BRONZ-GLOW
TEST STUDY 2

Cardinal Health Bolton

Energy savings on coil refurbishment
By Bronz-Glow UK Ltd

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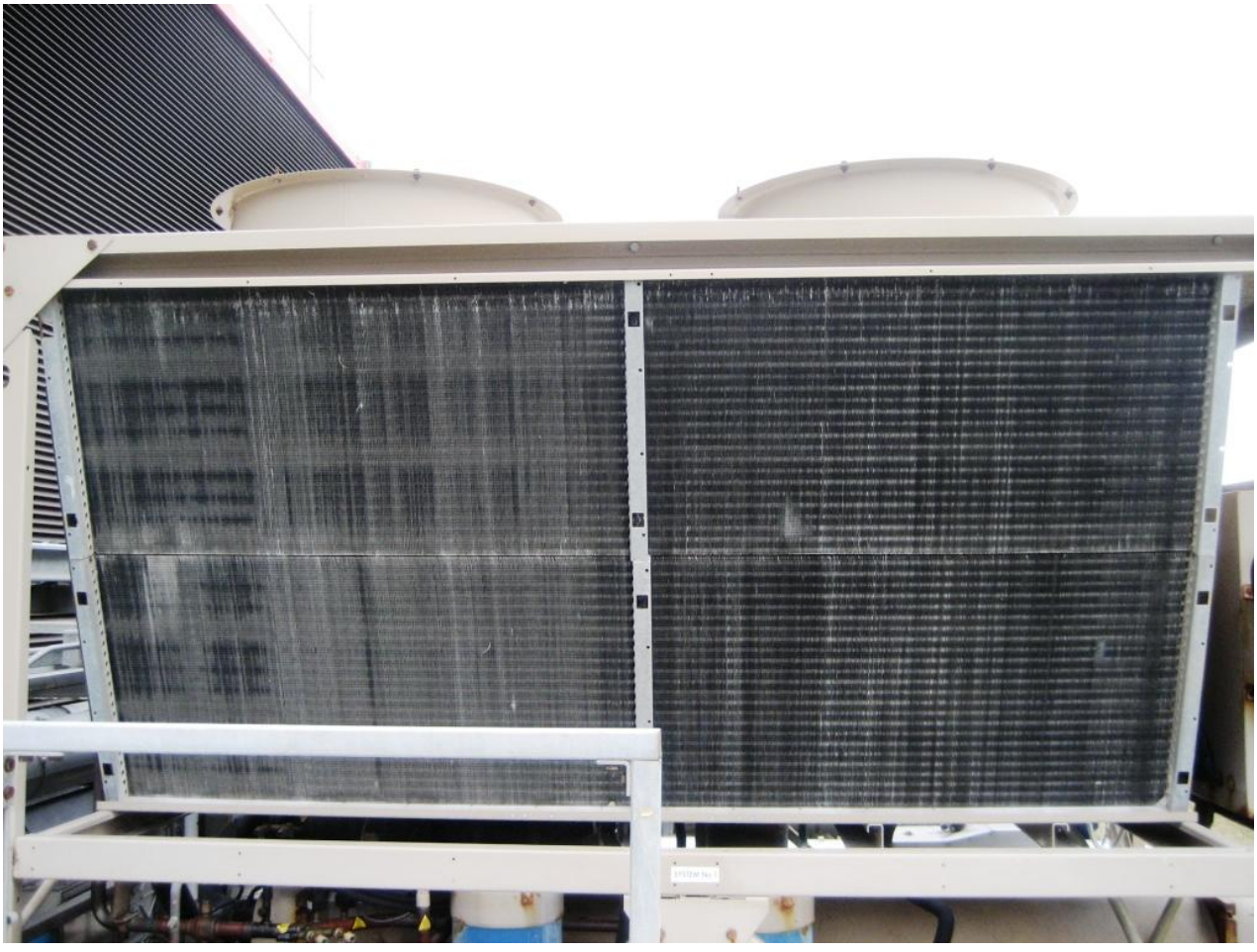

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1. Introduction

This case reviews the impact of an inland industrial atmosphere, The corrosion rate and increase of energy consumption of an air-cooled condenser (York chiller model).
A simple current draw reading (amps) before the coating process and after the coating process concluded an instant energy consumption decrease of 20%.

This study aims to present the enormous increase in energy efficiency when the condenser coils are protected and coated with *Bronz-Glow Coil Coat*. The immediate energy gains of a coil refurbishment of which results are concluded from actual current draw readings.

Engineering Data

The air sided heat exchanger performance depends on the pressure drop (DP) of the airflow through a coil and heat conductivity or K-value (DK) or heat exchange capacity of the coil. These two parameters together determine the actual performance compared to the nominal performance of the coil.

The K- Value and pressure drop are influenced by:

- The rate of galvanic corrosion (the rate at which the bi metallic coupling is dissolved due to the presence of an electrolyte like salt and water).
- Insulation factor of dust and dirt adhesion.
- Direct general deterioration of the heat exchange surface.
- Blocking of the airway due to corrosion and fouling.

For each 1 degree Celsius rise in discharge temp there is an increase in power consumption of 1.75%.

For each 1 degree Celsius rise in discharge temp there is a decrease in cooling capacity of 1.1%.

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2. Actual Situation

The York chiller is running 24 hours a day 6 days a week.

A York chiller was chosen for the test case because the cooling need was dependent on the capacity of the chiller and the energy consumption of this unit was extremely high. Also the deterioration of the condenser and dirt grade was high due to the rough corroded surface of the condenser coil.

The condenser coils are 4 row at 11 fpi.
The coils were situated in a W-shape configuration.

The coating was applied on site, situated on the roof. The fan covers were removed during cleaning and the blades were dismounted during coating to allow access from the top to the inside surfaces of the coil.
At no time were any electrical connections disturbed or the refrigerant circuit was compromised or affected in any way.

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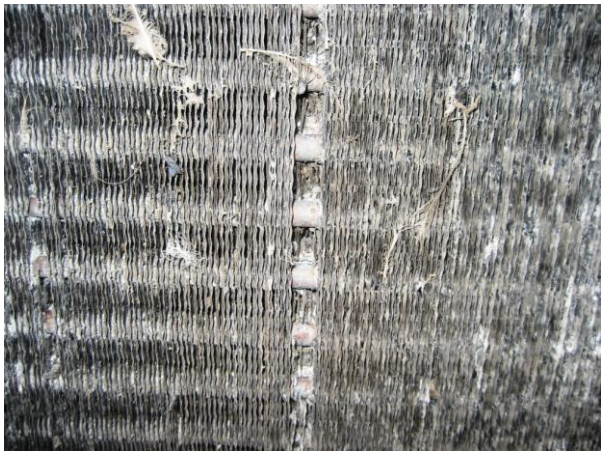
3. Instant Energy savings

The Chiller is separated in two sections. The sections were treated separately and the readings were also stated separately.



BEFORE TREATMENT

AFTER TREATMENT

System 1:

Results	Before Coating	After Coating
Compressor Amp draw	120 Amp	96 Amp
Suction pressure	4.96 bar	4.12 bar
Discharge pressure	18.1 bar	16.7 bar
Oil pressure	4.6 bar	4.4 bar
Oil temperature	44.2 ºC	43.2 ºC
Leaving water temperature	11.1 ºC	10.3 ºC
Return water temperature	14.3 ºC	13.7 ºC
Ambient temperature	18.1 ºC	18.5 ºC

System 2:

Results	Before Coating	After Coating
Compressor Amp draw	118 Amp	94 Amp
Suction pressure	4.98 bar	4.9 bar
Discharge pressure	17.4 bar	15.9 bar
Oil pressure	4.6 bar	4.3 bar
Oil temperature	43.6 ºC	42.9 ºC
Leaving water temperature	11.5 ºC	9.9 ºC
Return water temperature	14.5 ºC	13.1 ºC
Ambient temperature	18.1 ºC	18.6 ºC

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Taking only the current draw readings from the table we can see the immediate increase in efficiency of the condenser has led to approx 20% savings in electrical consumption. This calculation will not take into account additional energy savings made from increased cooling capacity due to lower discharge temperatures caused by increased heat exchange from the condenser.

Operating hours
24 hours run time per day, 6 days per week, 51 weeks per year. = 7344 hours run time per year per circuit.

Before coating system 1
At efficiency of 120 amps (average) = 94% of $FLA_{1)}$ = 66,74 kW x 7344 hours = 490,138 kWh per year at a rate of 8.8p per kWh = **£43,132** per year cost of electricity.

After coating system 1
At efficiency of 96 (average) = 76% of $FLA_{1)}$ = 53,96kW x 7344 hours = 396,282 kWh per year at a rate of 8.8p per kWh = **£34,873** per year cost of electricity.

Energy Savings system 1
£43,132 - £34,873 = **£8,259** per year cost of electricity.
The above figures reflect the running hours of one compressor for an average of 24 hours per day. It would be common to assume that the second compressor would run at 50% $FLC_{2)}$ which would amount up to:

Before coating system 2
At efficiency of 118 amps (average) = 93% of $FLA_{1)}$ = 65.97 kW x 7344 hours = 484,483 kWh per year.
At 50% of $FLC_{2)}$: 0.5 * 484,483 = 242,242 kWh
At a rate of 8.8p per kWh = **£21,317** per year cost of electricity.

After coating system 2
At efficiency of 94 amps (average) = 74% of $FLA_{1)}$ = 52.55kW x 7344 hours = 385,927 kWh per year.
At 50% of $FLC_{2)}$: 0.5 * 385,927 = 192,964 kWh
At a rate of 8.8p per kWh = **£16,981** per year cost of electricity.

Energy Savings system 2
£21,317– £16,981 = **£4,336** per year

Costs of coil replacement
Approx incl. Installation and commissioning (after 5 years): £ 18,948 in 5 years, so minimum of **£3,789** per year

Costs of treatment
Assume the price for treatment was approx £2,600, so over 5 years **£432** per year.

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Total yearly Savings = Savings system 1 + Savings system 2 + coil replacement costs

= £8,259 + £4,336 + £3,789 - £432 = £15,952

FLA1) : Compressor Full Load Amps, % nominal amps 127 amps / 71 kW,
max 150 amps / 85 kW.

FLC2) : Compressor Full Load Current, % compressor amp draw before and after treatment.

** : Average costs of electricity economy day rate*

*** : Based on prices in Uk*

****** :** Ask for a quotation at Bronz-Glow Uk Ltd for correct prices.*

CONCLUSION

The payback time of a Bronz-Glow Refurbishment
is less than 3 months with this unit in the state of deterioration.

This illustrates the potential savings of the Bronz-Glow Coating very clearly and if we look further at these numbers over a five year period (average life expectancy for a coil) the numbers are astronomical.