

CELEBRATING 30 YEARS OF ENERGY SAVINGS



Polarized Refrigerant Oil Supplement Products

FRIGI-TECH

For Air Conditioning and Refrigeration Compressors

PROA Technology for Energy Saving improvement

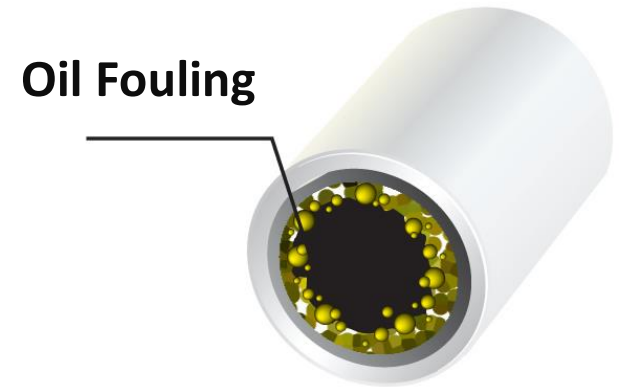
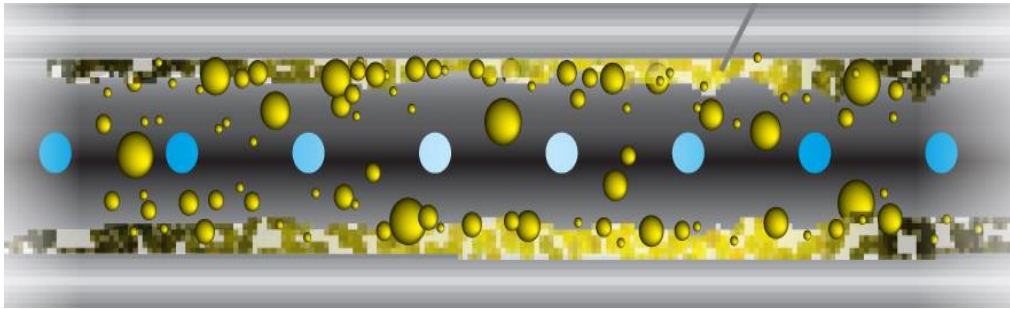
Frigi-Tech History

- Established in 1980's by Clarence Adams (C.D.) with Rice University's professor developing additive to extend the life of Air Conditioning Compressors.
- During the testing, there was a significant reduction of total KWH noticed.
- 1990's : Frigi-Tech changed from preventative maintenance with energy savings being a side benefit, to the main benefit being reduced KWH consumption with a preventative maintenance side benefit.
- 2002 : Frigi-Tech enhance formula for compatible with all of newly Refrigerants.
- Frigi-Tech have expanded international sales over 50 countries.
- Frigi-Tech is backed by 2 Million USD international liability insurance policy that has never experienced a claim filed against.



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 kilowatt usage.

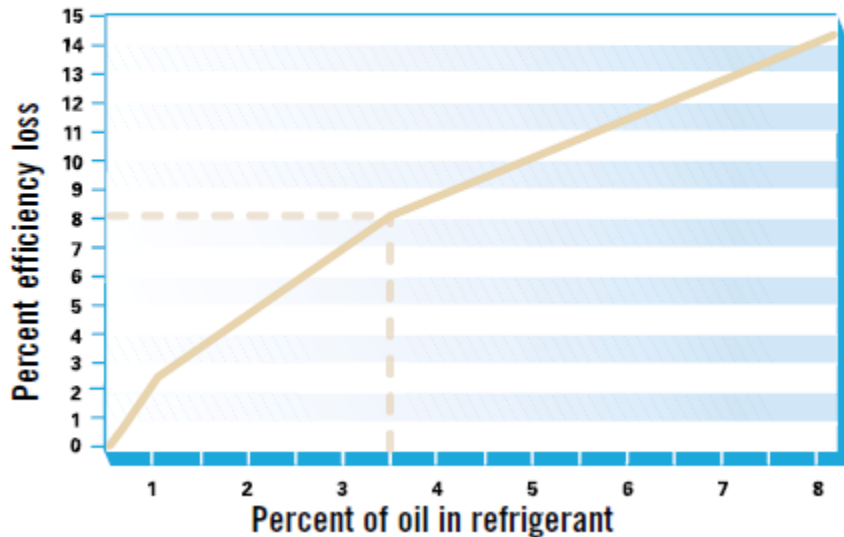
- ▶ 7% Loss after the 1st Year
- ▶ 5% after the 2nd Year
- ▶ 2% each additional Year

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

High Cost of Chiller Oil Fouling

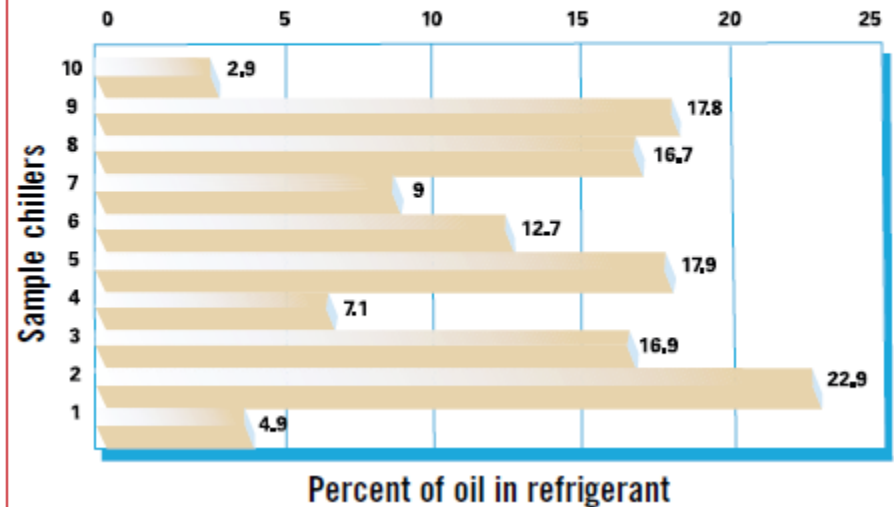
Failure to control excessive Oil deposit in Chiller's refrigerant will impact Chiller Capacity and Efficiency

Figure A.



Impact of Oil content in Refrigerant in terms of Efficiency loss

Figure B.



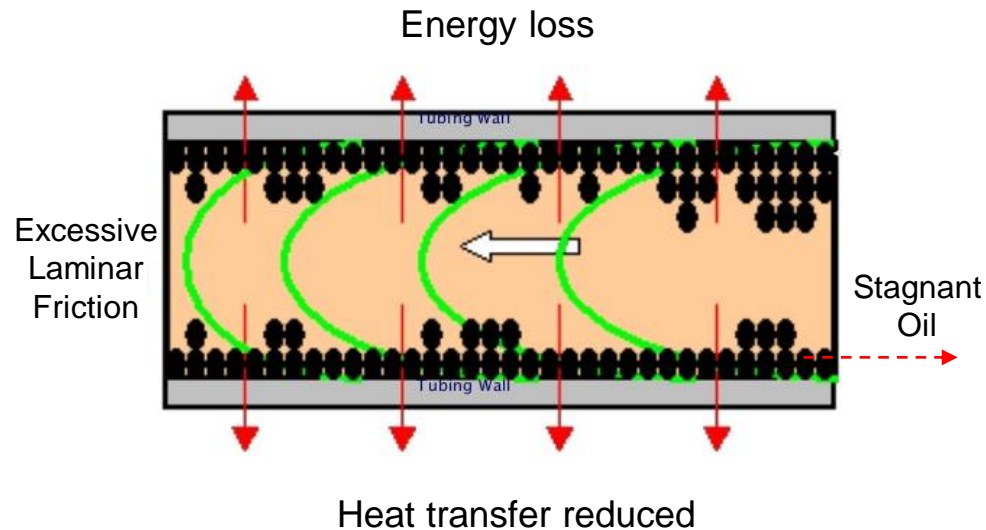
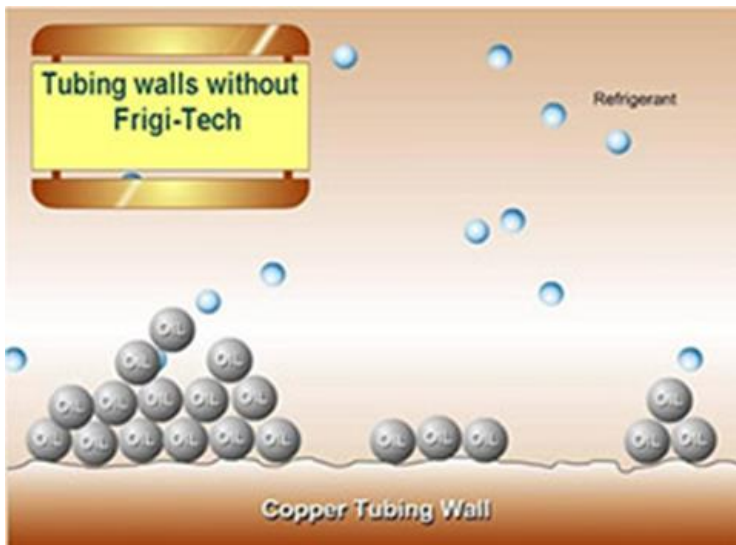
Oil content as a percentage of refrigerant in 10 older CFC-11 Chillers

Existing problem in Refrigeration system

Oil Fouling effect

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

- ✗ This barrier reduce the Heat transfer inside the Refrigerant circuit
- ✗ Increase the Energy consumption (kwh)

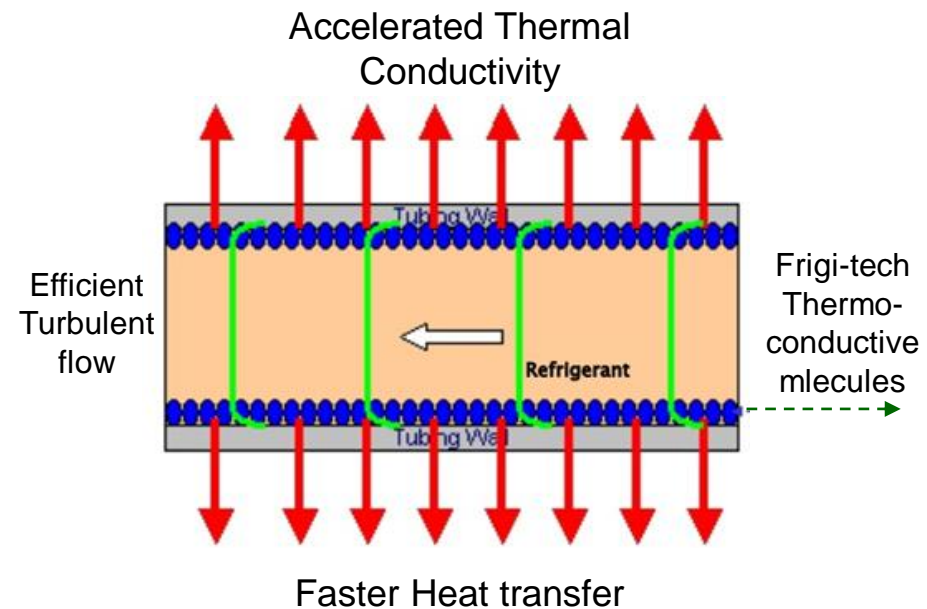
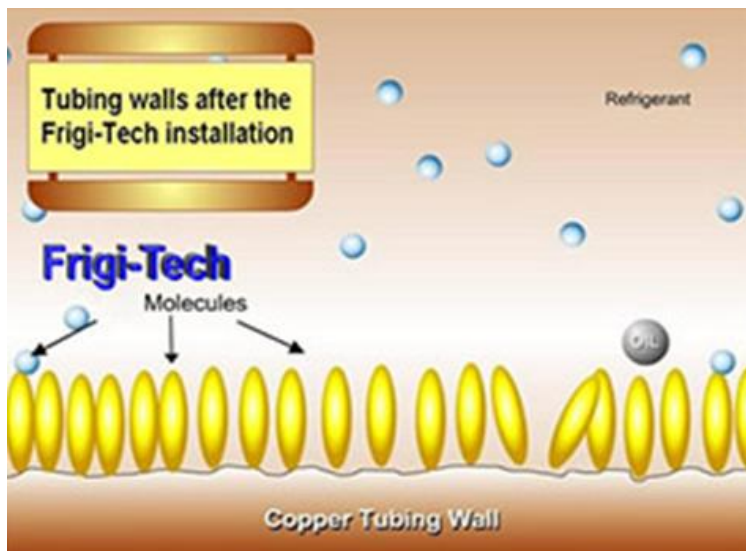


How Frigi-Tech solve the problem

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™

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



Frigi-Tech will restore the efficiency in the Condenser
and Evaporator coils by
“restoring the Heat exchange”



Frigi-Tech Product # Identification



TYPICAL BLENDS OF FRIGI-TECH™

FRIGI-TECH™ Products Types	Common Refrigerants
Mineral Oil Blend	CFC'S
Polyoester Oil Blend	HFC'S
Alkylbenzene Oil Blend	HCFC'S
Low Temp Oil Blend	Ammonia
PAG Oil Blend	Automotive
Custom Blend	Blended to be an exact match to customers brand of oil



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 <i>(1 Oz = 29.57 ml.)</i>
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.



Frigi-Tech Treatment Times

Frigi-Tech is a **one-time** treatment.

The only time additional **Frigi-Tech** is required is if and when a compressor is replaced or an oil change on a chiller.

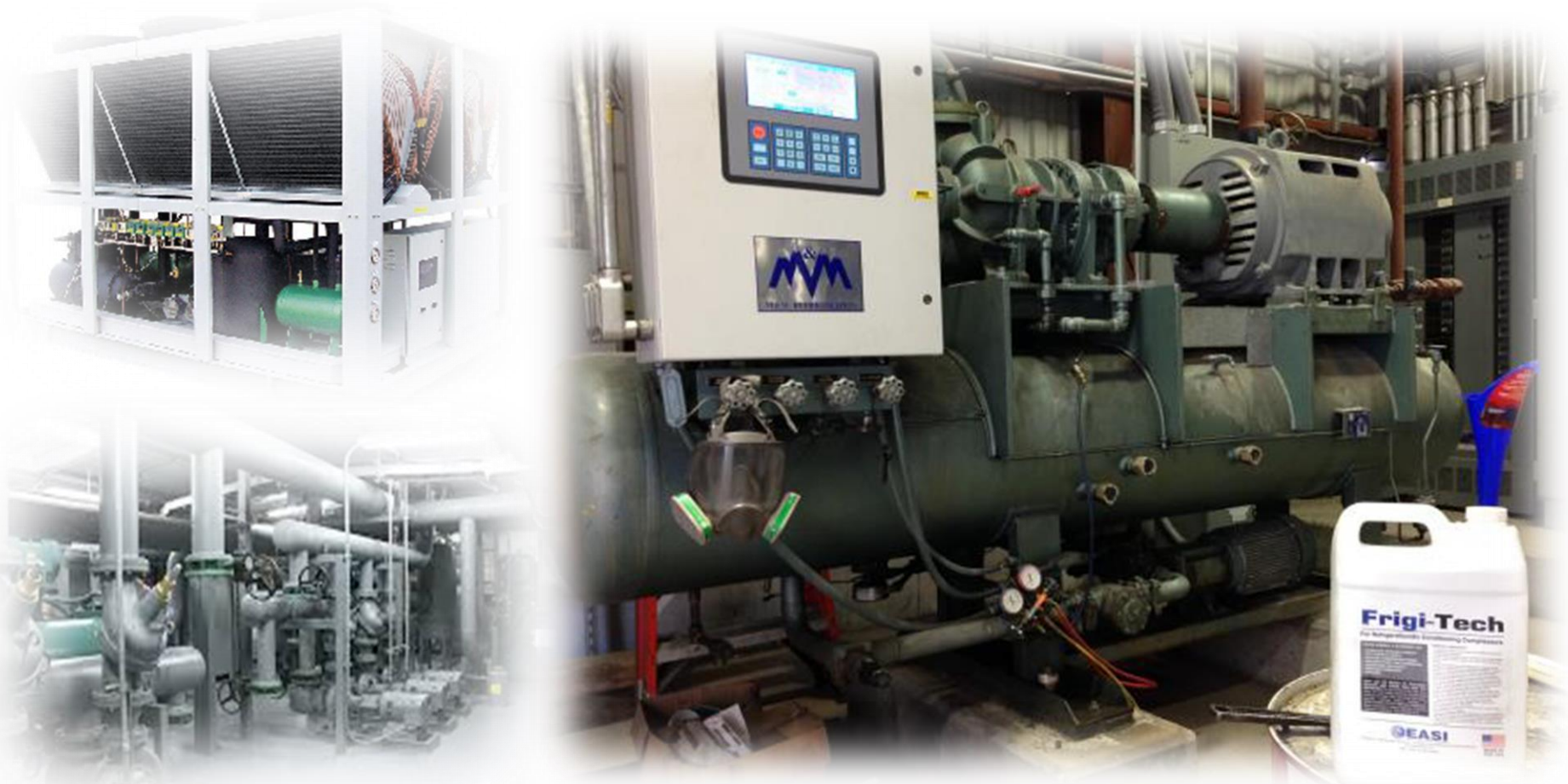
DO WE VOID MANUFACTURER'S WARRANTY ?

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

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

$$\text{kw/RT} = 0.723$$

$$\text{COP} = 4.86$$

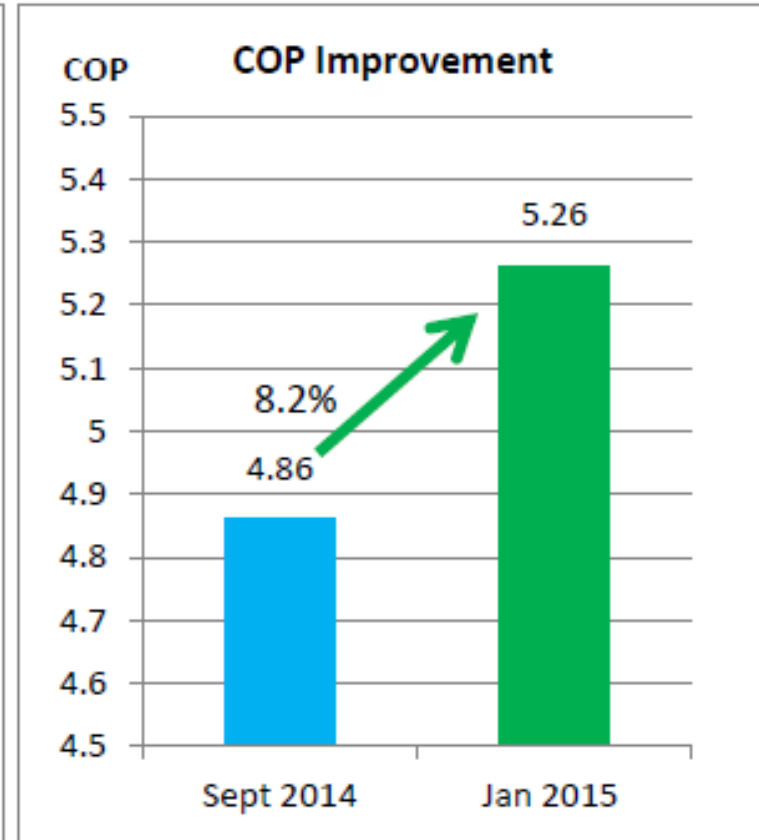
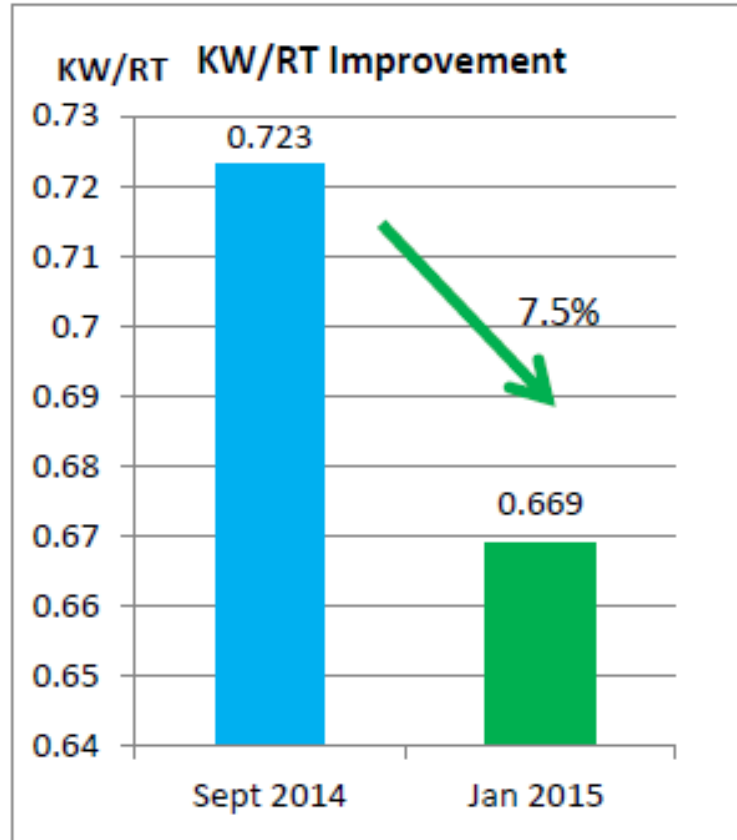
Measured Points (Temp in Deg C)						Calculated Points				
Chilled Water Supply (Deg C)	Chilled Water Return (Deg C)	Condenser Water Supply (Deg C)	Condenser Water Return (Deg C)	Chilled Water Flow (Usgpm)	Condenser Water Flow (Usgpm)	Qe, Chiller Heat Gain, kW	Qc, Chiller Heat Reject, kW	Chiller kW	Chiller Heat Balance Check	Chiller KW/RT
6.644	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

$$\text{kw/RT} = 0.669$$

$$\text{COP} = 5.26$$

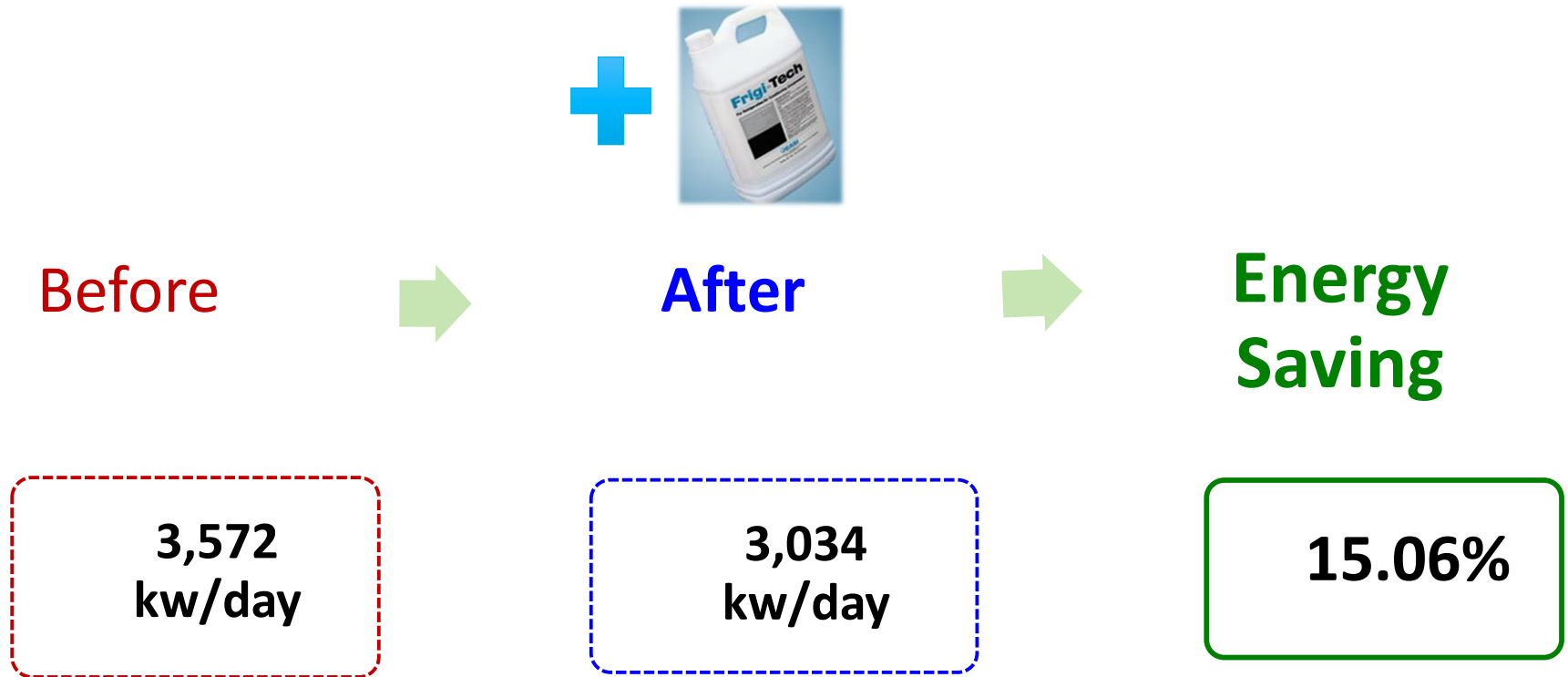
Ref : Centrifugal Chiller : York 250 Ton



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

COP improved by 8.2%

Ref : Chiller Centrifugal : York 600 tons



Ref :Chiller Centrifugal : 500 tons water cooled



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

Before

Avg : 140 amps

Phase 1

140
amps

Phase 2

145
amps

Phase 3

135
amps

After

Avg : 124.67 amps

Phase 1

124
amps

Phase 1

128
amps

Phase 1

122
amps

% Saving in Amps : 10.95 %

Ref : Chiller air cooled : York reciprocating compressor

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, °C	11.34	12.19	23.9% decreased
CHW Return, °C	13.24	8.62	7.9% decreased
ΔT	1.9	3.57	
Ambient temp. °C	17.43	18.2	3.2% increase

Ref : Chiller : 7500 W Scroll Air Cooled



Parameters	Before	After Frigi-Tech treated	Avg. diff %
Total Power of A/C (W)	3120	3020	11.4% Saving
Aux Evaporator capacity (kcal/hr)	5,658.10	6,089.00	11.4% Improved
COP	2.11	2.35	11.4% Improved

Ref : Chiller : 190 Ton (Screw Compressor)

Parameters	Before (Apr 10)	After (Apr 24)	Result
Cooling capacity in kw	382.9	452.5	18% improved
COP	3.6	4.13	15% improved
Kw/ton	0.975	0.85	12% Saving

@ Ambient temp : 28.3 °C with Condensor kw = 106.2

Re-test on May 14 (Ambient temp increase 5 °C)

As per Asia Energy efficient norms : 0.55 °C increase power consumption by 3% (impact 27%)

Compensate COP = $382.9 / (106.2 + 27\%) = 2.84$

Compensate kw/ton = $(106.2 + 27\%) / 111 = 1.21$

Parameters	Before	Re-test (May 14)	Result
Cooling capacity in kw	382.9	441.6	15% improved
COP	2.84	3.46	22% improved
Kw/ton	1.21	1.10	16% Saving

@ Ambient temp : 33.3 °C

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 %

Ref : Chiller Air Cooled : Trane 100 tons , dual compressor

Application : Building 50,000 ft²

Parameters	Before	After	Result
Kw/day	2,103.15	1,806.20	14.1% Saving
Chiller capacity	81.25	93.75	15.38 % improved
Compressor 14% less work, will have a much longer service life			

Frigi-Tech reference - **Air Conditioner**



Ref : A/C : Trane 5 tons Roof Top

Parameters	Before	After Frigi-Tech treated	Avg. diff %
Ambient temperature (°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 (°C)	15.27	13.61	1.66 °C lower
Compressor operating temp. (°C)	57.22	51.66	5.56 °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 = $(0.55 \times \text{Amb. Temp.}) + (0.2 \times \text{dew point}) + 17.5$			
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

Ref : A/C : Goodman 10 SEERS

2 Goodman A/C 10 SEERS units approximated 6 years old.

The FRIGI-TECH oil was charged prior under “SUPERHEAD” conditions

	Before	After
Delta T °F	20.1	26.9
6.8 °F Cooling increased		

Positively impacted the ratio of run-time/off-time as well.



Frigi-Tech reference - Freezer



Ref : Ice Water Compressor



35 hp Compressor 2 units

40 hp Compressor 5 units

Add to Oil Baths of the
Compressor

Reduction on the
power consumption
on average
18% Saving

**Cooling 20% more
milk/day**



Ref : 50 ton Mycom Freezer (Ammonia System)

- 10 psi dropped in the High Side
- 5 psi dropped on the Low side
- Freezer temperature dropped 7 degree within 1 week
- Amperage draw was down 8%

A reduced load in units

Run constantly to deliver the coldest freezer room temperature

Energy Saving

Ref : Ice Machine

- Delivered Ice cubes from 67 dumps/day to 878 dumps/day
- Production increased 16%



Ref : Trenton Refrigeration Units



- With Frigi-Tech**

✓ kw	decrease	13%
✓ Compressor run time	decrease	25%
✓ ΔT	decrease	16%



- With EasiLiner**

✓ Power factor	increase	26%
✓ kw total	decrease	16%
✓ Compressor run time	decrease	31%
✓ ΔT	decrease	21%



EasiLiner™ Reactive Power Correction System

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Let's start
Saving Energy!!

