



Technical Committee 8: Safety in heat treatment plants

Security considerations of personnel-free times in heat treat operations

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Preface:

Regularly, the consideration arises in heat treat operations whether staff must be present at all times and operating conditions. This contribution of the Technical Committee 8 "Safety in Heat Treatment Plants" of the Working Group heat treatment and materials technology (AWT) is intended to provide heat treatment companies with support in their concept for personnel-free periods.

Due to the wide range and differences of heat treatment plants and processes as well as construction year and manufacturer-related designs, this contribution can only give suggestions among other things which must be taken into account in the development of the concept.

General remarks

When working with the concept for personnel-free periods, legislative requirements and other standards must be complied with or taken into account, eventually a coordination with the property insurance is advisable. A risk assessment in accordance with the Occupational Safety and Health Act must be carried out. An assessment of the hazards must be used to determine which occupational health and safety measures are required. In addition, aspects of personnel-free periods, such as the extended time needed until manual intervention can be carried out, must be taken into account. The measures of occupational health and safety required due to the risks, such when people have to work alone, must take into account the established state of the technology.

The manufacturer of a heat treatment equipment shall determine its intended use and mode of operation. The safety concept of the system is designed for a specific use and operation. This information from the manufacturer is specific to the equipment and takes precedence over the general information in this article. An unattended process is understood to be a process that, once started, is to take place over a longer period of time without intervention or regular monitoring by personnel.

The use of a fire alarm system carries the risk of false alarms, but offers a significantly higher level of safety in times with no people present. With existing object monitoring, the use of a thermal imaging camera can help to detect dangerous conditions.

If there are no regular inspections or no warning device for the leakage of water-hazardous substances, obligations may result from the laws governing the protection of water and the corresponding regional regulations, depending on the quantity of liquids.

It makes sense to keep in touch with the fire brigade in order to discuss the specific hazards and coordinate reactions in the event of danger. A central shutdown point for combustible media provides a higher level of safety. It is also important for rescue workers to be provided with this specific information. It is also recommended that you include notes in the area where unattended processes take place.

Delimitation of the topic

In the present paper the main examples are considered to be:

1. Equipment operated at high temperatures or toxic, combustible atmospheres, such as salt baths, batch IQ, pusher, mesh belt or vacuum furnace
2. Supply equipment that provide necessary media for the above-mentioned equipment, such as a methanol tank, endothermic gas generator, ammonia station, propane tank.

1. Important points to consider at periods with no personnel present

- **Risk and risk assessment**

A formal risk assessment must be carried out. Personnel-free time must be considered separately, an extended risk assessment may be necessary. The different operating modes mentioned below must be taken in consideration.

- **Gas warning system**

The use of a stationary gas warning system has established itself as a state of the art in thermochemical processes. All media used and generated should be detected by this system. Furthermore, care must be taken to ensure that the sensors are mounted on the floor or ceiling according to the specific weight of the gas to be detected and the air movements in the hall. Especially in non-personnel times, the functioning detection of leaking gases and a functioning alarm chain are necessary.

- **Inspections or on-call reporting equipment by suitable personnel**

Faulty plant conditions, fires or the leakage of gases should be automatically reported and an alarm chain should be set in motion. Nevertheless, the safety of the plants and processes can also be confirmed by cyclical inspections by suitable persons. The frequency should be planned in the context of the risk assessment.

- **Remote access**

In the case of remote access to the heat treat equipment the functions shall be kept as limited as possible. Any possible remote intervention is to be assessed regarding the impact on safety. In order to prevent unauthorized access, aspects of data security should also be taken into account.

- **Danger to people, such as cleaning staff, security personnel (also unauthorized) accessing the heat treat facility**

The entry of the premises for unauthorised persons must be prevented, but the access for rescue workers must be ensured. Entering the premises of non-departmental employees during personnel-free periods is critical and therefore to be avoided. In the event that the action is unavoidable, this must be coordinated with the area managers in advance and secured with a risk assessment.

- **Defining the alert chain**

Depending on the risk assessment, an additional alarm chain must be established in advance, especially in the case of personnel-free time.

- **Regulations on fire protection**

The fire protection concept must be checked and, if necessary, adapted when introducing personnel-free periods.

- **Reference to safety recommendations of the AWT**

It is recommended to include the "Safety Technical Recommendations" of the AWT (German language) when preparing risk and risk assessments.

- **Control and maintenance content of the weekend shift**
Regular maintenance work, which is normally carried on weekends and which affects the safety of the equipment, must be taken into account when introducing personnel-free periods.
- **Suitability of the plant for personnel-free operation (interference, security concept, etc.)**
The safety concept of each plant and every process (even for connected systems) must allow personnel-free operation for every possible operating condition.

2. Risk assessment of plant conditions (examples without claim to completeness)

Modes:

1. Production (“ghost shifts”)
2. At operating temperature and gas flushed, but no active process
3. Heated not gassed, under nitrogen, equipment closed
4. Heated, non-gassed, equipment open and air atmospheric condition
5. Not heated, all process media separated, equipment open, elevated temperature possible

Risks	Relevant for operating mode	Action plan: to fill in and assess yourself
Failure of building ventilation (in- and outgoing ventilation)	1-4	
Failure of equipment exhaust system	1-5	
Failure of gas supply (process, heating)	1-4	
Unauthorized access to the area	1-5	
Authorised access to the area	1-5	
Crash, troubleshooting: intervention with personnel deployment regulated?	1-2	
Leakage in the gas supply (for example due to crash, damage)	1-5	
Internal leakage gas supply, (for example burner system, valves)	3-5	
Failure of cooling system	1-4	
Leakage in the roof, storm, etc.	1-5	
Leakage of the equipment to the outside (water/oil, hazardous materials, etc.)	1-5	
Condensation water	1-5	

Safety aspects at personnel-free times in heat treat operations

Risks	Relevant for operating mode	Action plan: to fill in and assess yourself
Power failure: Valves: flammable gases closed without power, emergency nitrogen flooding open without power, nitrogen pump or power generator for emergency water cooling	1-3	
Power outage: No lights in plant	1-5	
Power outage: other effects	1-5	
Failure of the safety gas supply	1-4	
Removing fire hazards, fire loads	1-5	
Uncontrolled discharge of gases (like CO) from the equipment	1-5	
Outage compressed air/hydraulics/...	1-4	
Failure of ignition burners	1-4	
Failure of safety flaring (for example endogas generator)	1-2	
Collision/ crash of internal furnace movement (for example batch IQ or mesh belt furnace)	1	
Process relevant failure of furnace component (Fan, etc.)	1-4	
Safety relevant failure of furnace component (ignition burner, temperature control, etc.)	1-4	
Accident in case of batch change, entry or discharge	1	
Failure control system	1-4	
Quenching oil levels too high or too low	1-3	
Parts loss in the furnace	1	
Untested processes, trials	1	
Is automatic restart possible after faults?	1	
Remote control actions: what functions are allowed??	1-5	
Insufficient maintenance status	1-4	
Burning Charge/ equipment - Fire protection control (alarm chain)	1	

