

Report No.AI/GENPACT/18- 19/001- FINAL

Date: 30th August, 2018

ENERGY SAVINGS REPORT

(Total 11 Pages)

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|---|---|---|
| 1. Client | : | GENPACT INDIA PVT LIMITED
Survey No.1, Uppal Kancha Village
Opp. NGRI, Adj. Jeevan Foods, IDA – Uppal
Habsiguda, Uppal, Hyderabad 500039 |
| 2. Location of Equipment | : | Uppal, Hyderabad |
| 3. Equipment Details | : | TRANE MAKE, 400 TR CHILLER Model CVGF400_ |
| 4. Serial Number of Chillers | : | L02012375 |
| 5. Refrigerant | : | R134A |
| 6. Pre Installation Data Recording Duration | : | 29/3/18 to 07/04/2018 |
| 7. Post Data Recording duration | : | 24/08/2018 to 29/08/2018 |

A) TRANE MAKE 400 TR WATER COOLED CHILLERS. Sr. No. L0201237



B) Data Logger Installation recording the data



C) Pre installation Data of TRANE make 400 TR water Cooled Chillers Sr.No. L02012375

Sr.No	Date	TRH	VLL	AMPS	KW	KWH	PF	Temp. In Deg C		Chiller		Condenser		RH
								AMB	Set Point	IN LET	OUTLET	INLET	OUT LET	
1	29-03-2018	9.00	399.8	375.00	234.50	2108.50	0.902	28.60	6.0	16.32	10.82	27.7	32.55	36.25
2	30-03-2018	11.00	406.2	357.33	225.20	2479.90	0.875	28.67	6.0	18.17	11.42	27.87	34.65	37.00
		7.00	403.0	365.30	228.60	1620.50	0.894							
3	31-03-2018	23.68	412.7	339.92	214.42	5026.00	0.879	27.30	6.0	10.90	5.73	27.81	31.79	38.30
4	01-04-2018	23.86	411.8	301.80	185.40	4365.00	0.860	27.25	6.0	10.35	6.54	26.55	30.64	41.00
5	02-04-2018	23.81	403.9	336.63	207.86	4932.00	0.878	27.21	6.0	14.78	8.57	28.25	32.95	44.90
6	03-04-2018	23.75	400.0	370.60	230.60	5482.70	0.897	27.23	6.0	14.61	8.33	28.02	32.95	47.72
7	04-04-2018	23.95	399.7	364.80	225.60	5381.90	0.896	27.59	6.0	14.37	8.51	27.60	32.95	48.96
8	05-04-2018	23.50	401.5	363.23	226.32	5321.90	0.894	27.40	6.0	15.10	8.874	27.85	32.01	50.00
9	06-04-2018	23.58	400.9	361.60	224.80	5078.00	0.894	27.67	6.0	14.20	8.45	27.53	32.12	50.55
10	07-04-2018	22.15	406.0	326.34	204.60	4772.20	0.867	28.08	6.0	12.78	9.17	33.02	38.2	31.96
Total		215.28				46568.60								
Average			404.1	351.14	218.9	216.32	0.885	27.7	6.0	14.16	8.64	28.2	33.1	42.66

D) POST DATA SUMMARY

Sr. No	DATE	Total		AVERAGE FIGURES						Temperatures in Deg C				
		TRH	KWH	VLL	VLN	AMPS	KW	PF	RH	AMB	CHILLER		CONDENSER	
											INLET	OUTLET	INLET	OUTLET
1	24-08-2018	11.75	2712	401.7	230	355.5	230.0	0.929	64.0	27.61	18.89	13.08	30.41	35.50
2	25-08-2018	23.11	4132	401.5	230	316.2	202.0	0.918	66.9	26.81	14.77	10.18	29.19	33.14
3	26-08-2018	22.88	3174	401.0	230	301.0	190.9	0.910	71.7	25.91	14.46	10.69	29.50	32.65
4	27-08-2018	23.66	3515	402.0	230	333.0	213.6	0.918	79.9	24.78	15.55	10.88	28.95	32.91
5	28-08-2018	23.96	4779	402.0	230	346.5	223.3	0.925	72.3	26.11	17.03	12.35	29.47	34.10
6	29-06-2019	23.55	4907	400.0	228	349.0	224.2	0.920	67.5	26.55	17.12	12.63	29.38	33.99
Total		128.9	23219											
Average			180.1	401.4	229.7	333.5	214.0	0.920	70.4	26.29	16.30	11.63	29.48	33.72

E) Comparison of PRE & POST summary of Data 400 TR Chiller Sr. No. L02012375

Sr. No	Parameters	Pre Data	Post Data August
1	Total Running Hours	215.28	128.9
2	Total Energy Consumption in KWH	46568.6	23219
3	Average Energy Consumption per hour in KWH	216.32	180.13
4	Average Load in KW per Hour	218.9	214
5	Average KWH/ KW	0.988214	0.841738
6	Average Voltage Line to Line (VLL) in Volts	404.1	401.4
7	Average Current in Amps	351.14	333.5
8	Average PF	0.885	0.920
9	Average Ambient Temperature in Deg C	27.7	26.29
10	Average Set Point in Deg. C	6.0	6.0
11	Average chiller Inlet temperature in Deg C	14.16	16.30
12	Average chiller Out let temperature in Deg C	8.64	11.63
13	Average Condenser Inlet Temperature in Deg C	28.2	29.48
14	Average Condenser Inlet Temperature in Deg C	33.1	33.72
15	RH %	42.66	70.4

F) Observations & Conclusions

a) Average Energy Consumption in KWH/ Hour (Pre)	:	216.32 Kwh
b) Average Energy Consumption in KWH/Hour (Post)	:	180.13 kwh
c) Difference	:	216. 32- 180.13 = 36.19 Kwh /Hour
d) Improvement with MAXR100 in %	:	$(36.19 / 216.32) \times 100 = \underline{16.73 \%}$

However, the Post MAXR100 the ambient temperature decreased from 27.7 Deg C to 26.29 Deg C (i.e. by **1.41 Deg C**)

Actual Energy Savings Considering the change in average Ambient Temperatures post MAXR100 installation period.

- For calculating the actual savings we need to consider the change in ambient temperatures of pre data period with the post data period, which is 1.41 Deg C. Any increase in the ambient temperature will affect the energy consumption of the AC unit. Hence for calculating the actual savings we need to consider COP- Coefficient of Performance principle which is most commonly used method.
- COP- is the ratio of heat removed from a system to the energy required to remove the heat. The theoretical maximum is equal to the coldest temperatures of the refrigerant divided by the difference between its coldest and hottest temperatures are expressed in Kelvins. Even the perfect system decreases efficiency with increased outside temperatures, dropping about 2% per Deg C.

- Considering 1.41 Deg C decrease in the ambient Temperatures for the post MAXR 100 installation period the energy consumption has decreased **2.82 %** during the period.

Considering the above we have to calculate the actual energy consumption during the post MAXR100 installation period and add the difference to the recorded total energy consumption.

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|---|---|--|
| a) Total Energy consumption in KWH | : | 23219 Kwh |
| b) Increase in Energy consumption due to rise in ambient temperature in % | : | 2.82 % |
| c) Actual Energy Consumption in KWH | : | $(23219 \times 2.82)/100 = 654.7758$ KWH |

$$23219 + 654.7758 = \mathbf{23873.75\ Kwh}$$

G) SUMMARY OF PRE & POST DATA(After adding the kwh consumption due to decrease in post Ambient Temperatures

Sr. No	Parameters	Pre Data	Post Data (After adding the difference in KWH consumption due to decrease in post Amb temp)
1	Total Running Hours	215.28	128.9
2	Total Energy Consumption in KWH	46568.6	23873.78
3	Average Energy Consumption per hour in KWH	216.32	185.2116
4	Average Load in KW per Hour	218.9	214.0
5	Average KWH/ KW	0.988214	0.865475
6	Average Voltage Line to Line (VLL) in Volts	404.1	401.4
7	Average Current in Amps	351.14	333.5
8	Average PF	0.885	0.92
9	Average Ambient Temperature in Deg C	27.7	26.29
10	Average Set Point in Deg. C	6.0	6.0
11	Average chiller Inlet temperature in Deg C	14.16	16.30
12	Average chiller Out let temperature in Deg C	8.64	11.63
13	Average Condenser Inlet Temperature in Deg C	28.2	29.48
14	Average Condenser Inlet Temperature in Deg C	33.1	33.72
15	RH %	42.66	70.4

H) FINAL ENERGY SAVINGS WITH MAXR100 :

a) Actual average Energy Consumption / Hour on kWh	:	23873.75 /128.9 = 185. 2116 KWH/Hour
b) Average Energy Consumption /Hour Pre	:	216.32 KWH/ Hour
c) Average Energy Consumption / Hour Post	:	185.2116 KWH/ Hour
d) Difference	:	216.32- 185.2116 = 31.10 Kwh/Hour
e) <u>Improvement with MAXR100</u>	:	(31.10/216.32) x 100 = <u>14.37 %</u>

I) PRE & POST DATA - GRAPH

