guidance

Insulation

Insulation is a simple, early step in energy management programs that is typically low cost, will save energy within the process, reduce HVAC costs and can engage employees in energy efficiency awareness. This guidance will show the brewer some steps that can be taken to ensure effective insulation management.

A quick review of insulation measures is shown in the table below.

In a brewery, the pipes that transport steam, hot water, chilled water and glycol are usually wrapped with traditional insulation materials, and are usually insulated when installed. However due to the difficulty of insulating odd shapes, bends and large components, there are many parts of these systems that have portions of their thermal envelope left unprotected. These non-insulated parts might include pipe elbows and joints, valves and flanges, large boiler parts, tanks, and heat exchangers. Having these non-insulated parts are not only an energy loss, but a safety issue as well.

Insulation performs one or more of the following functions:

- Reduce heat loss to achieve energy conservation
- Protect the environment by reducing CO_2, NOx, and GHG emission
- Control surface temperatures for personnel and equipment protection

Insulation considerations

WHAT	WHY	HOW
Insulation for hot and cold pipes, valves, flanges, tanks and heat exchangers	• Increases operating efficiency • Lowers energy cost • Lowers building HVAC cost • Lowers overall GHG emission • Controls surface temperature for both employee and equipment protection • Reduces noise	All Employees • Be aware of missing damaged insulation and areas that require insulation • Perform bi-annual insulation survey to repair, replace or add insulation where needed Maintenance Team • Identify necessary material needed for insulation project • Install, replace or repair insulation • Document when job is complete and communicate back to responsible team members to identify problems • Follow up with individual reporting insulation issues; close the loop • Update insulation survey, document work

- Control the temperature of commercial and industrial processes
- Prevent or reduce condensation on surfaces
- Increase operating efficiency of heating/ventilation/cooling, plumbing, steam, process and power systems
- Prevent or reduce damage to equipment from exposure to fire or corrosive atmospheres
- Reduce noise from mechanical systems

Be aware that insulation only slows down heat loss or heat gain - temperatures will always fluctuate from hot to cold. However, with insulation, less heat or cold is required to maintain desired temperatures. Consider the following example of a cooler full of beer: When ice is placed in the cooler, it immediately begins extracting heat from the beer. At the same time, the warmer outside air migrates towards the air inside of the cooler. Thermal insulation in the cooler slows this advancing outside air and allows the ice time to cool the beer. As heat is extracted from the beer, the ice melts - but as the beer cools, less ice will melt. As long as no air enters the cooler, the beer temperature should eventually equalize with the remaining ice temperature. Theoretically, the remaining ice should last as long as the beer remains in the cooler.



In many facilities, personnel will leave the flanges and valves uninsulated while insulating the pipe systems. Often the flanges are left bare, to avoid undetected leaks that may corrode the flange bolts. However, molded box insulation with inserts in the bottom of the box provides early warning of any leak. Non-insulated flanges and valves also introduce temperature stress, which may cause the leaks. Therefore, flanges and valves should never be left uninsulated.

It is also important to insulate all hot parts of the system (with the exception of safety valves). This includes all flanged joints on the mains, as well as valves and other fittings. It was once common practice to cut back the insulation at each side of a flanged joint in order to leave access to the bolts for maintenance purposes. But a non-insulated flange is equivalent to leaving a two-foot piece of bare pipe uninsulated!

Adequate thermal insulation is essential for preventing both heat loss from hot surfaces of ovens, furnaces and piping and heat gain in refrigeration systems. Inadequate thickness of insulation or deterioration of existing insulation can have a significant impact on the energy consumption. The insulation material is an important factor in achieving low thermal conductivity and low thermal inertia. Development of superior insulating materials and their availability at reasonable prices have made retrofitting or re-insulation a desirable and viable energy saving option.

Prefabricated insulating covers for flanged joints and valves are also more widely available. These usually come with fasteners for easy detachment that provide access for maintenance purposes.

Four Steps For Effective Insulation

Step 1: Create a team to identify all missing insulation
Step 2: Prioritize insulation
Step 3: Order and install insulation
Step 4: Install management program

Step 1: Create a team to identify all missing insulation

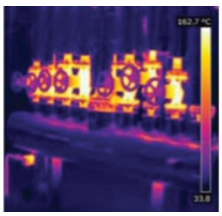
Assign a leader that will be responsible for identifying uninsulated pipe, valves and flanges. Assign team members as needed to assist the champions. This is a great opportunity to engage employees in the energy efficiency program and culture. Any employee can define a hot surface or value that has bad insulation or needs insulation installed.

The leader and team should set up an insulation survey to get an overview of all parts in the plant that are not insulated. All parts in the plant with poor insulation (soaked, compressed insulation). Poor insulation can also indicate moisture or ice on the lower part of horizontal pipe, at the bottom elbow of a vertical pipe, or around pipe hangers/saddles, as moisture may migrate to low areas.

The team should follow all hot (steam and condensate) lines and cold lines. Findings should be documented in a spreadsheet such as the following example:

HOT/COLD	LOCATION	DESCRIPTION (pipe, flange, valve, etc.)	TEMPERATURE

Use Thermographic Equipment Or Thermometers To Measure Temperatures And Detect Poor Insulation.


The survey should be reviewed twice a year to ensure that all changes to the system are accounted for and that newly appeared poor insulation is detected.

Step 2: Prioritize insulation

Once the survey is complete, determine which parts above 120° F or below 40° F are non-insulated. Determine if these parts need to be available for maintenance frequently (more than once per year). For parts that require maintenance more than once per year, use insulation jackets. For those parts that don't need maintenance or inspection more than once per year, use fixed insulation.

Prioritize the installation of the insulation by focusing on the hot lines – the hottest parts should have the highest priority.

Step 3: Order and install insulation

When non-insulated surfaces have been identified and prioritized, contact local insulation vendors for custom solutions and prices. For steam lines, valves, and flanges the boiler supplier can also be contacted. Look to other qualified vendors for competitive prices. Install the insulation or have it done by the supplier. Make sure to oversee and control the quality of the work.

Five Components That Characterize Quality Of The Insulation Job:

- *Insulation Material: The insulation itself should be a low thermal conductivity material with low water vapor permeability; it should be non-wicking.*
- *Insulation Joint Sealant: All insulation, particularly operating below ambient conditions, should utilize a joint sealant. The joint sealant should be applied as a full bedding coat to all sealant joints. A properly designed and constructed insulation/ sealant joint will retard liquid water and water vapor migration through the insulation system.*
- *Vapor Retarders: Vapor retarders prevent water vapor infiltration, keeping the insulation dry. Closed-cell insulation materials have a lower tendency to absorb water. However, most insulation materials will absorb a certain amount of water. Care should be taken to use low permeance (water vapor permeability less than 0.1 perm-inches) insulation materials or a continuous and effective vapor retarder system.*
- *The service life of the insulation and pipe depends primarily on the in-place water vapor permeance of the vapor retarder. Therefore, the vapor retarder must be free of discontinuities and penetrations. The insulation and the vapor retarder will expand and contract with ambient temperature cycling. The vapor retarder system must be installed with a mechanism to permit this expansion and contracting without compromising the integrity of the vapor retarder.*
- *Jacketing: The purpose of jacketing on pipe and vessel surfaces is to prevent weather and abrasion damage to vapor retarder and insulation. Protective jacketing is also required whenever piping is exposed to wash downs, physical abuse, or traffic. Various plastic and metallic products are available for this purpose.*
- *The jacketing must be of the band type, which holds and clamps the jacketing in place circumferentially. Pop rivets, sheet metal screws, staples or any other item that punctures should not be used because they will compromise the vapor retarder.*
- *Weather Barrier Joint Sealant: All metal-jacketed insulation systems operating below ambient conditions should utilize a weather barrier joint sealant. The joint sealant should be a liquid water resistant elastomeric material available to bond to the specified metal surface. The joint sealant is applied to all joints to prevent driven water from migrating through the joints, accumulating within the insulation system.*

Step 4: Install management program for ensuring proper insulation

After insulation needs have been prioritized, ensure that the insulation survey is executed on a regular basis (e.g. every quarter) so that all insulation is kept in perfect condition. To ensure initial success in insulation upgrades and manage continued success, all results of the surveys, adjustments, and actions should be documented regularly. Report these results quarterly to maintain awareness among the employees.