# Recommendation 1: Insulate Injection Molding Barrels

Recommended Action

Insulate the exposed surfaces on the injection molding barrels to both save energy and promote safety in the workplace.

Summary of Estimated Savings and Implementation Costs

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| --- | --- |
| Annual Cost Savings | $561 |
| Implementation Cost | $416 |
| Payback Period | 9 months |
| Annual Electricity Savings | 11,058 kWh |
| Annual Demand Savings | 1.3 kW |
| ARC Number | 2.2511.1 |

Current Practice and Observations

There are three injection molding barrels running at 150 oF, 240 oF and 130 oF. The exposed surfaces on these are hot enough to cause injury when the injection molding barrels are working. Insulating these will also reduce heat losses through the convection.

Anticipated Savings

**Line 1:**

Insulate the side surface of the injection molding barrel with 1-1/2 in insulation blanket to reduce heat loss. The annual heat loss, Q1, can be estimated as:

Q1 = h × C1 × A1 × (ΔT1E - ΔT1P) × OH1,

where

h = Combined convective and radiative heat transfer coefficient, estimated

to be 0.8 Btu/(hr·ft2·oF)[[1]](#footnote-1)

C1 = Conversion constant, 2.39×10-4 kW/(Btu/hr)

A1 = Estimated surface area (side) in line 1; 22.5 ft2

ΔT1E = Existing temperature difference between surface and ambient air; = 150oF - 75oF = 75oF

ΔT1P = Proposed temperature difference between surface and ambient air; after fully insulating the heater;

= 95oF - 75oF = 20 oF

OH1 = Hours per year operation; 8,736 hrs/yr (24 hours per day, 7 days per week, 52 weeks per year)

Thus,

Q1 = 0.8 Btu/(hr·ft2·oF) × 2.93×10-4 kW/(Btu/hr) × 22.5 ft2 × (75oF - 20oF) × 8,736 hrs/yr

= 2,534 kWh/yr.

**Line 2:**

Insulate the side surface of the injection molding barrel with 4 in insulation blanket to reduce heat loss. The annual heat loss, Q2, can be estimated as:

Q2 = h × C1 × A2 × (ΔT2E - ΔT2P) × OH2,

where

A2 = Estimated surface area (side) in line 2; 22.5 ft2

ΔT2E = Existing temperature difference between surface and ambient air;

= 240oF - 75oF = 165oF

ΔT2P = Proposed temperature difference between surface and ambient air; after fully insulating the heater;

= 95oF - 75oF = 20oF

OH2 = Hours per year operation; 8,736 hrs/yr (24 hours per day, 7 days per week, 52 weeks per year)

Thus,

Q2 = 0.8 Btu/(hr·ft2·oF) × 2.93×10-4 kW/(Btu/hr) × 22.5 ft2 × (165oF - 20oF) × 8,736 hrs/yr

= 6,681 kWh/yr.

**Line 3:**

Insulate the side surface of the injection molding barrel with 1½ in insulation blanket to reduce heat loss. The annual heat loss, Q3, can be estimated as:

Q3 = h × C1 × A1 × (ΔT3E - ΔT3P) × OH3,

where

A3 = Estimated surface area (side) in line 3; 22.5 ft2

ΔT3E = Existing temperature difference between surface and ambient air;

= 130oF - 75oF = 55oF

ΔT3P = Proposed temperature difference between surface and ambient air; after fully insulating the heater

= 90oF - 75oF = 15oF

OH3 = Hours per year operation; 8,736 hrs/yr (24 hours per day, 7 days per week, 52 weeks per year)

Thus,

Q3 = 0.8 Btu/(hr·ft2·oF) × 2.93×10-4 kW/(Btu/hr) × 22.5 ft2 × (55oF - 15oF) × 8,736 hrs/yr

= 1,843 kWh/yr.

The annual electricity savings, ES, will be:

ES = Q1 + Q2 + Q3

= 11,058 kWh

The annual demand savings, DS, is calculated as:

DS = Q1 / OH1 + Q2 / OH2 + Q3 / OH3

= 1.3 kW

The annual cost savings, ACS, is estimated as:

ECS = ES × EC + DS × DC

where,

EC = Electricity cost; $0.050/kWh

DC = Demand cost; $5.45/kWh

Therefore

ECS = 11,058 kWh/yr × $0.050/kWh + 1.3 kW × $5.45/kW

= $554 + $7

= $561/yr

Implementation Cost

The implementation cost for this assessment recommendation is $4/ft2 for 1-1/2 in insulation blanket, $9/ft2 for 4 in insulation blanket, and $0.5/ft2 for labor. The implementation cost is calculated as:

IC = A1 × ($4/ft2 + $0.5/ft2) + A2 × ($9/ft2 + $0.5/ft2) + A3 × ($4/ft2 + $0.5/ft2)

= $416

**The annual electricity savings for this recommendation will be 9,109 kWh/yr. The annual demand savings will be 1.3 kW/yr. The estimated annual cost savings is $561 and, with $416 in implementation costs, the payback period will be about 9 months.**

Implementation Cost References

The below links are for implementation cost references. We do not endorse/recommend these brands or products. Furthermore, these products may or may not be suitable for the application. The client should contact a vendor(s) to conduct a detailed study of the process, in order to determine the best product for the recommended application.

* <https://www.mcmaster.com/9328K512/>
* <https://www.mcmaster.com/9328K515/>

1. Heat Transfer: A Practical Approach, by Yunus A. Cengel [↑](#footnote-ref-1)