ENERGY MANAGEMENT AT KOHINOOR PRODUCTS

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❑ *Project Outline*

- *Introduction*
- *Objective*
- *Methodology*
- *Literature Review*
- *Project Work*
- *Work Plan*
- *Conclusion*
- *References*
- *Company certificate*

Introduction

PROJECT BACKGROUND:-

- The management of energy and improving energy efficiency has long been important for industry and commerce.
- Hence it is necessary to find out the current level of efficiency for performance evaluation, which is a pre requisite for energy conservation action in industry.

PROJECT STATEMENT:-

- After visiting to KOHINOOR PRODUCTS, a surgical dressing manufacturing company.
- The main problem arising after installation of boiler was less efficiency and heavy usage of fuel. So it can be reduced to certain extent by various approaches.

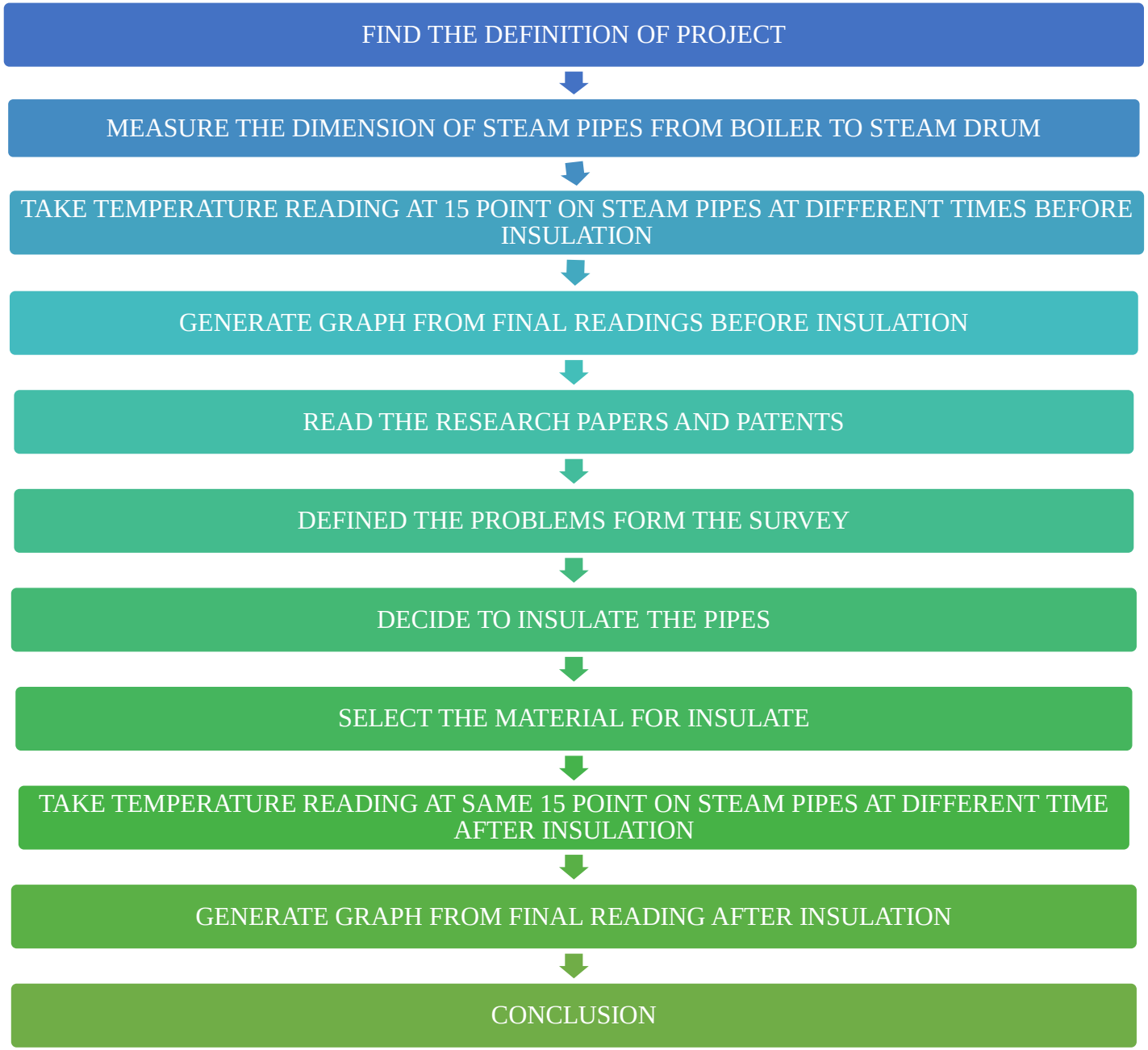
PROJECT OBJECTIVE:-

- This project is developed to reduce heat loss from steam pipes and drums by insulating them.

SCOPE OF PROJECT

- The problem faces by industry is solved by various techniques such as to change the fuel used in boiler and also to insulating the equipment’s.

Methodology



LITERATURE REVIEW

- **PIPERNO GUGLIELMO 1964**: -
- With the increase of power demands in industry and the necessity for the faster production of Steam, boilers have been built of increasing size and volume. The efforts in the past, however, have been to merely increase size without disturbing the conventional internal arrangements or designs, with a consequent loss of eminency and with an unnecessarily high cost.

- **K. S. CHEN, T S. T. TSAI 2 AND Y. W. YANG Z 1953**:-
- It is among the objects of this invention; to improve the art of steam boilers generally; to obviate the use of headers in steam boilers; to improve the efficiency of boilers; to prevent the exposure of bare walls to the heat of the flame in the boiler; to provide an improved circulatory path for the flames and heated gases in steam boilers; to increase the efficiency of heat transfer between heated gas and the fluid-containing pipes to be heated.

CONTINUE

- **ROBERT CLARKE FORSYTH.1978**:-
- The purpose of this invention is to provide an improved substitute for the more or less perfectly insulating Wrappings and sheathings for steam or other heating pipes, which are commonly employed to prevent the loss of heat by radiation, and consequent condensation of steam in the pipes.
- In general, the invention consists in sheathing the steam pipe in a pipe of larger inner diameter than the outer diameter of a steam pipe, thereby forming a dead-air chamber around the steam pipe.

- **R. KOUHIKAMALI , H. HESAMI , A. GHAVAMIAN 2012**:-
- The utility model relates to a novel industrial boiler capable of reducing the heat loss, which comprises a combustion chamber, a hot water chamber and a smoke pipe, wherein the combustion chamber is connected with the smoke pipe; the smoke pipe is spiral in the hot water chamber; the tail end of the smoke pipe extends out of the hot water chamber and is connected with an exhaust fan.
- the heat loss of the combustion chamber through the external wall is avoided, the problem that the heat of the smoke pipe outside the hot water chamber is lost through a pipe wall is solved, the heat generated by fuel combustion is fully used, and energy sources are saved.

- **DAVID C. GOTI, LA GRANGE,1952**:-
- One of the primary applications of the present invention is in the iield of insulating steam pipes under conditions of extreme cold where the ground in which the steam pipes are to be imbedded is frozen, particularly in the so-called penna-frost egions.
- Another prime application of the invention other than in permanently frozen soils, is in installation where it is desired to keep steam or other heated fluids flowing continuously through the pipes or ducts during the time that the insulation is being applied.

- **HARRY K. STUEBER, BALTIMORE 1955**:-
- This invention relates to an insulated pipe system, particularly as applied to underground installations, although there are certain above ground applications where the principals involved are economical and practical. Also the invention relates particularly to heating or cooling systems but there could be applications outside this field where the principles lend themselves advantageously.

- **G. E. ZIEGLER [1965]**:-
- The method and apparatus of the present invention relate to insulated pipe installations, particularly pipe installations for carrying heated aids, which pipe installations are embedded in a thermally insulating composition, and buried underground.

- **T. D. STAFFORD 1961**:-
- This invention relates to the insulation and protection of pipes operating at elevated temperatures, and has been developed primarily in connection with underground installations of steam and condensate lines. In general, there are two aspects to the protection of underground pipe installations: (a) the elevated temperatures increase the problems of corrosion, and (b) the functioning of insulation must remain substantially unimpaired regardless of the presence of moisture surrounding the installation. Moisture has a tendency to affect both aspects.

Project Work

- **BOILER USES**
  - 15 tonne of wood per month
  - Electricity
  - Water
- **REASONS OF HEAT LOSSES**
  - Lack of insulation on steam piping
  - Steam leaks
  - Flash steam
- **DATABASE**

  Boiler manufacturer specification database

MATERIAL USED FOR INSULATION :-

- Mineral wool
- Fibre glass
- Asbestos
- Cellulose
- Polyurethane Foam

Mineral Wool

- Poor barrier to oxygen and water vapor
- Naturally transparent
- Density = 0.96 to 1.04 g/cm³
- Melting point = 240º C
- Thermal conductivity = 0.033 W/mK
- Non metallic , inorganic product
- The exceptional thermal , fire and acoustic properties
- It is a very versatile material
- price— 25/kg

Cellulose

- Thermal conductivity = 40 W/mK
- Reduce noise
- Less expensive
- Fire retardation
- Vapor barrier may not be needed
- Long term cost saving
- Save 20% to 50% on their utility bills
- Cellulose insulation lost 26.4% less heat energy over
- Time fiber glass insulation

Fiberglass

- Resistance to corrosive attacks
- Tight structure
- Superior shock and wear resistance
- Lightweight
- Simple assembling
- Cheap maintenance in service
- Low electrical conductivity
- Aesthetical and attractive lock
- At temperature below zero it doesn’t become slippery or covered with ice

- Hardly bendable material
- Low thermal conductivity
- Less brittle
- Its raw materials are much cheaper
- Bulk strength better
- More readily molded into complex shapes
- Density = 1.6-20 t/m^3
- destroying compressive stress – 220 MPa
- Bending failure stress = 220 MPa
- Modulus of elasticity = 21GPa

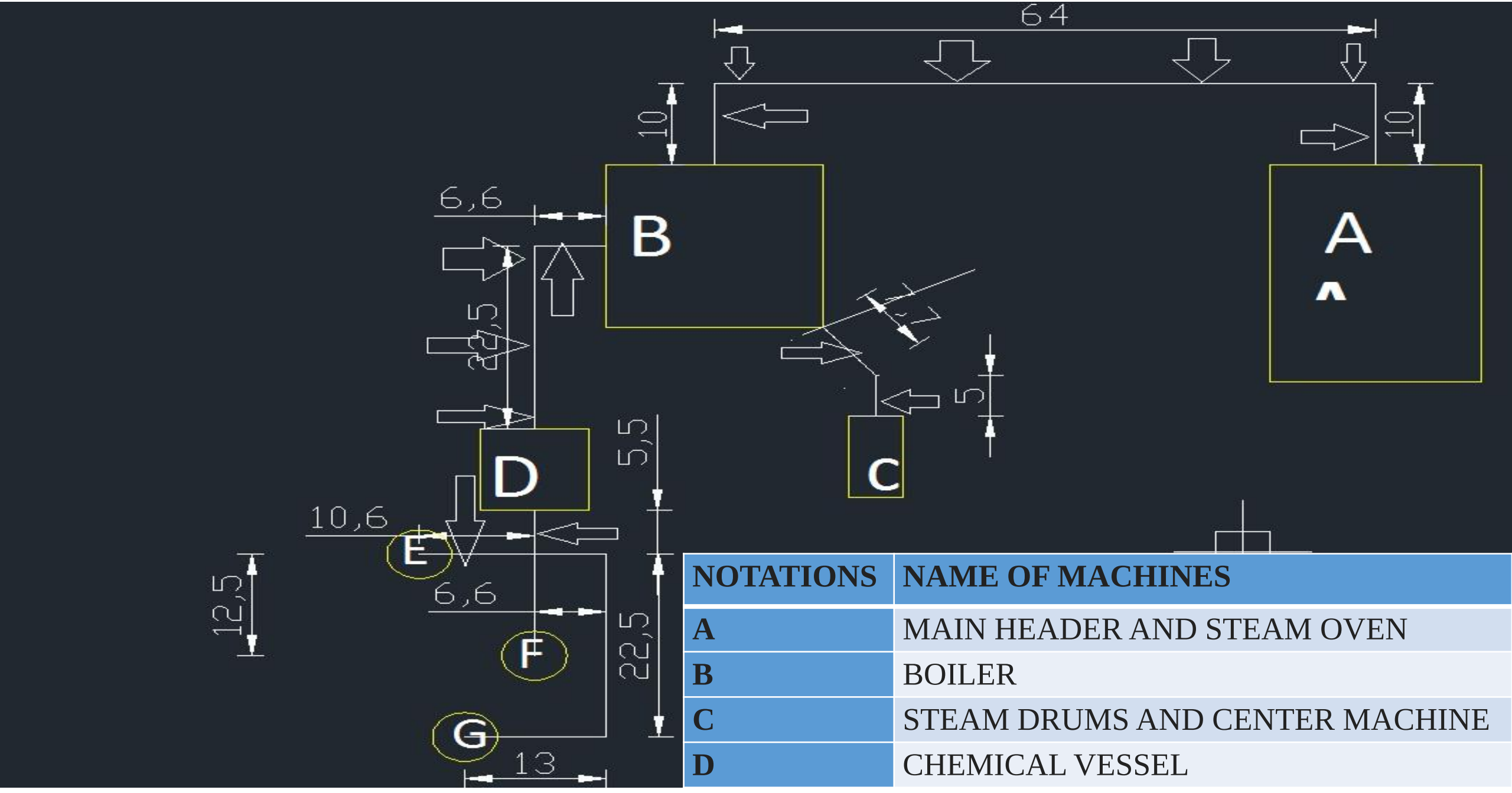
Asbestos

- Non- Flammable
- Thermal and electrical resistance
- Its tensile strength surpasses that of steel
- Sound absorption
- Average tensile strength
- Resistance to fire, heat, electrical and chemical damage
- Affordable

Polyurethane Foam

- Good air sealant
- The R-value of foam is higher per inch than other types of insulation
- Closed- cell foam has a very low potential for water vapour to pass through it
- Closed- cell Polyurethane foam is not susceptible to damage from short term wet conditions
- Not compress or settle
- Foam bonds to the structure
- Resist wind shear

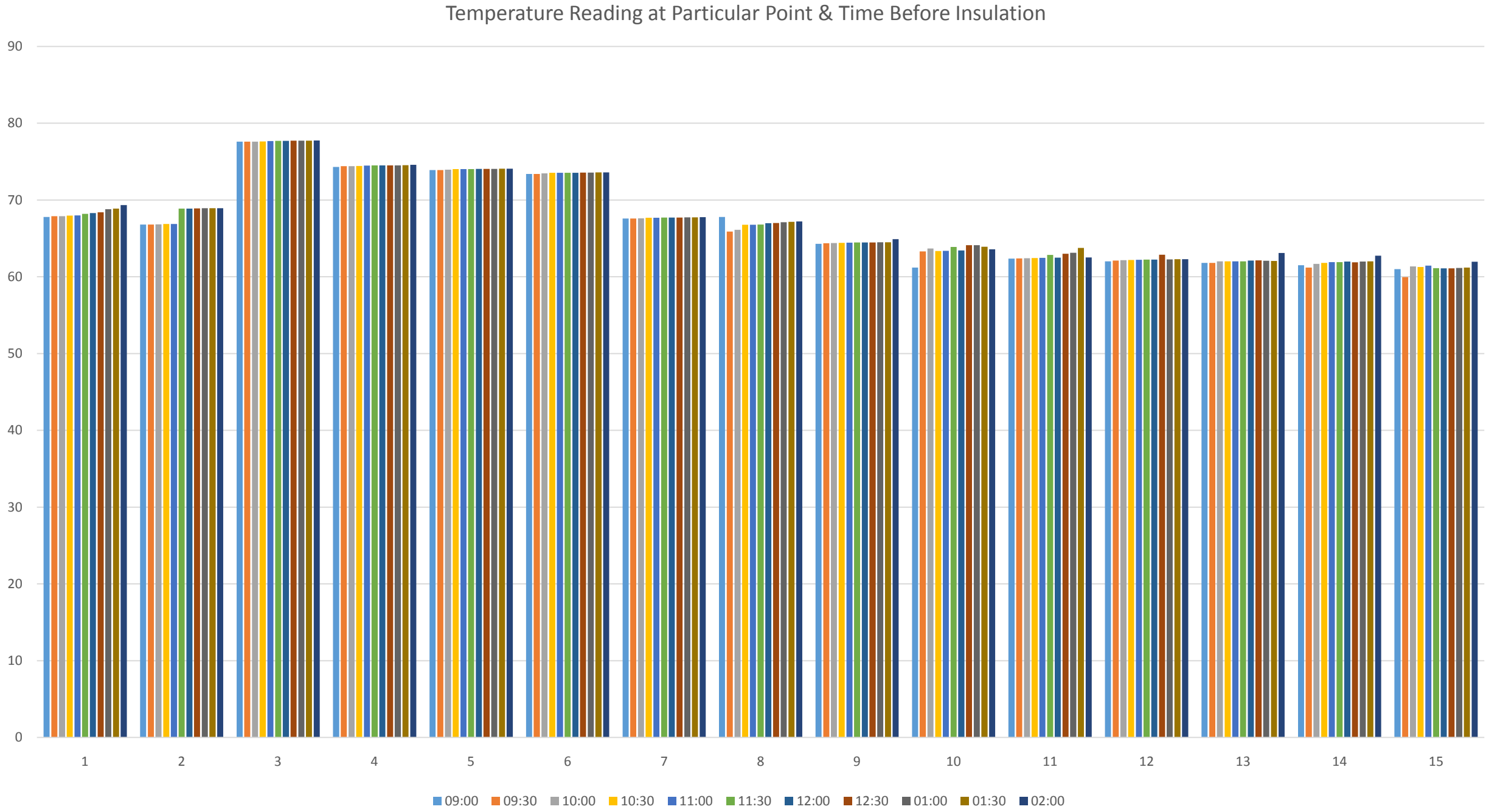
Company Layout of Steam Pipe Line



NOTATIONS	NAME OF MACHINES
A	MAIN HEADER AND STEAM OVEN
B	BOILER
C	STEAM DRUMS AND CENTER MACHINE
D	CHEMICAL VESSEL

Average Temperature Reading of 8 Days at Particular time & Point Before Insulation

POINT/TIME	09:00	09:30	10:00	10:30	11:00	11:30	12:00	12:30	01:00	01:30	02:00
1	67.8	67.9	67.9	67.98	68	68.2	68.3	68.39	68.81	68.89	69.35
2	66.8	66.8	66.83	66.88	66.88	68.89	68.89	68.9	68.92	68.94	68.93
3	77.6	77.6	77.61	77.64	77.69	77.7	77.71	77.72	77.73	77.74	77.76
4	74.3	74.4	74.4	74.43	74.49	74.5	74.51	74.52	74.52	74.54	74.58
5	73.9	73.9	73.96	74.03	74.03	74.04	74.05	74.06	74.06	74.08	74.09
6	73.4	73.4	73.47	73.54	73.54	73.55	73.55	73.56	73.58	73.59	73.59
7	67.58	67.6	67.62	67.7	67.7	67.71	67.72	67.72	67.74	67.75	67.76
8	67.8	65.9	66.12	66.78	66.78	66.8	66.98	67	67.1	67.17	67.2
9	64.3	64.36	64.39	64.41	64.45	64.46	64.47	64.48	64.49	64.5	64.89
10	61.2	63.3	63.69	63.35	63.39	63.89	63.43	64.12	64.12	63.91	63.59
11	62.36	62.4	62.42	62.45	62.47	62.84	62.5	63	63.13	63.75	62.53
12	62	62.1	62.17	62.19	62.22	62.24	62.25	62.88	62.26	62.28	62.29
13	61.8	61.8	62.01	62	62.01	62.01	62.1	62.13	62.08	62.05	63.09
14	61.5	61.2	61.69	61.8	61.9	61.9	61.98	61.89	61.98	62	62.74
15	61	59.97	61.34	61.28	61.45	61.12	61.1	61.1	61.15	61.19	61.96


Temperature Reading at Particular Point & Time Before Insulation
90
80
70
60
50
40
30
20
10
0
1
2
3
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5
6
7
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09:00
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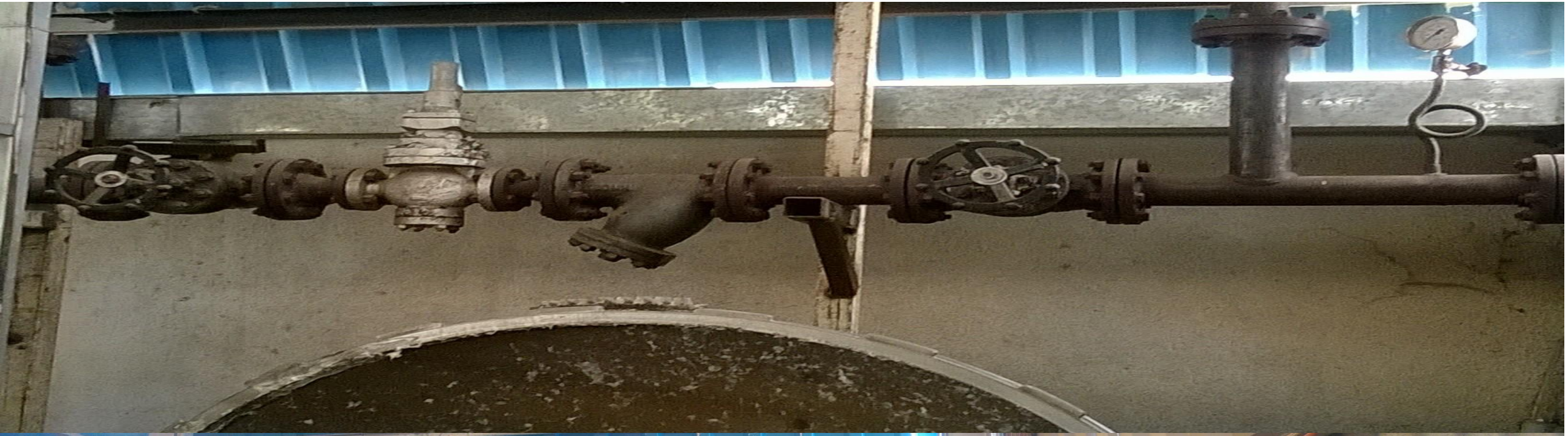
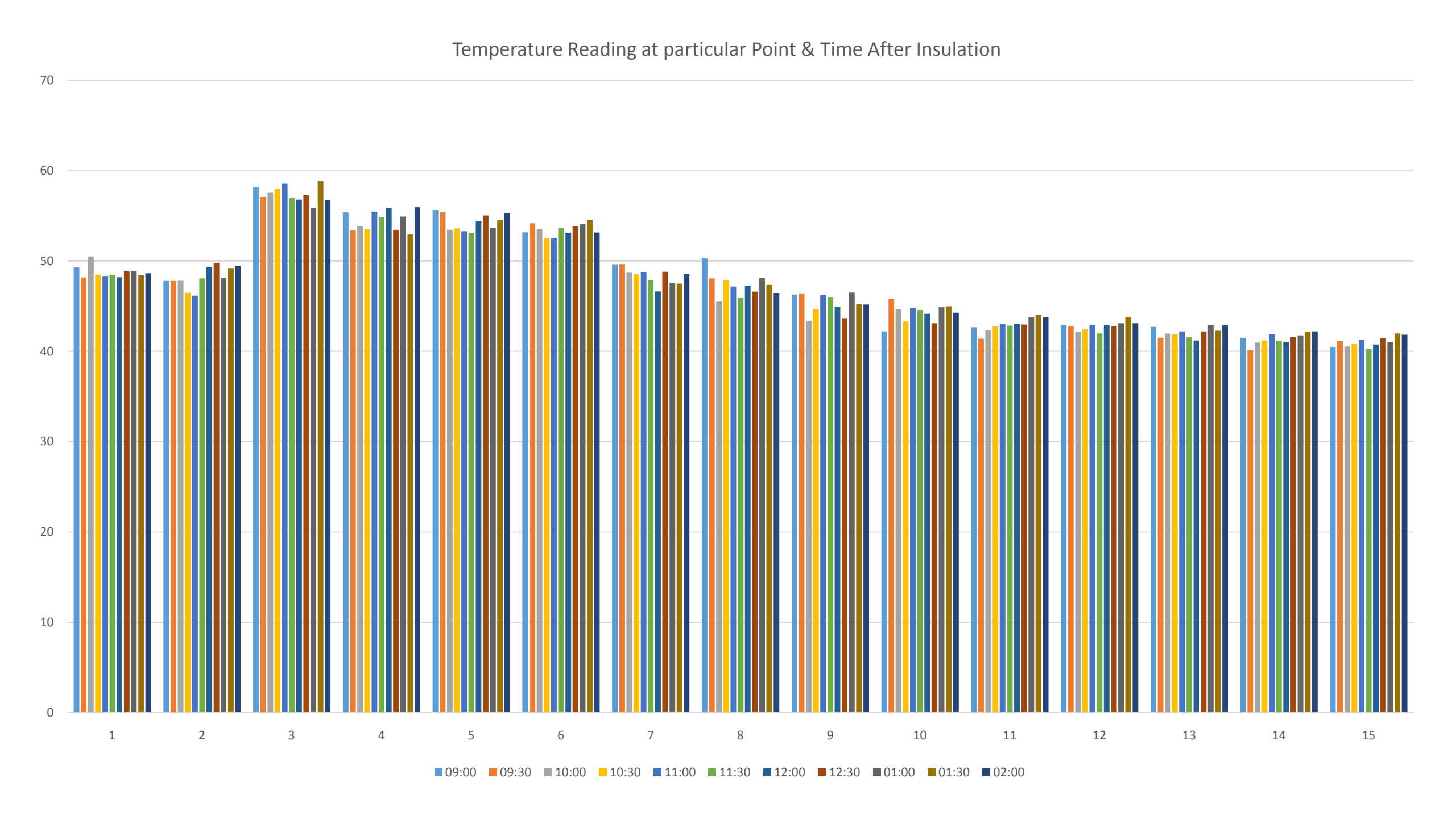
WORK PLAN




Kohinoor Products

Average Temperature Reading of 8 Days at Particular time & Point Before Insulation

POINT/TIME	09:00	09:30	10:00	10:30	11:00	11:30	12:00	12:30	01:00	01:30	02:00
1	49.3	48.2	50.5	48.48	48.3	48.5	48.22	48.89	48.91	48.43	48.65
2	47.8	47.8	47.83	46.48	46.18	48.1	49.34	49.8	48.14	49.16	49.48
3	58.2	57.1	57.59	57.94	58.59	56.91	56.81	57.32	55.86	58.81	56.76
4	55.4	53.4	53.9	53.53	55.49	54.85	55.91	53.48	54.94	52.94	55.98
5	55.6	55.4	53.48	53.63	53.25	53.14	54.45	55.06	53.72	54.56	55.34
6	53.2	54.2	53.57	52.54	52.58	53.65	53.15	53.86	54.11	54.59	53.18
7	49.58	49.6	48.72	48.56	48.8	47.89	46.63	48.82	47.55	47.5	48.56
8	50.3	48.1	45.52	47.88	47.18	45.91	47.28	46.62	48.13	47.37	46.42
9	46.3	46.36	43.39	44.71	46.25	45.96	44.93	43.68	46.51	45.2	45.19
10	42.2	45.8	44.69	43.31	44.8	44.59	44.17	43.12	44.88	44.98	44.28
11	42.66	41.4	42.3	42.75	43.05	42.85	43.05	42.98	43.76	44.01	43.79
12	42.9	42.8	42.19	42.45	42.92	41.98	42.92	42.79	43.12	43.81	43.12
13	42.7	41.5	41.97	41.89	42.2	41.56	41.2	42.2	42.89	42.29	42.89
14	41.5	40.1	40.98	41.19	41.9	41.18	41.01	41.56	41.76	42.18	42.21
15	40.5	41.12	40.54	40.84	41.28	40.26	40.75	41.45	41.02	41.98	41.85


Temperature Reading at particular Point & Time After Insulation
70
60
50
40
30
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10
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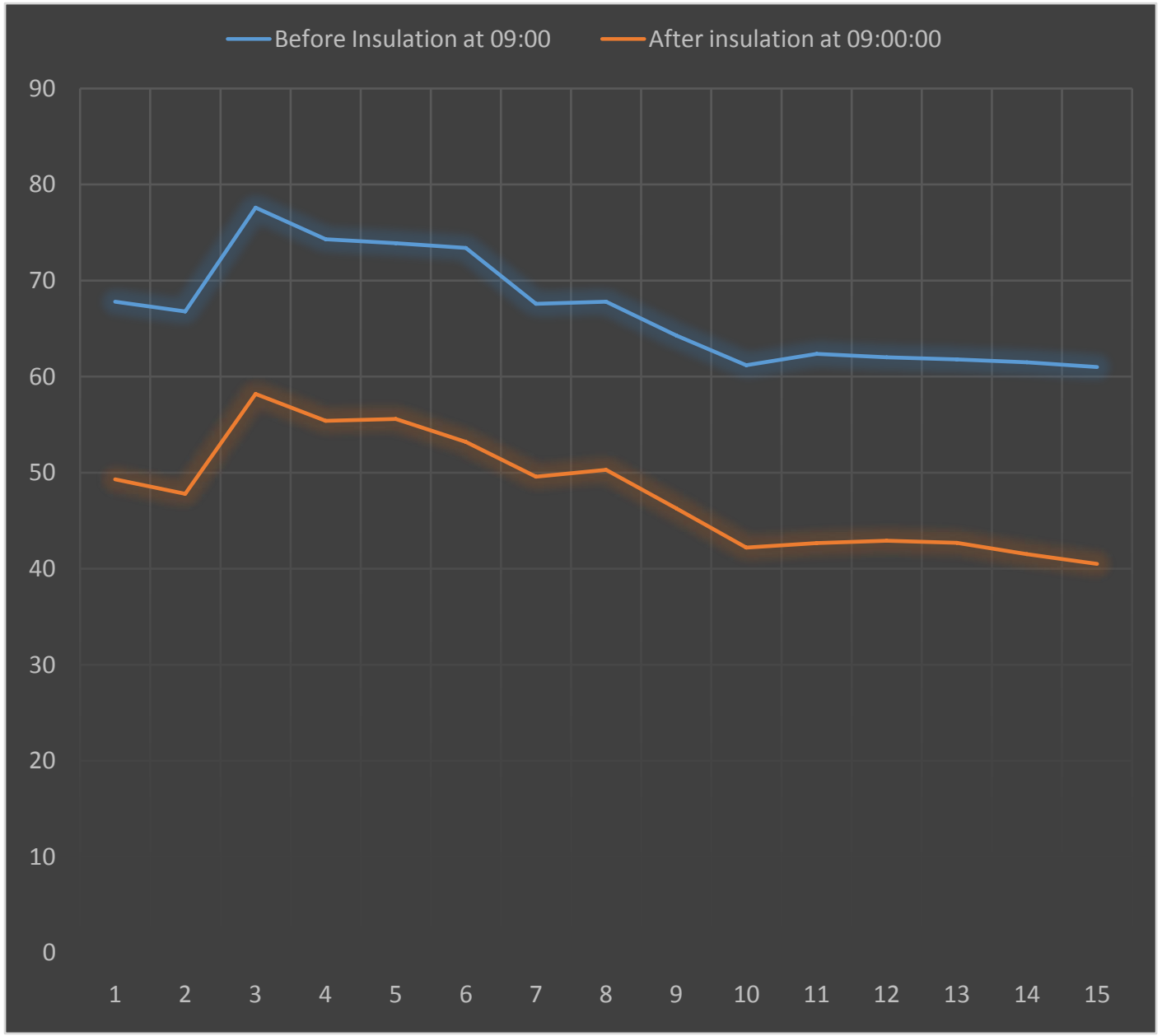
12:30
01:00
01:30
02:00

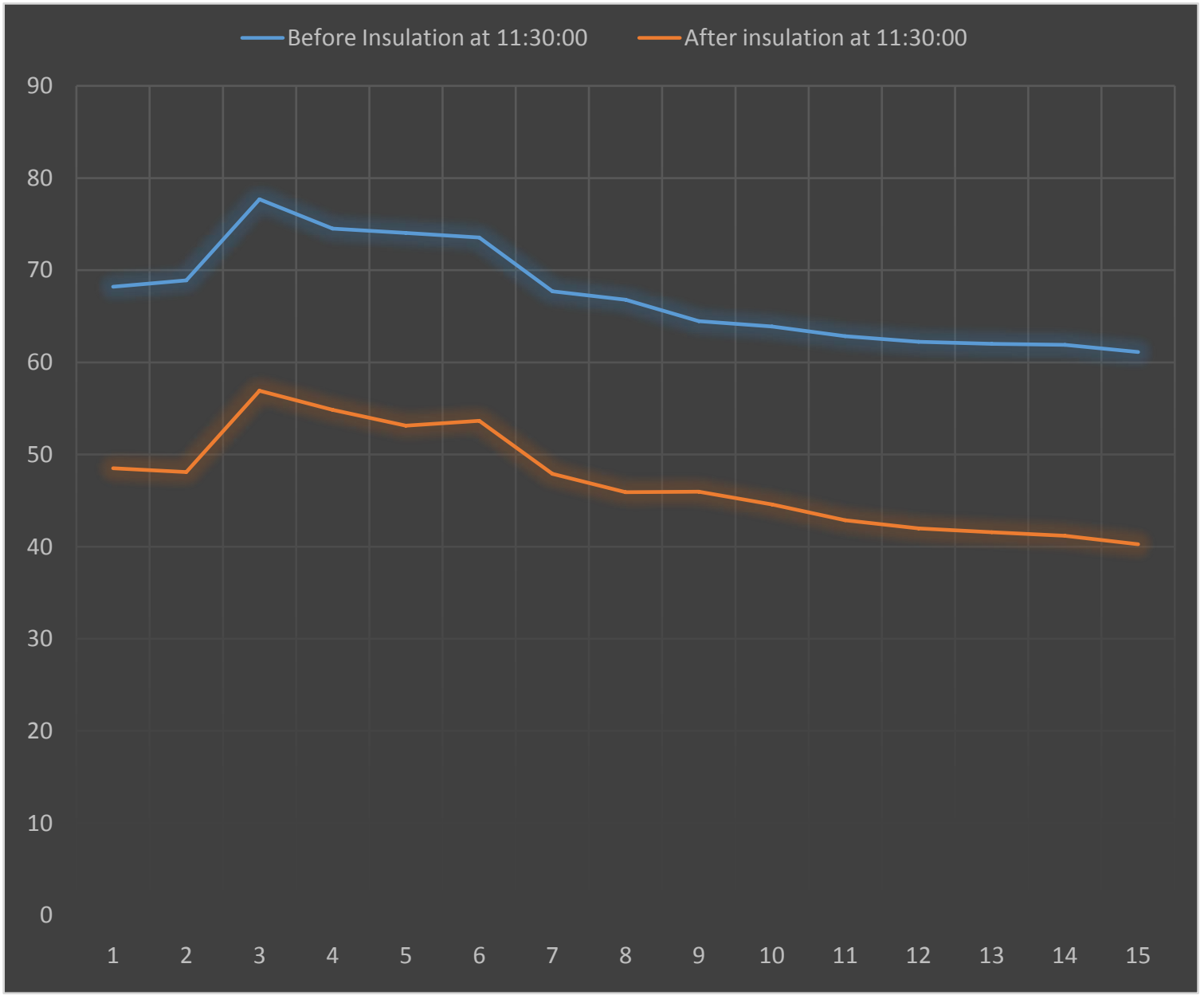
Temperature Difference at Particular Time & Point

POINT/TIME	Before Insulation at 09:00	After insulation at 09:00:00
1	67.8	49.3
2	66.8	47.8
3	77.6	58.2
4	74.3	55.4
5	73.9	55.6
6	73.4	53.2
7	67.58	49.58
8	67.8	50.3
9	64.3	46.3
10	61.2	42.2
11	62.36	42.66
12	62	42.9
13	61.8	42.7
14	61.5	41.5
15	61	40.5



Temperature Difference at Particular Time & Point

POINT/TIME	Before Insulation at 11:30	After insulation at 11:30:00
1	68.2	48.5
2	68.89	48.1
3	77.7	56.91
4	74.5	54.85
5	74.04	53.14
6	73.55	53.65
7	67.71	47.89
8	66.8	45.91
9	64.46	45.96
10	63.89	44.59
11	62.84	42.85
12	62.24	41.98
13	62.01	41.56
14	61.9	41.18
15	61.12	40.26



Temperature Difference at Particular Time & Point

POINT/TIME	Before Insulation at 02:00:00	0After insulation at 2:00:00
1	69.35	48.65
2	68.93	49.48
3	77.76	56.76
4	74.58	55.98
5	74.09	55.34
6	73.59	53.18
7	67.76	48.56
8	67.2	46.42
9	64.89	45.19
10	63.59	44.28
11	62.53	43.79
12	62.29	43.12
13	63.09	42.89
14	62.74	42.21
15	61.96	41.85

CHAPTER 4- CALCULATION

- **DESCRIPTION**

Q= Heat loss

Ts = Surface temperature of pipe

Ta= Ambient temperature

ΔT=Temperature difference

r_i=Inner radius of pipe = 50 mm

ro =Outer radius of pipe = 55 mm

r_1 = Critical Radius of mineral wool (insulating material)

h_i = Heat transfer co efficient of steam = 14.2 w/m² k

ho = Heat transfer co efficient of air =7.9 w/m² k

K_1 = Thermal conductivity of mild steel pipe =54 w/m k

K_2 = Thermal conductivity of mineral wool (insulator) =0.033 w/m k

➢ CRITICAL THICKNESS

$$r_1 = \frac{K}{h}$$

$$= \frac{54}{14.2}$$

$$= 3.802816 = 38.028 \text{ mm}$$

➢ CRITICAL RADIUS

$$r = ro + r_1$$

$$= 55 + 50$$

$$= 105 \text{ mm}$$

➢ HEAT LOSS CALCULATION BEFORE INSULATION

$$Q = \frac{\Delta T}{\frac{1}{h_i A_i} + \frac{ln(\frac{ro}{ri})}{2\pi KL} + \frac{1}{ho\ Ao}}$$

$$Q = \frac{44(2\pi)(34.74)}{\frac{1}{(14.2*.05)} + \frac{ln(\frac{55}{50})}{54} + \frac{1}{(7.9*.055)}}$$

$$Q = 9604.225/3.711$$

$$Q = 2588.04\ w$$

4.5 HEAT LOSS CALCULATION AFTER INSULATION

$$Q = \frac{\Delta T}{\frac{1}{h_i A_i} + \frac{\ln(\frac{r1}{ri})}{2\pi K_1 L} + \frac{\ln(r0/r1)}{2\pi K_2 L} + \frac{1}{ho\ Ao}}$$

$$Q = \frac{2\pi(34.74)(24)}{\frac{1}{(14.2*.05)} + \frac{ln(0.055/.05)}{54} + \frac{ln(0.105/0.055)}{0.33} + \frac{1}{(7.9*0.105)}}$$

$$Q = 5238.66/4.5746$$

$$Q = 1145.146\ w$$

➢ COMPANY BENEFIT

➢ DIFFERENCE IN HEAT LOSS AFTER INSULATION

Q = Q (before) – Q (after)

= 2588.04 – 1145.146

= 1442.58 w

= 1.44258 kW

➢ ANNUAL POWER SAVING

P=1.44258*24*365

P=12637.0008 kwh/year

Total Saving per Year= 59393.90 □

Work Plan

ACTIVITY	AUG	SEPT	OCT	NOV	DEC	JAN	FEB	MAR	APR
Problem definition									
Literature review									
Analyses									
Implementation									
Analyses									
Thesis									

Conclusion

- By insulated the pipes the heat losses are decreased also the energy required is decreased. So the boiler requires less input as fuel and gives more output as steam so overall efficiency of plant is increased.

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"AN ISO 9001:2000 CERTIFIED COMPANY"

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A HANDLOOM PRODUCTS

LETTER OF APPRECIATION

We would like to thanks the following students for their hard work and dedication towards the project. They spent there valuable hours towards there project which will directly help to the company

We sincerely appreciate the efforts of folowing students in the project which heps us to complete our insulation work.

PATEL DARSHAN P.

PATEL JAY R.

PATEL VIKAS K.

PATEL RIYA K.

SINCERELY,

Pankaj Patel

MR. PANKAJ PATEL (M.D.)

THANK YOU