

RiskTopics

Fire Safety - Hot Work

Global statistics show that hot work causes many fires each year. Whether it is in Great Britain, Finland or New Zealand, hot work has caused up to 15% of workplace fires in recent years. Whether associated with new construction, renovations, process changes or emergency repairs, hot work fires can seriously delay a project or turn a hasty production enhancement into a lengthy business interruption.

Discussion

For the purposes of this document, hot work;

- Is a support operation
- Involves portable equipment
- Introduces a source of ignition
- Is outside an area specifically intended for hot work



Source: Zurich Services Corporation

Support operation

For both construction and maintenance, hot work is used in support of the primary work or activities being conducted.

For a facility under construction, renovation, or demolition, hot work is one of many methods available to assemble or disassemble machines or materials. Welding and torch cutting are familiar examples of hot work. Additional examples include: hot riveting, grinding and heat applied to roof coverings.

For an occupied building, hot work is an activity that is not directly related to the primary business purpose of the location. Instead, hot work is associated with renovations or maintenance.

As a support activity, hot work usually is not routine or repetitive. Often, each operation takes place in a new location, or if the location is the same, the surroundings may change continuously. It is this non-routine characteristic of hot work that requires consistently enforced fire prevention procedures.

Portable equipment

Hot work equipment is portable. Smaller equipment can be hand-carried to a point of use by workers. Examples include soldering irons, soldering torches, and grinders. Larger equipment may be wheel mounted. Examples include oxyacetylene torches with large gas cylinders on a hand truck, or arc welding equipment on a cart.

Portability is the characteristic of hot work equipment that introduces the greatest challenge to the management and control of this activity. Portability allows hot work equipment to be found just about anywhere on a construction site or anywhere on or within a completed building. For example, hot work can occur on ladders, on scaffolding, inside tanks, inside water cooling towers, and on roofs.

Source of ignition

Hot work involves tools and equipment that produce heat or sparks. Examples include exposed flames, ejected hot slag, or a spray of metal sparks from a grinder.

It is this characteristic of producing heat and sparks that introduces a need to relocate or otherwise protect combustibles that may be present in the hot work area.

Areas not intended for hot work

Often, a maintenance shop includes a work area specifically designed and intended for hot work. It is ideal to perform all hot work in these areas. However, when hot work is needed to erect or modify a building or install or repair a piece of machinery, it may not be feasible or realistic to move the work to the shop. In these cases, portable hot work equipment is moved to an area not normally intended for such work.

In accordance with Zurich Best Practice, apply a hot work permit program to any hot work conducted in an area not intended for such work.

Why is a hot work permit program needed?

- Hot work is not routine work
- Hot work equipment is portable and can appear anywhere
- Hot work is a frequent source of ignition
- Hot work is often needed in areas not intended for such work

It is these characteristics that drive the need to carefully assess, control, and manage all hot work.

Hot work and contractors

Zurich data shows that the largest hot work losses have been caused by contractors. Many contractors will frequently bring their own hot work equipment onto a site. It is vital that any contractor on the premises utilises an effective hot work program.

Hot work permit programs apply to all contractors

Always assume any contractor coming onto a site is bringing their own hot work equipment with them. Require all contractors to use the site's hot work permit program.

Hot work and construction sites

When a construction project begins, the potential for fire is often rather low. Earth moving, underground utility installation and foundation work often involve minimal fire exposure to the building or structure to be erected. However, at some point, combustibles are introduced to a site.

Once combustibles are introduced to a construction site, begin using a hot work permit program in any area where combustibles are present. This includes combustible construction features or combustible contents.

Hot work permit programs and construction projects

The Site Fire Prevention Program should authorise the site Fire Prevention Program Manager to designate Hot Work Permit Required areas. These are areas that possess combustible construction features or combustible contents. Use a hot work permit program in areas that are not designed and arranged to accommodate hot work.

Guidance

Develop a written hot work program tailored to the specific needs of the location. To assist in tailoring the program to the site consider the following items; General Risk Assessment, Establishing Designated Areas, and Evaluating Options for less hazardous methods.

General risk assessment

A sample Zurich Hot Work Permit is shown in Appendix A, and a sample Zurich Hot Work Permit procedure is shown in Appendix B. Recognise that these Zurich documents are generic. These procedures and documents may need to be modified to protect against unique site Hot Work exposures. This includes controls needed to reduce the likelihood and impact of fire or explosion. Appendix C contains a risk assessment framework to assist in evaluation of unique Hot Work exposures.

General risk assessment

It is essential to have the general risk assessment conducted by a person with appropriate knowledge, training, and experience. Specifically, a person who is aware of the hazards associated with hot work.

Establish designated areas

A key component of a Hot Work program is to establish the areas where Hot Work permits are required. An efficient method of completing this is to use the general risk assessment to categorise all site areas with one of the following descriptions. An effective method to communicate these site designations is to plot them on a site map or plan.

- Designated area
- Non-designated area
- Prohibited areas

Note:

Designated areas are permanent places, inside or outside, specifically designed and intended for hot work. Non-designated areas are places where hot work is only allowed when a valid hot work permit is issued.

Prohibited areas are places where hot work is never permitted. Prohibited areas include spaces in or near buildings made of fast burning construction materials such as expanded polystyrene. Another example is an area where flammable or combustible liquids, gases, or dusts are routinely stored and used with no reasonable means available to remove these materials.

Arrange the hot work permit process to include a review of the work location description. Deny permits to work in prohibited areas.

Evaluate options for less hazardous work methods

Initiate the review of each hot work permit request with a consideration of less hazardous work methods. Confirm that no less hazardous work method is possible.

Less hazardous work methods

Vigorously pursue every effort to avoid hot work. Thoroughly review all possible less hazardous alternatives such as cold work.

Project specific work method statements

Evaluate if the hot work permit alone will provide sufficient control of hazards for the planned work.

The authoriser is responsible to identify when project specific work method statements are needed. Project specific work method statements will identify additional hazard control measures to be applied such as the use of a confined space entry permit or the use of lock-out/tag-out procedures.

Qualified personnel

Require hot work operations to be managed, supervised, and implemented by qualified personnel. Provide initial and periodic retraining for all personnel responsible for hot work operations. Qualified personnel will assume responsibilities such as:

- Authoriser – The person designated by management to authorise hot work
- Supervisor – The person conducting the periodic work area inspections
- Worker – The person conducting the hot work
- Fire Watch – The person or persons posted to monitor the work area for fire
- Fire Watch Lead – The person selected as lead for the fire watch if more than one fire watch is posted

Require contractors to comply with all elements of the hot work program including the training requirements. Verify or provide appropriate training to contractors before they are permitted to perform hot work on site.

Permit process

Use the hot work permit program to manage each hot work activity conducted in non-designated areas. The permit process should incorporate elements including:

- Review of less hazardous work methods
- Project specific work method statements
- Worker qualifications
- Work area risk assessment
- Authorisation to perform hot work
- Worker acknowledgement
- Periodic work area inspections
- Final work area inspection
- Permit close out

Each of the above elements is reviewed in detail in Appendix B.



Source: Zurich Services Corporation

Conclusion

Developing and implementing a written hot work permit program is an essential component of facility risk management.

A program for the control of outside contractors should include measures to require permission to bring hot work equipment onto the facility premises, and full compliance with the hot work permit program when hot work is to be performed.

Management should periodically verify that the hot work program is in use for both employees and outside contractors.

Zurich can provide a supply of hot work permits in support of the recommended hot work program described above. Contact your Zurich account team for a supply of permits.

References

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APPENDIX A – ZURICH HOT WORK PERMIT

Hot work permit



Company name: _____	Permit Number: _____	Authoriser name (print): _____ Date: _____
Location: _____		Authoriser signature: _____ Position: _____

<p>Part 1 – Risk assessment and authorisation</p> <p>Work method assessment: Have less hazardous methods been considered? <input type="checkbox"/> Yes <input type="checkbox"/> No Why are less hazardous methods not being applied? _____</p> <p>Project specific work method statement: Will a project specific work method statement be used and copy attached? <input type="checkbox"/> Yes <input type="checkbox"/> No</p> <p>Work by: <input type="checkbox"/> In-house staff <input type="checkbox"/> Contractor - name: _____ Supervisor and Worker qualifications verified? <input type="checkbox"/> Yes <input type="checkbox"/> No</p> <p>Work area risk assessment Completed by: _____ Position: _____</p> <p>a. Work area is not a "hot work prohibited" area? <input type="checkbox"/> Yes <input type="checkbox"/> No b. Automatic sprinkler fully operational (see note 1 on back)? <input type="checkbox"/> N/A <input type="checkbox"/> Yes <input type="checkbox"/> No c. Hot work equipment is functional, secure and in good repair? <input type="checkbox"/> Yes <input type="checkbox"/> No d. Within 10 m (35 ft) of the work area: 1. Flammable liquids removed? <input type="checkbox"/> Yes <input type="checkbox"/> No 2. Combustible materials removed or covered with fire resisting materials? <input type="checkbox"/> Yes <input type="checkbox"/> No 3. Floors swept and overhead structure clean from dust, lint, and debris? <input type="checkbox"/> Yes <input type="checkbox"/> No 4. Floor and wall openings protected against spread of sparks or embers? <input type="checkbox"/> Yes <input type="checkbox"/> No e. Does work involve enclosed equipment? (If yes, complete items 1 to 4) <input type="checkbox"/> Yes <input type="checkbox"/> No 1. Adequate ventilation provided? <input type="checkbox"/> Yes <input type="checkbox"/> No 2. Thoroughly cleaned to remove all flammables and combustibles? <input type="checkbox"/> Yes <input type="checkbox"/> No 3. Flammable vapors purged? <input type="checkbox"/> Yes <input type="checkbox"/> No 4. Purging and ventilation verified with gas detector? <input type="checkbox"/> Yes <input type="checkbox"/> No f. Fire watch (provided during and after hot work) 1. Number of personnel required? _____ 2. Location of fire watch personnel: _____ 3. First aid firefighting equipment to be provided: _____ 4. Fire watch duration (minutes) after work complete: <input type="checkbox"/> 30 <input type="checkbox"/> 60 <input type="checkbox"/> >60 minutes _____ Note: 60 minute minimum for torch applied roofing g. Additional precaution required for this job: _____</p> <p>Authorisation: <input type="checkbox"/> Work method assessment approved <input type="checkbox"/> Work area risk assessment approved 1) Work location: _____ 2) Work description: _____ Permit valid for work on: Date: _____ Times - From: _____ To: _____ Specify frequency of inspections made by the Supervisor during the hot work and the fire watch: Frequency: <input type="checkbox"/> Continuous <input type="checkbox"/> 15 minutes <input type="checkbox"/> 30 minutes <input type="checkbox"/> 60 minutes <input type="checkbox"/> Other _____</p>	<p>Part 2 – Worker acknowledgement (completed by worker before work begins) Worker and Fire Watch been briefed on precautions and emergency procedures? <input type="checkbox"/> Yes <input type="checkbox"/> No Worker name (print): _____ Date: _____ Worker signature: _____ Position: _____</p> <p>Part 3 – Periodic work area inspections (completed by supervisor during hot work and post-work fire watch period) Inspection time: ____:____ am / pm Work in compliance: <input type="checkbox"/> Yes <input type="checkbox"/> No Initials: ____ Inspection time: ____:____ am / pm Work in compliance: <input type="checkbox"/> Yes <input type="checkbox"/> No Initials: ____ Inspection time: ____:____ am / pm Work in compliance: <input type="checkbox"/> Yes <input type="checkbox"/> No Initials: ____ Inspection time: ____:____ am / pm Work in compliance: <input type="checkbox"/> Yes <input type="checkbox"/> No Initials: ____ Inspection time: ____:____ am / pm Work in compliance: <input type="checkbox"/> Yes <input type="checkbox"/> No Initials: ____ Inspection time: ____:____ am / pm Work in compliance: <input type="checkbox"/> Yes <input type="checkbox"/> No Initials: ____ Description of any non-compliance and actions taken: _____ _____ _____</p> <p>Part 4 – Final work area inspection (completed by supervisor at end of fire watch) Time hot work ended: ____:____ am / pm <input type="checkbox"/> All areas where sparks or heat might have spread have been inspected with no sign of fire. <input type="checkbox"/> All fire alarm detectors isolated during the work have been reinstated. <input type="checkbox"/> Work completed in accordance with this permit. Supervisor name (print): _____ Date: _____ Time: _____ Supervisor signature: _____ Position: _____</p> <p>Part 5 – Permit close out (completed by authoriser at end of fire watch) Permit closed based upon (check one): <input type="checkbox"/> Permit and work completed in satisfactory manner <input type="checkbox"/> Permit withdrawn due to: _____ Authoriser name (print): _____ Date: _____ Time: _____ Authoriser signature: _____ Position: _____</p>
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Zurich Hot Permit - Front

Hot work permit



**WARNING
HOT WORK IN PROGRESS
WATCH FOR FIRE!**

In case of emergency, take these actions:

Note 1: Fire protection impairments

- Only fire alarm system smoke detectors in the immediate vicinity should be isolated to avoid unwanted alarms.
- Hot work should not be permitted in any area equipped with automatic sprinklers while sprinklers are impaired.
- Where hot work cannot be avoided during a sprinkler impairment, consult with Zurich before any hot work proceeds.

Note 2: Fire watch

- Maintain an uninterrupted fire watch throughout the work area and adjacent areas.
- This includes during lunch, breaks, and shift changes.
- After work is completed, maintain the fire watch for the timeframe indicated in Part 1 of this permit.

Zurich Hot Work Permit - Back

APPENDIX B – USING THE ZURICH HOT WORK PERMIT

The Zurich hot work permit is a generic permit. As advised in the Guidance section, the content of any hot work permit selected for use at a specific location should be validated through a general risk assessment

Use of the Zurich hot work permit and permit process

The Zurich hot work permit (Appendix A) and permit process (Appendix B) are offered as generic tools. As discussed in the Guidance section, the content of any hot work permit selected for use at a specific location should be validated through a general risk assessment.

The generic Zurich hot work permit includes the following five parts:

- Part 1 - Risk assessment and authorisation
- Part 2 - Worker acknowledgement
- Part 3 - Periodic work area inspections
- Part 4 - Final work area inspection
- Part 5 - Permit close out

The following describes the use and application of each parts of the generic Zurich Hot Work Permit.

Part 1 – Risk assessment and authorisation

The intent of Part 1 is that the hot work Authoriser assumes responsibility for the risk assessment and authorisation of the hot work operation. While activities such as the work area risk assessment may be delegated to other qualified personnel, such as the hot work Supervisor, the responsibility for the hot work operation cannot be delegated. The Part 1 activities include:

- Work method assessment: Is a less hazardous work method available? The Authoriser is expected to vigorously drive a thorough discussion regarding this question. Do not permit hot work in a non-designated area until it is verified that a less hazardous method is not a suitable.

Less hazardous work methods

Consider:

- Less hazardous work methods to separate materials, such as; pipe cutters, hydraulic shears, or reciprocating saws
- Less hazardous work methods to joint materials, such as; threaded, bolted, or flanged connections
- Relocating work to an area designed for hot work.
- Project specific work method statement: Will the use of the hot work permit be sufficient to control hazards associated with the planned work? The Authoriser is responsible for recognising when work will introduce hazards that require controls beyond those addressed through the use of only a hot work permit. In these cases, a project specific work method statement will be needed.

Project specific work method statements

Consider specific work method statements for cases such as:

- Work conducted in confined spaces
- Work involving energy sources to be controlled through a lock-out/tag-out program
- Work conducted in high hazard occupancies where flammable liquids, combustible liquids, or combustible dusts are handled.
- Worker qualifications: Is the permit Supervisor qualified? Are the workers performing the hot work qualified? Consult training records to verify the qualification of in-house staff that will supervise or perform hot work. Confirm their training is current. For contractors, verify or provide appropriate training before they are permitted to perform hot work.

- Work area risk assessment: The work area risk assessment will be conducted by the Authoriser. As an alternative, the Authoriser may assign the assessment to another qualified person such as the hot work Supervisor; however, the Authoriser remains responsible for the completion of an appropriate assessment. The work area risk assessment should confirm conditions such as:
 - Work is not planned for a hot work prohibited area.
 - Automatic sprinklers, where installed, are in service. Hot work permits should not be issued for work in areas where automatic sprinklers are impaired.

Managing fixed fire protection other than sprinklers

Where possible, other types of fixed fire protection systems that are present should be in automatic service as well. Where other fixed fire protection systems rely upon smoke detection for release and the hot work may generate smoke that could activate the smoke detectors:

- Impair the automatic actuation means of the system
- Post a fire watch at the manual release
- Instruct the fire watch to promptly actuate the system in the event of a fire
 - Hot work equipment is functional, secure, and in good repair.

Example items for checking oxyacetylene hot work equipment

- Cylinders are secure
- Hose connections are tight
- Flashback arrestors are provided at each regulator outlet or torch inlet
- Flashback arrestors are serviceable, following manufacturer guidelines
- Cylinders, cylinder valves, regulators, pressure gauges, and torch assemblies show no signs of physical damage
 - Suitable conditions are present within 10 m (35 ft) of the work.

Conditions to evaluate within 10m (35ft) of the planned hot work

- Flammable liquids have been removed
- Combustible materials have been removed or protected with appropriate flameproof tarpaulins or welding screens
- Floors are swept clean of combustibles
- Above floor surfaces are cleaned of combustible dust, lint or debris
- Floor and wall openings are protected with appropriate flameproof tarpaulins, welding screens, or noncombustible close-fitting covers
 - Suitable conditions are present within any enclosure where hot work will be performed.

Conditions to evaluate for enclosure where hot work is planned

- Permits for concealed space and lock-out/tag-out are issued where appropriate
- Adequate ventilation is provided within the enclosure
- Enclosure is thoroughly cleaned to remove all flammables and combustibles
- Enclosure is cleared of flammable vapors
- Actions to purge and ventilate enclosure are verified with appropriate gas detectors
 - Qualified fire watch personnel are provided as a continuous fire watch until the permit is closed.

Conditions to evaluate when posting a fire watch

- Number of personnel needed
 - Location of personnel
 - First aid equipment needed such as portable fire extinguishers or charged hose lines
 - Fire watch duration after work is complete
- **Authorisation:** The authorisation to proceed with hot work will be signified by the issuing of a hot work permit signed by the Authoriser.

The signed permit will signal that the Authoriser has approved both the work method and the work area risk assessment. The authorisation will display the work location, the work description, the frequency of hot work area inspections by the Supervisor, and the date and times for which the permit is valid.

Expired hot work permits

When a hot work permit expires, hot work is to stop and Parts 4 and 5 of the permit are to be completed. If work is not complete, a new permit is to be issued before hot work resumes. Repeat all risk assessment and authorisation steps before issuing a new permit.

Part 2 – Worker acknowledgement

Part 2 begins with the Supervisor conducting a briefing with both the Worker and Fire Watch that includes actions to take should a fire occur and a review of the emergency actions listed on the back of the hot work permit.

The Worker performing the hot work completes Part 2 of the permit by taking the following actions:

- Verifying a briefing on precautions and emergency procedures has been conducted in conjunction with the Fire Watch.
- Sign and date Part 2 of the hot work permit.

A copy of the hot work permit with Parts 1 and 2 completed will be posted in the work area to signify that hot work may begin.



Source: Zurich Services Corporation

Part 3 – Periodic work area inspections

Once work has started, the supervisor will conduct periodic work area inspections in accordance with the frequency stipulated by the Authoriser.

During each inspection, the Supervisor will review the work area risk assessment elements in Part 1 of the permit.

Where no conditions have changed, the Supervisor will complete the first open row under Part 3 with the inspection time, a “Yes” check mark, and initials.

Where an adverse condition has developed, the Supervisor will take the following actions:

- Stop the hot work
- Complete the first open row under Part 3 with the inspection time, a “No” check mark, and initials.
- Provide a description of the non-compliant condition and actions taken.
- Complete Parts 4 and 5 and close the permit.

Part 4 – Final work area inspection

Once hot work is finished (or the hot work activity has been stopped) and the post-work fire watch period has been completed, the Supervisor implements a final work area inspection and complete Part 4 of the posted hot work permit.

Final work area inspections actions

- Visually survey all areas where sparks or heat may have spread
- Verify no signs of fire (e.g. smoke or smoldering) are apparent
- Verify all fire detection equipment impaired during the work are restored to normal service
- Verify all work is complete in accordance with the issued permit

When the final inspection is complete, the Supervisor signs and dates Part 4 of the posted permit and returns the posted copy of the permit to the Authoriser for completion of Part 5.

Part 5 – Permit close out

Once the posted copy of the permit is returned, the authoriser reviews the result of the hot work that was authorised. The Authoriser checks if the work was completed in accordance with the original authorisation or if the permit was withdrawn (work not completed). If the permit was withdrawn, record the reason on the permit.

To finalise the closing of the permit, the authoriser signs and dates Part 5 of the permit. The permit is then filed for a period of at least one year.

APPENDIX C – GENERAL RISK ASSESSMENT

The following is a list of sample questions to consider during a general risk assessment:

- What would be the potential consequences of a hot work fire or explosion? For example, consider the possible extent of any damage to property and interruption to business.
- Are there any areas where hot work will be prohibited? For example, areas near combustible/flammable materials including combustible polystyrene composite panels.
- What types of hot work activity might occur, and which can be avoided? For example, how can less hazardous work methods be used to avoid hot work?
- Who would authorise and supervise hot work?
- Who would perform hot work? For example, would work be performed by internal maintenance staff, contractors, or both?
- What standards of competence are required for those authorising, supervising, and performing hot work? What skills, experience, knowledge, and training will they need?
- What additional training/instruction will be needed for personnel who do not meet the competence standards established above?
- Are adequate procedures in place to assess the competence of contractors selected to perform hot work?

APPENDIX D – PERSONNEL TRAINING

The following provides an outline of minimum training objectives for personnel responsible for hot work operations.

Training – Minimum objectives	
Work Position	Training
All personnel	<ul style="list-style-type: none"> • Understanding the fire risks associated with hot work • Using and applying the hot work permit program
Authorisers	<ul style="list-style-type: none"> • Understanding regulatory and insurer’s requirements • Understanding corporate safety standards • Evaluating work plans and consider alternative methods • Identifying the potential consequences of a hot work fire/explosion • Assessing the risks of fire/explosion occurring, whether they can be reduced to acceptable levels, and if so using what control measures • Preparing a work plan/method statement • Competent to review an assessment/ work plan/method statement prepared by others, e.g. a contractor • Preparing or reviewing emergency procedures • Evaluating a hot work area • Selecting the number and location of Fire Watch personnel • Selecting fire watch duration • Selecting work area inspection frequencies • Closing a permit
Supervisors	<ul style="list-style-type: none"> • Verifying automatic sprinklers are in service • Evaluating hot work equipment condition • Evaluating a hot work area • Evaluating hot work involving enclosed equipment • Selecting the number and location of Fire Watch personnel • Briefing the Worker in precautions and emergency procedures • Conducting periodic hot work area inspections • Conducting final hot work area inspections • Understanding when to prohibit or stop hot work
Workers	<ul style="list-style-type: none"> • Evaluating hot work equipment condition • Understand the hot work permit program • Understand emergency procedures
Fire Watch	<ul style="list-style-type: none"> • Use manual fire protection equipment provided during fire watch assignments • Maintain visual awareness across the field of sparks or slag generate by the hot work • Identify potential fire hazards and stop work until corrected • Identify a smoldering or flaming fires • Implement emergency procedures when a fire is detected

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