat Flow, Btu/hr	23,542	23,542
5. Latent Heat Flow, Btu/hr	6,588	11,529
6. Total Heat Flow, Btu/hr	30,129	35,701
7. Capacity Restored Btu/hr	-	4,942
8. Cycles/24 hrs	39	58
9. Running Time/24 hrs	8.5	7.75
10. Running Time 2-6 PM hrs	3.43	2.45
11. Running Time Saved 2-6 PM hrs	-	0.98
12. Kwh/24 hrs	48	44
13. Amps	23.9	23.3
14. Kwh Saved/24 hrs	-	4
15. Savings \$/24 hrs @ 8¢/Kwh	-	0.32
16. Savings \$/Month	-	9.60

**TABLE 4**  
**Result Demonstrations in A/C Servicing**  
**563 Rodney – 24,000 Btu A/C**

ITEM	BEFORE SERVICE*	AFTER SERVICE
1. Inside Temperature °F	72	72
2. Inside RH %	82	69
3. Delta T Across Evap. Coil °F	-	9
4. Sensible Heat Flow, Btu/hr	-	14,118
5. Latent Heat Flow, Btu/hr	-	5,926
6. Total Heat Flow, Btu/hr	-	20,044
7. Capacity Restored Btu/hr	-	-
8. Cycles/24 hrs	21	31
9. Running Time/24 hrs	21.4	18.5
10. Running Time 2-6 PM	4.0	4.0
11. Running Time Saved 2-6 PM hrs	-	-
12. Kwh/24 hrs	56.6	54
13. Amps	10	12.5
14. Kwh Saved/24 hrs	-	2.6
15. Savings \$/24 hrs @ 8¢/Kwh	-	0.21
16. Savings \$/Month	-	6.38

\*2 Air Leaks Between Air Handler and Coil

#1 - 1/4" x 18"

#2 - 1" x 12"

**TABLE 5**  
**Result Demonstrations in A/C Servicing**  
**640 Broadmoor Avenue\* – 43,000 A/C**

ITEM	BEFORE SERVICE*	AFTER SERVICE
1. Inside Temperature °F	80	75
2. Inside RH %	55	58
3. Delta T Across Evap. Coil °F	14	15
4. Sensible Heat Flow, Btu/hr	8,467	20,088
5. Latent Heat Flow, Btu/hr	11,424	20,237
6. Total Heat Flow, Btu/hr	19,891	40,325
7. Capacity Restored Btu/hr	-	20,434***
8. Cycles/24 hrs	1**	6
9. Running Time/24 hrs	23.3	20.5
10. Running Time 2-6 PM	4.0	4.0
11. Running Time Saved 2-6 PM hrs	-	-
12. Kwh/24 hrs	129	96.9
13. Amps	22	19.5
14. Kwh Saved/24 hrs	-	32.1
15. Savings \$/24 hrs @ 8¢/Kwh	-	2.57
16. Savings \$/Month	-	77.04

\* A/C Consumes 80% of Total Kwh

\*\* Manual – Let Machine Rest

\*\*\* Air Flow Increased 2.2 Times

### **RATING OF A/C COMPONENTS BY A SERVICE PROFESSIONAL**

All air conditioning systems were serviced by the same service professional. During the servicing period the service professional was asked to rate the condition of each component in each of the air conditioning systems serviced. This was a five-category rating indicated by the key words poor, fair, average, good and excellent. Graph 1 is a summation of this rating effort. Of all the components evaluated, a fair rating was the most prominent rating. The most prominent range was from poor to average. This information implies that if the 5 units evaluated are typical, then service would perhaps restore at least ½ to 1 ton or more air conditioning capacity through each central air conditioning unit.

### **DISCUSSION**

Air conditioning systems seemed capable of giving reasonable performance when their state of maintenance rated from fair to average. This is based upon the fact that as long as the home is comfortable, most residential occupants feel that the air conditioner is performing satisfactorily. This is especially true since the trade appears to have a tendency to oversize the system and then, if the family has made energy improvements such as additional insulation and installed storm windows, the air conditioning system can be performing below its capacity because of poor maintenance and maintain comfort while energy utilization increases.

As with most equipment, the maintenance of all components can influence the equipment's performance. However, there appears to be, in most cases, one to two components in "poor shape" that primarily limits the equipment's performance.

**GRAPH 1**

**CONDITION OF AIR CONDITIONING COMPONENTS  
EVALUATED BY SERVICE PROFESSIONAL**

COMPONENT	CONDITION				
	POOR	FAIR	AVERAGE	GOOD	EXCELLENT
CONDENSER	-----				
EVAPORATOR COIL		-----			
FILTER		-----			
BLOWER WHEEL	-----				
FREON CHARGE	-----				
CONTROLS			-----		
CONDENSATE SYSTEM	-----				
RETURN AIR LEAKS	-----				
DUCT LEAKS		-----			

**TABLE 6**

**Savings with A/C Service, \$/month (8¢/Kwh)**

DEMONSTRATION	AFTER SERVICE
#1 1211 Rue Crozat	\$39.60
#2 1528 Louray	31.20
#3 549 Rodney Drive	9.60
#4 563 Rodney Drive	9.38
#5 640 Broadmoor Ave.	77.04
Average	<u>32.76</u>

**TABLE 7**

**Capacity Restored (Btu/Hr)**

DEMONSTRATION	AFTER SERVICE
#1 1211 Rue Crozat	5,981
#2 1528 Louray	6,725
#3 549 Rodney Drive	4,942
#4 563 Rodney Drive	-----
#5 640 Broadmoor Ave.	20,434
Average	<u>9,520</u>

**TABLE 8**

**Running Time Reduction (Hrs/Day)**

DEMONSTRATION	AFTER SERVICE
#1 1211 Rue Crozat	2.0
#2 1528 Louray	0.05
#3 549 Rodney Drive	0.75
#4 563 Rodney Drive	2.90
#5 640 Broadmoor Ave.	2.80
Average	<u>1.70</u>

**TABLE 10**

**Kwh Saved/Day**

DEMONSTRATION	AFTER SERVICE
#1 1211 Rue Crozat	16.5
#2 1528 Louray	13.0
#3 549 Rodney Drive	4.0
#4 563 Rodney Drive	2.6
#5 640 Broadmoor Ave.	32.1
Average	<u>13.6</u>