CELEBRATING 30 YEARS OF ENERGY SAVINGS

Polarized Refrigerant Oil Additive (PROA)

FRIGI-TECH

For Air Conditioning and Refrigeration Compressors

PROA Technology for Energy Saving improvement

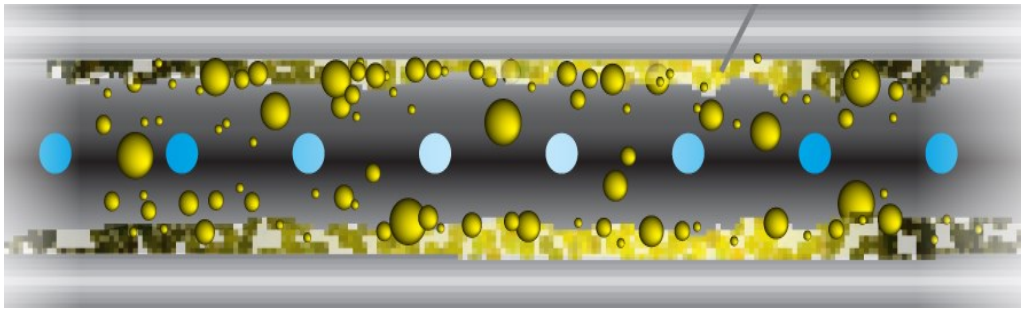
Frigi-Tech™

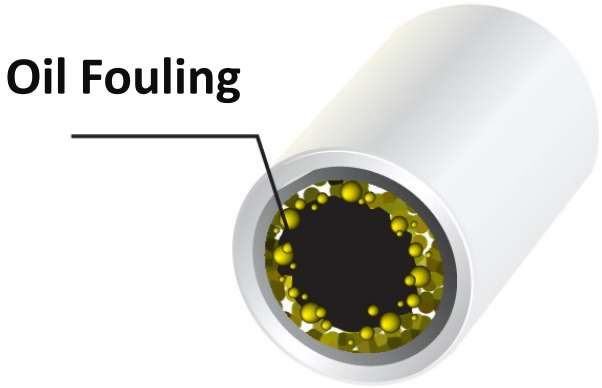
Polarized Refrigerant Oil supplement

Main Benefits Outlook
Eliminates Oil Fouling From Refrigerant Lines , Restoring Heat Exchanging
Reduces Friction of moving Compressor parts during operation as well as start-up
Increases Cooling Capacity
Saving Energy by Reducing Compressor Run Time
Quiets the decibel of Compressor noise during operation.
Extending Life of Parts, Bearings and Seals , relief from Service issues.
Only One Treatment necessary

Oil Fouling Problem in Refrigeration Systems

Effects on Heat Transfer Losses





Oil fouling that impedes HVAC system operation and makes compressors work harder, causing higher kw usage.

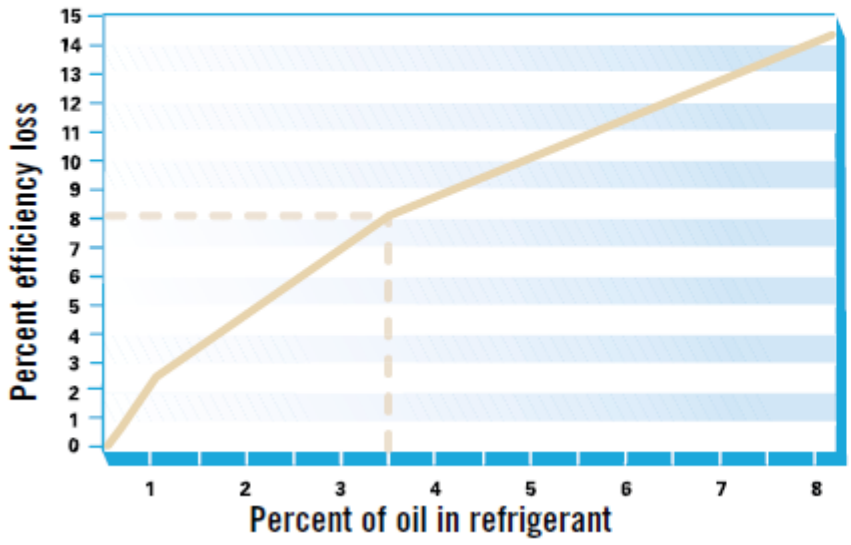
- 7% Loss after the 1st Year
- 5% after the 2nd Year
- 2% each additional Year

Usually the efficiency degradation will peak between 20 % - 30% *(ASHARE Handbook published)*

High Cost of Chiller Oil Fouling

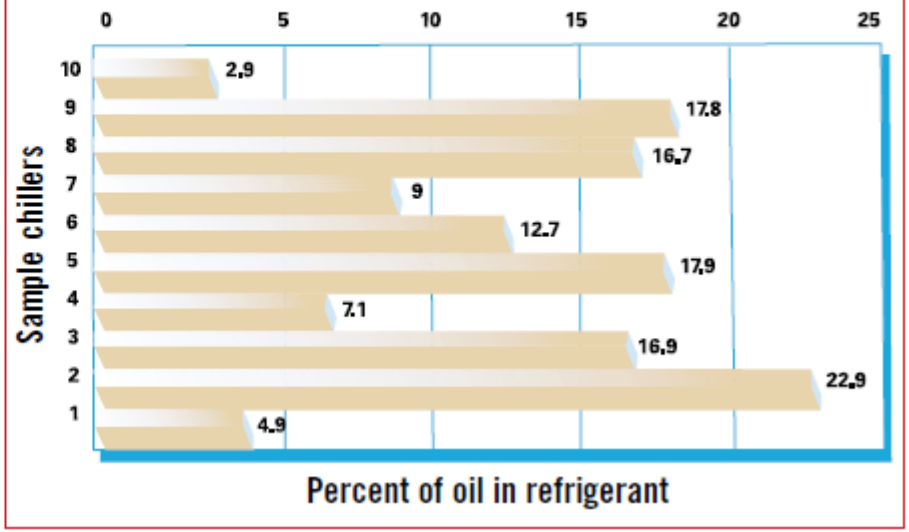
> Failure to control excessive Oil deposit in Chiller's refrigerant will impact Chiller Capacity and Efficiency

Figure A.



Impact of Oil content in Refrigerant in terms of Efficiency loss

Figure B.



Oil content as a percentage of refrigerant in 10 older CFC-11 Chillers

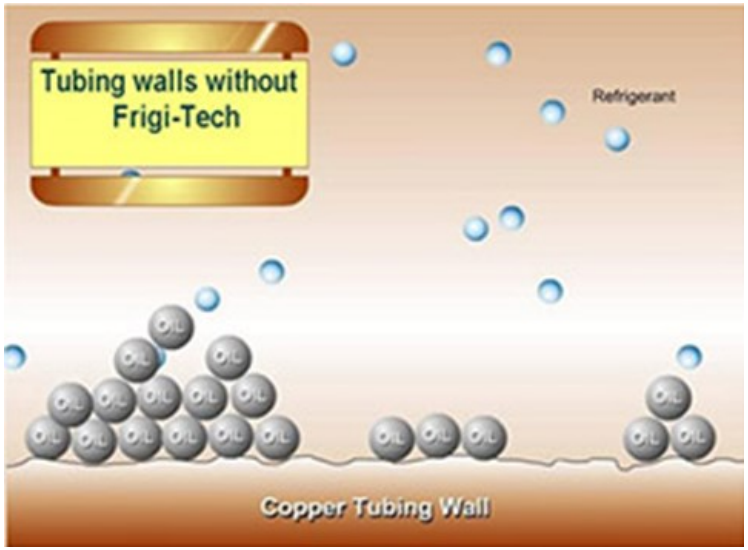
Existing problem in Refrigeration system

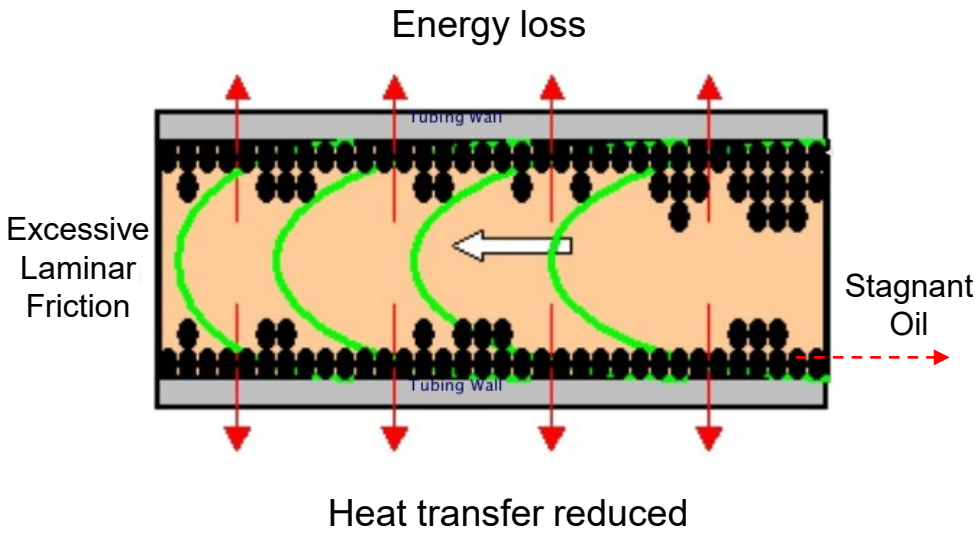
Oil Fouling effect

Oil fouling that impedes HVAC system operation and makes compressors work harder, causing higher kilowatt usage.

X This barrier reduce the Heat transfer inside the Refrigerant circuit

X Increase the Energy consumption (kwh)



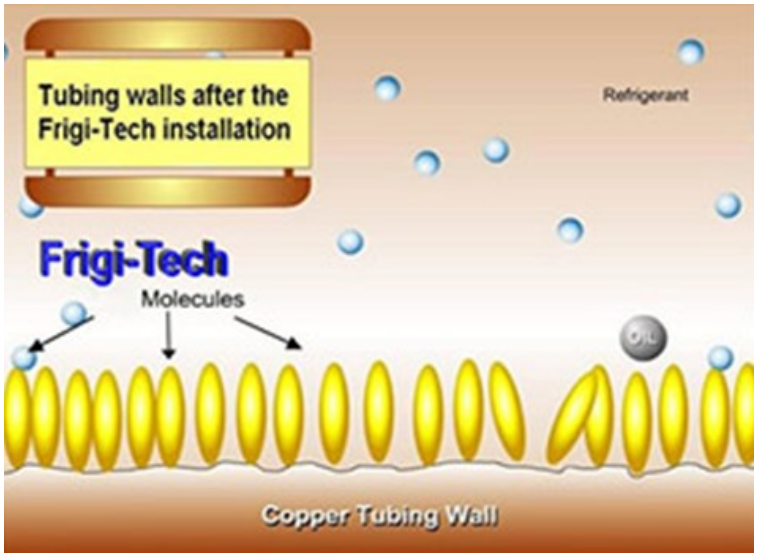


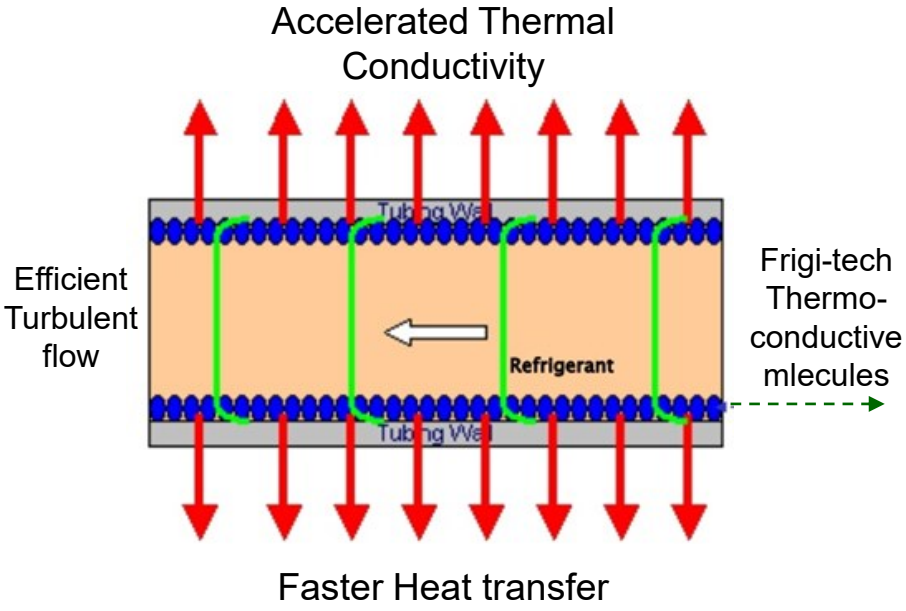
How Frigi-Tech solve the problem

After treatment with Frigi-Tech

Frigi-Tech's polarized molecules bond to the metal inside the system, preventing the insulating build-up of oil which occurs over time due to oil fouling.

√ Oil barrier is completely and permanently removed





Frigi-Tech Features & Benefits

FEATURES	BENEFITS
Increased Heat transfer in the evaporator and condenser **up to 25%**	**Improved Cooling** with shorter cycle times, equating to less run time and energy used
Reduction of friction	Lower Amp draw and reduced start Amps
Reduced noise and vibration	Comfort of the mechanical rooms
Lower Operating temperatures of the oil and the compressor	For every 10 ^{0}C a motor runs hotter, it reduces its life by 50%
Improved Energy efficiency	Payback time realized in months and then all further savings go towards the bottom line.

Frigi-Tech Product component

1. **Anti-Ware additive (A) Contact activate additive & B) Friction activate additive)**
   Bond to metal surface and protect against damage during Hydrodynamic lubrication failure.

2. **Oxidation inhibitor**
   Preserve oil from oxidized or deteriorate, allowing refrigeration oil to perform at peak level longer and extend oil life.

3. **Corrosion inhibitor**
   Protect precision Compressor component from acid.

4. **Surfactant agent**
   Reduce foaming and increase Cooling capacity (Foam slow the heat transfer process)
   Minimize residue Oil film thickness in condenser and evaporator Coils (act as insulator)

5. **Conditioner**
   Maintain Elastomer resiliency and pliability from cracking
   (seal, valve, gasket, hose, pressure relief)

Frigi-Tech Application

- Air Conditioners
- Chillers
- Refrigerated Transport
- Freezer / Ice machines
- Heat Pump
- Automobiles

Frigi-Tech Treatment amount

Tonnage	Amount of Frigi-Tech
1- 10 tons	1 Ounce per ton *(1 Oz = 29.57 ml.)*
20 tons and greater	5% -10% of the Oil capacity of the Compressor

- **Recommendation**
  - 5% application for units 5 years younger and
  - 10% application for units 10 years and older.

DO WE VOID MANUFACTURER'S WARRANTY ?

FRIGI-TECH MEETS AND THEN EXCEEDS

After the introduction of Frigi-Tech there was over

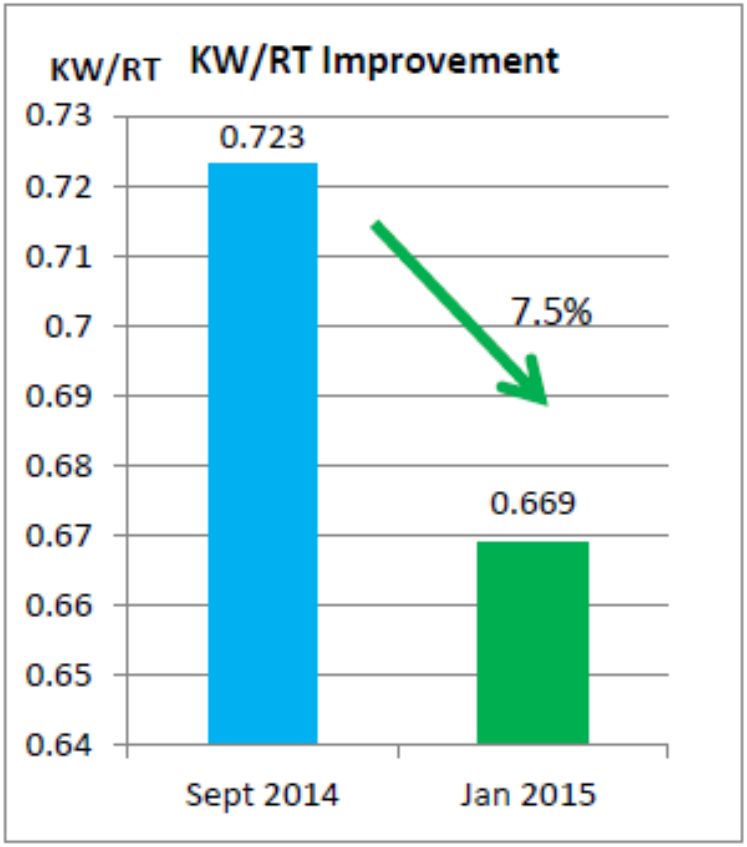
1,000% improvement in the mixture lubricating ability.

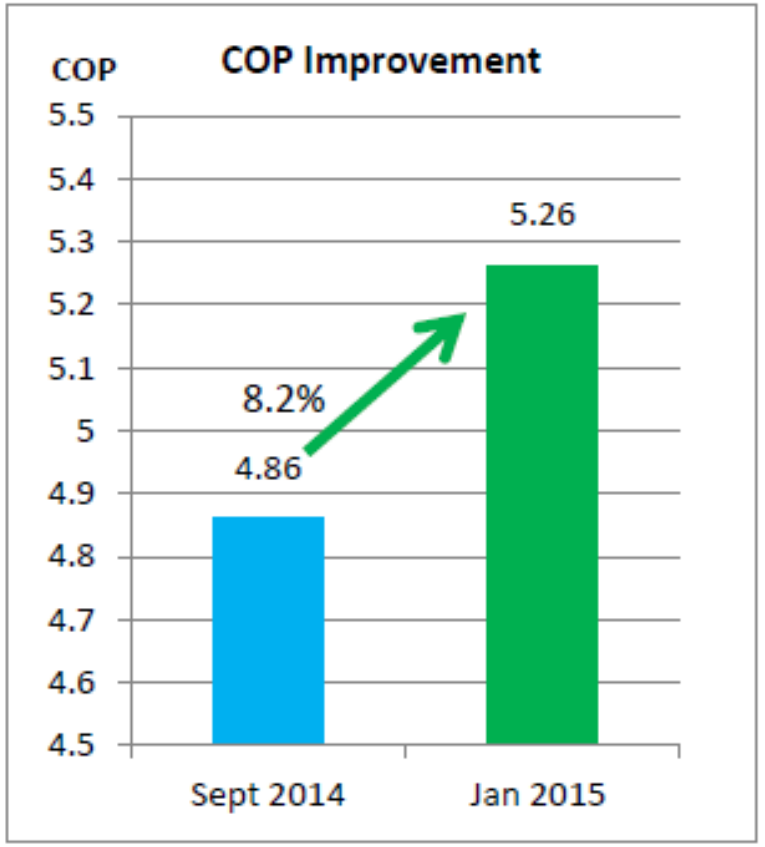
The modified Falex test was used to determine lubricity.

Frigi-Tech exceeded the 582 pound limits of the test.

Frigi-Tech reference - Chiller application

Ref : Centrifugal Chiller : York 250 Ton





Kw/RT for the treated Chiller is lower by 7.5%

COP improved by 8.2%

Ref : Centrifugal Chiller : York 250 Ton

Measured Points (Temp in Deg C)						Calculated Points				
Chilled Water Supply (Deg C)	Chilled Water Return (Deg C)	Condenser Water Supply (Deg C)	Condenser Water Return (Deg C)	Chilled Water Flow (Usgpm)	Condenser Water Flow (Usgpm)	Qe, Chiller Heat Gain, kW	Qc, Chiller Heat Reject, kW	Chiller kW	Chiller Heat Balance Check	**Chiller KW/RT**
6.678	9.489	29.781	32.625	766.792	892.380	567.178	671.068	111.407	-0.011	0.781
6.795	9.806	29.971	33.010	768.636	892.461	609.818	716.828	114.317	-0.012	0.746
6.765	9.768	29.364	32.474	759.706	893.586	601.449	734.010	114.806	-1.262	0.697
6.716	9.657	29.025	32.024	754.211	889.067	586.497	705.080	111.479	0.015	0.723
6.740	9.692	29.132	32.131	752.936	908.182	587.526	719.940	113.606	0.028	0.741
6.833	10.013	29.261	32.455	753.235	908.949	633.195	767.459	116.839	0.022	0.650
6.754	9.737	29.422	32.453	759.253	897.437	597.610	719.064	113.742	-0.203	**0.723**

Before

kw/RT = 0.723

COP = 4.86

Measured Points (Temp in Deg C)						Calculated Points				
Chilled Water Supply (Deg C)	Chilled Water Return (Deg C)	Condense r Water Supply (Deg C)	Condense r Water Return (Deg C)	Chilled Water Flow (Usgpm)	Condenser Water Flow (Usgpm)	Qe, Chiller Heat Gain, kW	Qc, Chiller Heat Reject, kW	Chiller kW	Chiller Heat Balance Check	**Chiller KW/RT**
6.644	9.509	29.093	31.790	797.944	1038.355	604.299	740.294	109.072	0.036	0.637
7.094	10.016	28.763	31.499	798.090	1039.308	616.526	751.779	117.239	0.022	0.676
6.649	9.086	28.657	30.961	756.076	910.981	486.934	554.994	95.977	-0.051	0.732
6.672	9.419	28.882	31.443	798.282	1038.484	579.833	703.086	104.053	0.027	0.632
6.765	9.508	28.849	31.423	787.598	1006.782	571.898	687.538	106.585	0.008	**0.669**

After

kw/RT = 0.669

COP = 5.26

Ref :Chiller Centrifugal : **500 tons water cooled**

Before

COP 5.16

After

COP 5.63

Improvement

9.1%

Parameter measurement :
Power , Cooling capacity , Condensing water in/out temp., Ambient temp.

Ref : Chiller Centrifugal : Trane 1,250 Tons

The average of the data collected:				
	Baseline	Frigi-Tech	Change	%
Chilled Water Supply Temperature	37.00	36.96	-.04	-.11%
Chilled Water Return Temperature	45.71	45.09	-.62	-1.36%
Condenser Water Supply Temperature	77.81	76.73	-1.08	-1.39%
Condenser Water Return Temperature	83.55	81.87	-1.68	-2.01%
Evaporator Refrigerant Temperature	31.61	32.62	1.01	3.20%
Pneumatic Acuator Pressure (PSI)	10.63	9.87	-.76	-7.15%
Tons Produced	583.04	544.13	-38.91	-6.67%
Kilowatts per Ton	.962	.928	-.034	-3.53%
Kilowatts Demand	561.17	505.40	-55.77	-.11%
Accumulators:				
Kiliton Hours	210.15	198.88	-11.27	-5.36%
Megawatt hours	179.10	160.30	-18.80	-10.50%
BTU per Watt	14.00	14.88	.88	6.29%

Ref : Chiller Water cooled : Trane 80 tons

GEORGETOWN HOSPITAL

Before

Avg : 140 amps

Phase 1	Phase 2	Phase 3
140 amps	145 amps	135 amps

After

Avg : 124.67 amps

Phase 1	Phase 1	Phase 1
124 amps	128 amps	122 amps

% Saving in Amps : 10.95 %

Ref : Chiller air cooled : York reciprocating compressor (R-417)

Parameters	Before	After Frigi-Tech treated	Avg. diff %
Compressor input power, kw *(a)*	60.3	55.07	**9.49 % Saving**
Cooling Capacity, kw *(b)*	115	216.5	**46.6% Improved**
EER Cooling *(b/a)*	1.91	3.92	**105.3% Improved**
CHW Flow, ^{0}C	11.34	12.19	**23.9% decreased**
CHW Return, ^{0}C	13.24	8.62	**7.9% decreased**
ΔT	1.9	3.57	
Ambient temp. ^{0}C	17.43	18.2	**3.2% increase**

Ref : Chiller : 150 tons

Chiller # 1

Testing	amps			Avg amps	
Before	274	266	263	267.6	
After	223	213	213	215.3	
				Energy Saving in amps	**19.1 %**

Chiller # 2

Testing	amps			Avg amps	
Before	285	276	277	279.3	
After	212	205	204	207.0	
				Energy Saving in amps	25.8 %

Frigi-Tech reference – Air Conditioner

CB Richard Ellis

Ref : A/C : Trane 5 tons Roof Top

Parameters	Before	After Frigi-Tech treated	Avg. diff %
Ambient temperature (^{0}C)	28.3	27.7	same condition
Compressor amp.	15.67	13.57	**13.4% Saving**
Discharge pressure (psi)	245	210	**14.29% decreased**
Suction pressure (psi)	72	65	**9.72% decreased**
Supply Air / Discharge Air (^{0}C)	15.27	13.61	**1.66 ^{0}C lower**
Compressor operating temp. (^{0}C)	57.22	51.66	**5.56 ^{0}C lower**
Kilowatts to operate unit	5.92	5.13	**13.34% Saving**
Kilowatts per ton to operate unit	1.18	0.93	**21.18 % Saving**
ASHARE calculation for total ton produced	5	5.54	**10.8 % improved**
ROI 9.13 months (if included Compressor run time reduced 13% ROI = 8.08 months)			

Ref : A/C 40 Tons

Tested duration :

- Pre-test (Before) 1 week
- Post – test (After) 1 week after treatment of Frigi-Tech

Parameters	Before	After	Result
kwH	158.3	148.55	6.1% Saving
THI = Temperature and Humidity index = (0.55 x Amb. Temp.) + (0.2 x dew point) + 17.5			
THI	77.45	77.44	5.88% improved
Cooling index (kwH/THI)	2.04	1.92	5.88% improved
Payback 9.3 months			

Ref : A/C : York 4 tons Split system

for Convention Center

York 4 Ton Split Systems 101 Convention Center - The Plaza	Unit # P-3 #84				Unit P-3 #32			
	Before	After	ΔT	%Δ	Before	After	ΔT	%Δ
Measurements & Readings	July 19th	July 29th			July 19th	July 29th		
Ambient Temperature (°F)	121	123	2.0	1.7%	120	120.1	0.1	0.1%
Suction Pressure (PSIG)	78	74	(4.0)	-5.1%	64	57	(7.0)	-10.9%
Suction Line Temperature (°F)	52.7	52.9	0.2	0.4%	85.9	75.2	(10.7)	-12.5%
Evaporator Coil Temp (°F) (P/T Chart)	46	44	(2.0)	-4.3%	37	32	(5.0)	-13.5%
Discharge Pressure (PSIG)	360	335	(25.0)	-6.9%	355	310	(45.0)	-12.7%
Liquid Line Temperature (°F)	123.3	116.5	(6.8)	-5.5%	121.5	120.1	(1.4)	-1.2%
Condenser Temperature (P/T Chart)	144	139	(5.0)	-3.5%	143	127	(16.0)	-11.2%
Condenser Intake Air (°F)	120.1	119.3	(0.8)	-0.7%	123.3	112	(11.3)	-9.2%
Condenser Discharge Air (°F)	138	138	0.0	0.0%	150.1	130	(20.1)	-13.4%

Results

1. Suction pressure dropped
2. Evaporator Coil temperature lower
3. Head (Discharge pressure dropped
4. Temperature in Condenser coil lower

Advantage

1. Colder temperature in Evaporator coils
2. Providing colder air into space, make happier Unit cycle off more saving Energy consumption
3. Increased efficiency in the Condenser (do not work as hard to subcool the refrigerant)
4. Extends lives of the Compressor