

RiskTopics

Fire safety precautions for hot tar applied roofing systems

Zurich Resilience Solutions - Risk Engineering

Built up roof systems using hot, molten asphalt as a binder are commonly used in new building projects and building renovations. These installations often involve hot tar kettles and kettle fuel supplies that can present additional fire, explosion, and safety risks on the jobsite. Proper employee training, kettle maintenance and fire prevention measures can help mitigate these risks to ensure a safe operation.

Introduction

Molten tar or asphalt is commonly used in the construction of commercial, low slope, built up roofing systems (BUR roofs). A typical BUR system consists of several alternating layers of roofing felts rolled into a layer of hot, liquid asphalt or coal-tar. The asphalt or tar is often heated in a tar kettle and applied with mops or mechanical spreaders at the point of application. BUR systems can be surfaced with a variety of materials such as a modified bitumen cap sheet, aggregate ballasts, elastomeric coatings, hot-mopped asphalt, etc. BUR systems have been in use for over 100 years and remain popular because they offer long service life, high durability and excellent waterproofing properties when properly applied and maintained. Hot applied, rubberized asphalt or modified bitumen waterproofing membranes are also often specified for rooftop levels with accessible spaces such as pool and clubhouse levels, pet walking yards, rooftop gardens and “green” roof designs with vegetated spaces. Maintaining proper product temperatures in the tar kettle and at the point of application is critical to ensure a high quality and safe installation. Underheated or overheated asphalt can lead to performance issues with the completed roof system. Overheating can also lead to kettle fires or explosions and significantly increases worker exposure to toxic fumes.

Discussion

BUR roofs involve heating the asphalt or coal-tar product into a liquid form that releases flammable vapors in the process. The material in these tar kettles can easily reach the product’s flash point if the operations are not properly monitored and controlled. Additionally, tar kettles require a local fuel source such as LP gas or natural gas that presents additional fire and safety hazards.

Extreme caution should be exercised while installing fluid applied roof coverings. Site-specific procedures should be developed for the safe use of tar kettles and applicators to prevent a fire from occurring at the kettle or on the roof during application. The list below describes some basic fire-safety precautions when using a hot tar roof kettle or similar material heating vessel. In addition to building, roofing and kettle fire

hazards, there are numerous personnel safety considerations when working with molten asphalt; however, it is not the intent of this RiskTopic to cover worker safety hazards associated with tar kettle operations, such as burns, inhalation, slips, trips and falls, etc.

Project-specific safety requirements along with the fire-prevention practices listed below should be reviewed and confirmed with your roofing subcontractor during a Pre-Construction Meeting and again with a Job Hazard Analysis prior to the start of roofing. Roofing crews should then conduct daily pre-task plans to ensure all hazards are recognized by current crew members and all necessary safety measures are in place prior to start of operations.

Guidance

Fire safety considerations

- Tar kettles and kettle fuels should be located at grade (outside and away from the building) and heated materials pumped or hoisted to the roof. The kettle and any associated pumps, hoses, hot pipes, and fittings should be inspected prior to each use.
- The kettle should be attended and operated by a competent person at all times (within eyesight and 25 feet of kettle). The kettle operator should remain on the same level as the kettle.
- The competent person should be knowledgeable of the material's temperature limits and kettle features to prevent heating above the flash point.
- In conjunction with a Job Hazard Analysis, the project team should identify the maximum kettle temperature and the specified point-of-application temperature. The maximum kettle operating temperature is critical to reduce the risk of a kettle fire or explosion, as recommended on the product specifications or in accordance with ASTM D312. The recommended point-of-application temperature, also referred to as the equiviscous temperature (EVT) will be specified by the manufacturer and the target application range will typically be plus or minus 25°F of the EVT.
- Working and flash point temperatures should be available on keg packaging or SDS sheets and vary depending on the asphalt's ASTM type.
- Never heat kettle contents above the working temperature (usually 25° to 50° F below the flash point) to improve workability at application point, a common but dangerous practice for cold weather roofing. Instead, use double-jacketed kettles, insulated lines, hot luggers and reduce distances to the point of application when cold weather roofing is necessary.
- The kettle or operator must have a functional, readable thermometer. Kettle mounted thermometers should be verified with the use of a calibrated immersion-style temperature probe.
- Locate kettle greater than 10 feet from the building and any egress paths or exits.
- Keep combustible materials, packaging, debris, etc. at least 20 feet from the kettle; require daily removal of roofing debris and product packaging.
- Spontaneous combustion of improperly stored roofing mops and rags is possible. Remove excess asphalt from roofing mops at conclusion of work. Remove used mops and rags from the roof and store away from the tar kettle, combustible materials, and fuel sources.
- At least (2) 20 lb. fire extinguishers are recommended within 10 to 25 feet of the kettle. Do not place fire extinguisher on the kettle or immediately next to it since the kettle could be on fire preventing access to the fire extinguisher. Additional extinguishers should be distributed across the roof.
- In the event of a kettle fire, water should not be used to extinguish the fire. Introducing water into a kettle on fire may cause the molten asphalt to froth, splatter and possibly overflow the kettle, exposing the operator or emergency responder to injury.
- Keep propane cylinders and other fuel sources more than 10 feet from the kettle. Secure cylinders at all times and limit quantity to a two-day supply.
- Follow all OSHA regulations and NFPA 58 Standards (Standard for the Storage and Handling of Liquefied Petroleum Gases) concerning handling and storage of propane or other burner fuel sources. Propane storage is not allowed within a building.
- Store all cleaning solvents away from the kettle and fuel cylinders.

- Kettle should have a tight fitting, metal cover (minimum 14 gauge) capable of smothering a potential fire and a quick closing valve at the spigot.
- Kettles should never be filled above the manufacturer specified operating limit. Consider splitting large kegs into manageable sizes to prevent splashing when loading the kettle.
- Ensure the kettle outlet has a quick-closing valve. An extension handle is necessary as well for access to the valve in the event of a kettle fire.
- Maintain a fire watch in accordance with NFPA 51-B after the kettle is turned off each day. If the roofing work also involves torch-applied membranes or systems, increase the fire watch to 120 minutes (in accordance with NFPA 241).
- Do not attempt to move or relocate kettle while contents are still molten. Kettle wheels should be chocked on both sides at all times when not in transit.
- Whenever possible, transfer hot tar in wheeled carts or luggers instead of hand-held buckets; pump product to upper or lower roof levels instead of using ladders to carry or hoist product.
- Prohibit smoking on the roof during any roofing activity.

Additional fire safety considerations when the tar kettle must be located on the roof

Tar kettles and fuel sources should be located at grade (reference NFPA 241, Chapter 9); however, there may be circumstances where placement of the kettle on the roof is unavoidable (e.g., high rise buildings, site logistics, etc.) In such cases, these additional fire safety considerations should be followed.

Note – if this arrangement is required, always obtain prior approval, or permits from the local Authority Having Jurisdiction to ensure compliance with local construction codes. Always notify the fire department whenever a tar kettle and fuels will be located above grade level.

- Verify weight of full kettle and asphalt kegs do not exceed structural capacity of roof.
- Locate kettle and fuels greater than 20 feet from egress paths and roof exits and greater than 6 feet from roof edges unless suitable guardrails are in place.
- Locate kettle at least 10 feet from walls and roof mounted equipment. Locate kettle at least 20 feet from walls with combustible framing, insulation or EIFS systems (or use a fire resistive barrier if adequate spacing is not possible).
- Place the kettle on a noncombustible base.
- Consider spill containment means in the event of tank or hose leak (i.e., ensure liquid asphalt cannot flow into a floor opening, stairwell or over the roof edge exposing workers and materials below).
- Any mops and rags must be safely disposed of and not left in buckets or unattended on the roof. Buckets or buggies must not leak.
- Make sure kettle wheels are chocked or locked to prevent rolling or movement from bumping. Kettle must be leveled prior to operation.
- For mid- and high-rise construction – the building's fire protection standpipe and hose connections should be completed up to the roof level prior to firing the roof kettle.
- Use a daily Hot Works Permit procedure to monitor and control kettle fire hazards and to keep all parties informed as to when kettle is in operation. Consider an extended fire watch period for roof-based kettle operations and cease roofing operations at least one hour prior to end of shift.

Conclusion

The hot tar applied roofing work should be considered a high hazard activity. It is important to pre-plan the work to make sure all unnecessary hazards and risks are eliminated prior to the start of roofing and to perform routine equipment and work area inspections during hot tar roofing operations. Kettle operations and asphalt temperatures should carefully follow all manufacturer guidelines. All hazards should be reviewed, and specific procedures should be developed which take into account any site-specific considerations. These procedures should be reviewed with all involved and affected site personnel prior to the start of roofing operations.

For more information on Zurich's extensive Risk Engineering and Sustainability services, please contact your Risk Engineer or visit us at [Risk Engineering and Sustainability Services | Zurich Resilience Solutions](#).

References

“NFPA 241.” NFPA 241: Standard for Safeguarding Construction, Alteration, and Demolition Operations, www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards/detail?code=241. Accessed 25 July 2023.

“NFPA 58.” NFPA 58: Liquefied Petroleum Gas Code, www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards/detail?code=58. Accessed 25 July 2023.

“ASTM D312 - Standard Specification for Asphalt Used in Roofing.” D312/D312M, www.astm.org/d0312_d0312m-16ar23.html. Accessed 25 July 2023.

“Recommendations Regarding Built-up Roofing Asphalt.” Asphalt Roofing Manufacturers Association (ARMA), 4 May 2020, www.asphaltroofing.org/recommendations-regarding-built-up-roofing-asphalt/.

“Recommended Practices for Controlling Asphalt Fume Exposures.” Asphalt Roofing Manufacturers Association (ARMA), 28 Feb. 2020, www.asphaltroofing.org/recommended-practices-for-controlling-asphalt-fume-exposures/.

“29 CFR Part 1926 - Part 1926-Safety and Health Regulations for Construction.” Legal Information Institute, www.law.cornell.edu/cfr/text/29/part-1926. Accessed 25 July 2023.

“MIOsha-STD-1319 (01/13) PART 24. TAR KETTLES.” Michigan Administrative Code, www.michigan.gov/leo/-/media/Project/Websites/leo/Documents/MIOsha/Standards/Construction/CS_24/CS_24__01-09-2013.pdf?rev=042310a99b4541e096ee079bbfca2f9e&hash=8AD95FC8DDD6E3E080F7963E7100A1F4. Accessed 25 July 2023.

Other resources

[Recommended Practices for Controlling Asphalt Fume Exposures – Asphalt Roofing Manufacturers Association \(ARMA\)](#)

Other related Zurich RiskTopics

- Spontaneous combustion of rags and roofing mops
- Fire exposure reduction in buildings under construction or renovation
- Fire extinguishers for construction sites

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