Bulletin on
Lock Down &
Prestart up Safety
Guidelines

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Risk Services
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The Novel Corona Virus has affected more than eight hundred thousand people in more than 150 countries. The COVID-19 outbreak is wreaking havoc on businesses. With employee work restrictions in place to combat the COVID-19 crisis, just 29% of companies can continue to be fully operational and 57% expect to be partially operational.

*It is not the most intellectual or the strongest of species that survives; but the species that survives is the one that is able to adapt to and adjust best to the changing environment in which it finds itself.*

- Darwin

The viruses adapt to their hosts by evading defense mechanisms and taking over cellular metabolism for their own benefit. Alterations in cell metabolism as well as side-effects of antiviral responses contribute to symptoms development and virulence. COVID-19 has introduced many new challenges to business environment.

The Govt has taken number of steps to control the spread of COVID-19. As per the direction of govt of India, Industrial operations are suspended/forced shutdown or operating with minimum skeleton staffs. The shutdown and start-up operations are different from the normal operations, and calls for great attention from all the personnel involved, especially the operations personnel. All personnel must be well trained and shall be aware of the risks associated with such activities. A good understanding of the Scale down operation/shutdown requirements, the execution plans and the identification of risks and potential problems should be addressed appropriately for ensuring safety.

Here is the analogy that we can apply, when an invisible organism adapts to the environment to survive overcoming many challenges, we must be prepared to apply proactive measures to successfully navigate this Lockdown situation especially in hazardous installations.
Process Industries during Shutdown

Process unit start-ups and shutdowns are significantly more hazardous than normal facility operations. A start-up is a planned series of steps to take a process from an idle, at rest, state to normal operation. A shutdown is the reverse sequence. According to CCPS, process safety incidents occur five times more often during start-up than during normal operations. This is because the start-up and shutdown periods involve many non-routine procedures, and these periods can result in unexpected and unusual situations. In most cases, process chemicals are also present at the site during shut-downs and often parts of the process plant are still in operation during the shut-down. Even if all processes are stopped, chemicals are alive in the facilities.

Risks involved during shutdown and start-up

- Accidents caused by unsuccessful isolation of the object worked on during the shut-down;
- Accidents happening at plant sections that are in operation during the shut-down;
- Accidents due to failure to maintain temperature in chemical storage areas;
- Exposure to dangerously high or low temperatures and pressures;
- Arc flash from the equipment;
- Fire incident due to electrical faults;
- Non availability of Detection and protection devices including firefighting equipment;
- Not keeping Maintenance program, safety programs and routine audits active to avoid accidents. Idle plants with small crews operating at a very relaxed tempo can be dangerous places;
- Accidents during start-up of a part of the facility.
First Chemical Corporation facility in Pascagoula, Mississippi, steam leaking through manual valves heated mononitrotoluene (MNT), a raw material used to produce dyes, rubber and agricultural chemicals, inside a 145-foot-tall chemical distillation column. The column had been shut down five weeks prior to the incident and was thought to be isolated and in standby mode. During the days leading up to the explosion, the hot MNT began to decompose, forming unstable chemicals. This resulted in a runaway reaction and explosion (October 13, 2002) that injured three workers, damaged plant equipment, and ignited several fires. The CSB found that the facility lacked an effective system for evaluating hazards during shutdown operations.

At the Bayer Crop Science facility in Institute, West Virginia, a runaway chemical reaction occurred inside a 4,500-gallon pressure vessel known as a residue treater, causing a vessel in the methomyl unit to explode. The methomyl unit used the highly toxic chemical, methyl isocyanate (MIC), in a series of complex chemical reactions to produce methomyl, a dry chemical used to make the pesticide Larvin®. The incident occurred during the restart of the methomyl unit after an extended outage to upgrade the control system and replace the original residue treater vessel. The CSB investigation found that the standard Pre-Start-up Safety Review (PSSR) and turnover practices were not applied to the methomyl control system redesign project. The CSB also found that the equipment was not tested and calibrated before the unit was restarted. Finally, the CSB found that operators were inadequately trained to operate the methomyl unit with the new distributed control system, or DCS.
Critical Challenges during Shutdown and start-up

- Gap in adhering to Management of Change procedure during shut-down and Pre-Start up activities
- Ensuring competent crew are mandatory for facilities handling hazardous chemicals/ operations.
- Less Systematic training of the plant people while a plant shutdown activity as well as during Pre-Start up activities
- Number of people at the site is much higher than normal and many safety systems are not fully functional.
- Very dynamic situation during Shutdown and Prestart up
Ways to manage shut down and pre start-up safely

Bringing the processes to a controlled halt and leaving the process plant in a safe state are two crucial tasks prior to the shut-down.

- Follow MOC effectively to adequately addresses changes due to operational variance
- Use appropriate hazard analysis techniques for evaluating the changes
- Communicate the essential elements of temporary operating procedures in writing.
- Written operating procedures need to have sufficient details to avoid the likelihood of valve misalignments during start-ups and shutdowns.
- Written checklists and diagrams to verify proper valve positioning should be provided, if needed.
- Ensure the facility’s lockout/tagout program requires that equipment is rendered safe prior to opening for inspection or maintenance
- Process equipment, pipes, valves, pumps, and other machinery must be emptied and cleaned in a safe and reliable way.
- Pipelines containing compressed air, inert gases, water or steam must be depressurised and flushed if not used during the shut-down.
- Equipment and even entire plants containing chemicals or utilities must be reliably isolated from those sections still working during the shut-down and the success of the isolation must be verified
- Conduct high level management review and approval when safe opening conditions, such as equipment depressurization, cannot be verified
- Conduct daily inspection to ensure shut down program is effective
- Critical safety devices must not be bypassed during troubleshooting operations during unit start-ups and shutdowns
- Ensure that the persons in charge of making the plant safe have the necessary skills to carry out their tasks.
- Ensure that operators are supervised and supported by experienced, technically trained personnel during unit start-ups and shutdowns
Bringing the processes to a controlled halt and leaving the process plant in a safe state are two crucial tasks prior to the shut-down.

- Crisis management and communications - Analyzing the situation and informing staff, media, suppliers, and customers of the crisis and the plan

- Tanks, pressure vessels and pipework. In all cases ensure these are as clean and dry as possible. Insert line blinds to create manageable zones that can be slightly pressurized (0.5+ psig) using nitrogen or dry air. Provide a small flow and arrange for some simple tell-tale mechanism to show pressure, flow and level of humidity

- For vessels, tanks and containments that must be kept full of liquid, employ some form of oxygen scavenger or anti biological growth chemical (like Hydrazine hydrate /Cyclohexyl amine (CHA)). If a pipework system contains any traps, remove their internals and clear all strainers.

- Boilers: These can be laid up using either long-term dry or wet hydrazine methods. The latter involves leaving the wet-side — i.e., boiler, economizer and superheater — full of treated feed water (dosed with 15% hydrazine, a proprietary solution, and then pH adjusted to raise alkalinity to a minimum pH of 8.3) and supplying the fireside with heated air with desiccant as a backup.(Refer procedure provided by your OEM)

- Both waterside and fireside points should have new gaskets, except for furnace hot-air entry inspection and exit points.

- Pumps, engines, compressors and machinery: To minimize internal corrosion, close off all vents and openings and completely fill the casing with the manufacturer’s recommended lubricant.

- For large compressors, turbines: use a portable filtration cart with water-absorbing elements to remove any free water in existing oil soon after shutdown.

- To minimize external corrosion, spray either a light wax or liquid PVC on unpainted surfaces.

- Motors and generators: Clean exterior, grease and apply protective covering. Lift carbon brushes from commutators/slip rings. Include packets of desiccants if completely sealing a unit.

- Instruments and controls: Maintain the driest possible conditions for both electronics and external field devices, including sensors, transmitters and valves, by strategically placing desiccant packages and sealing the enclosures.
Bringing the processes to a controlled halt and leaving the process plant in a safe state are two crucial tasks prior to the shut-down.

- Instruments that would normally be in contact with process materials should be removed, cleaned, protected and marked for immediate local storage.

- Electrical enclosures: Seal and insert bags or wraps. Alternatively, heat using individual strip or built-in heaters.

- Periodically — nominally monthly — exercise equipment by rotating it several times and leaving it at a different (90°) angle. Where humidity controls have been set, monitor these at least weekly; where chemical controls are used, check every three months. In addition, long-term lay-up requires regular monitoring of motor/generator internal resistance (meggar), as well as tank oxygen and humidity levels.

- Auxiliaries: Don’t forget that in most cases fire protection systems and alarms still need to be maintained and powered up — fires are common in dried-out wooden cooling towers. If batteries normally are used, disconnect them and smear terminals with petroleum jelly. Fully charge vented-type lead-acid batteries, then drain and flush them with distilled water.

- Frequently when shutting down a plant, companies don’t take appropriate steps to preserve assets and ease restart. We are all familiar with the problems that magically appear after a shutdown/turnaround of only a few weeks. It’s therefore no surprise that idled facilities left essentially unattended over a period become seriously degraded. Detecting and quantitatively assessing that degradation usually takes considerable time and expertise.
Pitfalls during a restart after long shutdown

A restart process has things in common with a new-build start-up but can be more complicated. Hence it is recommended to carry out HAZID study to ensure adequate control measures are adopted to prior to start-up. A sample HAZID study is given below for reference.

**GROUP: 1: Meeting Prior to conduct PSSR**

<table>
<thead>
<tr>
<th>Potential Hazards</th>
<th>Causes</th>
<th>Consequences</th>
<th>Safeguards</th>
<th>Recommendations</th>
<th>Responsibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spread of SARS-CoV-2 (COVID-19 disease)</td>
<td>Day meeting with the reporting manager</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Social etiquettes followed during the meeting</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Seating arrangement in the manager cabin</td>
<td>Potential exposure of SARS-CoV-2 leading to health issues</td>
<td>None</td>
<td>Social distancing and sanitation guidelines shall be followed through out the PSSR meeting. Safe distance of 6 feet to maintained by all the members.</td>
<td>All Employee</td>
</tr>
<tr>
<td></td>
<td>Usage of AC in the cabin</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cabin hygiene e.g. Gate handles, Chairs used etc.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Distance in the cabin or gathering place</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
# GROUP: 2: Equipment / Process System Specific (Long Shutdown)

<table>
<thead>
<tr>
<th>Potential Hazards</th>
<th>Causes</th>
<th>Consequences</th>
<th>Safeguards</th>
<th>Recommendations</th>
<th>Responsibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inappropriate shutdown of the equipment during protracted declaration of lockdown period</td>
<td>Mechanical Failure / Stored Energy associated with equipment leading to sudden release of the equipment or material causing injury / fatality of the person in the area.</td>
<td>Start-Up and Shutdown procedure available at the site</td>
<td>None</td>
<td>Operation</td>
<td></td>
</tr>
<tr>
<td>Presence of toxic or flammable material inside the equipment</td>
<td>Sudden release of toxic or flammable material during start-up. Toxic exposure / fire &amp; explosion leading injury, asset damage and environmental damage.</td>
<td>Site shall ensure purging of the equipment prior to start-up</td>
<td>None</td>
<td>Operation</td>
<td></td>
</tr>
<tr>
<td>Degradation of equipment due to left over material since protracted lockdown period</td>
<td>Sudden release of toxic or flammable material through the degraded part due to corrosion or material incompatibility during start-up. Toxic exposure / fire &amp; explosion leading injury, asset damage and environmental damage.</td>
<td>Site shall ensure purging of the equipment prior to start-up.</td>
<td>None</td>
<td>Operation</td>
<td></td>
</tr>
<tr>
<td>Inspection methodology prior to start-up inadequate (e.g. Only Visual)</td>
<td>Potential loss of containment or stored energy associated with the equipment leading to injury of the personnel, asset damage.</td>
<td>Site shall inspect the Safety Critical equipment prior to start-up. Relief devices shall be tested on the bench to ensure working of the equipment.</td>
<td>None</td>
<td>Operation</td>
<td></td>
</tr>
<tr>
<td>Safety Critical equipment degradation e.g. PSV, Explosion Vent, Flare)</td>
<td>Potential accumulation / dissipation of energy in the system leading over pressurization or de-pressurization of the system. Loss of Containment leading fire and toxic release. Potential injury to personnel, asset damage and environmental damage.</td>
<td>Site shall inspect the Safety Critical equipment prior to start-up. Relief devices shall be tested on the bench to ensure working of the equipment.</td>
<td>None</td>
<td>Operation</td>
<td></td>
</tr>
<tr>
<td>Potential Hazards</td>
<td>Causes</td>
<td>Consequences</td>
<td>Safeguards</td>
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</tr>
<tr>
<td>Inadvertent operation of the valve by employee due to protracted lockdown (Operational inability to perform)</td>
<td>Sudden release of toxic or flammable material through the degraded part due to corrosion or material incompatibility during start-up. Toxic exposure / fire &amp; explosion leading injury, asset damage and environmental damage.</td>
<td>Basic orientation / Refresher Training shall be ensured before handing over any process activities.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control / Manual / Shutdown valve in stuck position</td>
<td>Potential overlooking of the valve leading to process upset. Damage to equipment and Loss of containment in case of maloperation / in-operation.</td>
<td>Lubrication of the valves is carried out prior to the start-up</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pneumatic tuning degradation operating critical control valves</td>
<td>Inability to operate the valve leading to escalation of the fire / process upset.</td>
<td>Critical shutdown valves and control valves shall be checked for its pneumatic air lines healthiness prior to start-up.</td>
<td></td>
<td>Operation</td>
<td></td>
</tr>
<tr>
<td>Degraded lubricants due to formation of algae or mild acids</td>
<td>Potential equipment damage leading to asset loss.</td>
<td>Lubricants checks are carried out for any kind of algae formation.</td>
<td></td>
<td>Maintenance</td>
<td></td>
</tr>
<tr>
<td>Burners tip degraded or plugged.</td>
<td>Potential accumulation of fuel gas in the burner house leading to fire and explosion. Injury/fatality, asset loss and environmental damage.</td>
<td>All the fuel and air lines shall be purged and checked for any leak. The nozzles perforation shall be checked as per the OEM guidelines.</td>
<td></td>
<td>Maintenance</td>
<td></td>
</tr>
</tbody>
</table>
### GROUP: 2: Equipment / Process System Specific (Long Shutdown) (Contd.)

<table>
<thead>
<tr>
<th>Potential Hazards</th>
<th>Causes</th>
<th>Consequences</th>
<th>Safeguards</th>
<th>Recommendations</th>
<th>Responsibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Potential breakdown/Fire/Explosion/Toxic release</td>
<td>Fuel line / air line choking</td>
<td>Potential accumulation of fuel gas in the burner house due to inefficient air fuel mixture at the tip leading to fire and explosion. Injury/fatality, asset loss and environmental damage.</td>
<td>All the fuel and air lines shall be purged and checked for any leak. The nozzles perforation shall be checked as per the OEM guidelines.</td>
<td></td>
<td>Maintenance</td>
</tr>
<tr>
<td>Reporting of person after 1 month shutdown leading to inefficient knowledge about the process</td>
<td>Gauges nozzles plugged on the process line.</td>
<td>Inadequate reading from the gauge leading to critical process upset causing spillage, overpressure etc.</td>
<td>Gauges nozzles shall be checked at the filed prior to start-up to ensure no plugging of the instrument nozzles.</td>
<td></td>
<td>Maintenance</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Potential maloperation leading to release of stored energy. Potential injury, asset loss.</td>
<td></td>
<td>Basic orientation / Refresher Training shall be ensured before handing over any process activities.</td>
<td>Operation</td>
</tr>
</tbody>
</table>
HVAC Operation and Maintenance

- It is known that most of the infectious particles ranging from 0.65 to 3.3\(\mu\)m in the cough-generated aerosols were immediately respirable. Here is also no reported data or studies to rule out the possibility of the airborne-particle route. One indication for this: Corona virus SARS-CoV-2 has been isolated from swabs taken from exhaust vents in rooms occupied by infected patients.

- In the indoor environment, one of the sources of dust is atmospheric dust (PM2.5 and PM10) coming in through fresh air intakes. The other prominent source is the dust generated by humans and processes. Reduction of indoor dust levels is a step towards mitigation of this source of COVID-19 transmission.

- Set Room Temperature between 24°C and 30°C. Maintain relative humidity between 40% and 70%. (In humid Climates set temperature closer to 24°C for dehumidification and in Dry Climates closer to or at 30°C Use Fans to increase air movement)

For Hi Wall Units, Tower Units & Multiple cassettes Units

- If fresh air is not provided, it is advisable to introduce a fresh air duct attached to a central inline fan filter unit and distribute the fresh air by grilles into the space or near the indoor units. For Cassette Units the fresh air duct may be connected to the available port of the Cassette Unit. In case fresh air cannot be provided through a fan it is recommended to actively use operable windows.

- A minimum fresh air volume of 3 cum/hour per person and 3.75 cum per hour per sqm (5 cfm per person and 0.6 cfm per sq. ft) is recommended.

- A separate Treated Fresh Air DX Unit may be provided in the case of a multiple unit installation. This will reduce the impact of reducing available cooling capacity by supplying non treated fresh air.
For Ducted units, Fan coil Units & Air handling units

- Fresh air must be provided by an inlet duct and fan. It is advisable to provide a MERV 13 or higher filter fitted on the Air Handling Unit. If a filter of higher filtering capability is retrofitted into an existing system, care shall be taken to ensure that the fan and motor capacities are adequate to handle the higher pressure drop.

- A minimum fresh air volume of 3 cum/hour per person and 3.75 cum per hour per sqm (5 cfm per person and 0.6 cfm per sq ft) must be provided. The recommendation is to maximize supply of outside air within the limits of the system.

- In buildings without mechanical ventilation systems it is recommended to actively use operable windows. Add a TFA (treated fresh air) unit if recommended Fresh Air intake impacts cooling performance.

- Install UVGI (Ultraviolet germicidal irradiation) for larger Ducted Units and AHUs to keep Coils continuously clean and disinfected. It is advisable to inspect the AHUs and ducts for Air tightness and low leakage.

- Minimum air changes of around 10-15 ACHP is advised for good ventilation. The mechanical exhaust air shall be 70% to 80% of fresh air quantity to maintain necessary positive pressure in the space.

- In cases of evaporative cooling / air washers it is advisable to disinfect the water using UVGI or Ionization or chemical dosing. Run the system in fan only mode for 30-60 minutes every day to dry the cooling pads. Then run only the pumps for water circulation without fans in operation for 30 minutes, to wash out any bacterial growth. Finally flush the water from the tanks and re-start the system with fresh water.

- In case of re-circulating system, it is recommended to limit return air circulation. The return air system could be converted to an exhaust system.
It is essential to conduct PSSRs in order to prevent incidents and the resultant harm to personnel, equipment damage, and loss of production and profits. The plants shall aware of the following pit falls in order to have a safety start up.

- Failure to conduct a PSSR after a prolonged stoppage/ outage;
- Assembling a team without the necessary knowledge and skills to adequately perform the PSSR;
- Skipping or forgetting parts of the PSSR needed to ensure the process is completed and ready to start;
- omitting critical safety features from the review or not checking them for proper installation and operation;
- lack of appropriate approval steps for the PSSR before proceeding to start or restart the process.
Check Points during Lock Down and Prestart up Safety Review (LDPS)

Chola MS Risk Services has come out with critical check points (but not limited to) related to crucial areas in the process plants to facilitate the safe lock down and pre start up post lock down period.
Personal Hygiene Checks – COVID 19

- Social Distance Guideline Adopted in the office & Plant premises
- Disinfection and Sanitization Procedure adopted at your entire Plant including office rooms, washrooms, Doors, Handles, Lifts, staircase, lift lobby, parking area, roof top including your panel rooms and substation etc. Practice of disinfecting employees passing through using Disinfection / fumigation tunnels prohibited.
- Self-declaration procedure available from employees and all service providers to be taken about his or her illness on daily basis.
- Large gathering related to work has been avoided (like town hall meetings, Class room trainings)
- Visual signage provided at canteen and cafeteria to restrict crowd gathering and Ensure social distancing
- Encourage your employees to bring the food from their home till the normalcy restore
- Biometric system stopped and alternate attendance monitoring system adopted which prevents transmission of Infection
- Travel restriction (Domestic, International) guideline implemented and monitored
- Deployment of hand sanitizers and wearing masks until the normalcy resumes and have the strict instructions been passed out to all employees and for all service providers for effective usage.
- Screening system in place by checking the temperature of employees/ contractors/support staff in all entries of the office floors
- Company transport vehicles sanitized properly and check list available for the same. Ensure seating arrangement in the bus considering Social distancing
- Define used mask disposal process clearly at your Plant and ensure proper disposal after use

Don’ts:
- Have a close contact with anyone, if you're experiencing cough and fever
- Touch your eyes, nose and mouth
- Spit in public
**Process Equipment Checks**

- Release pressure that may be trapped between two closed valves or closed process equipment loops.
- Ensure pipe line leading to the vessels are drained & Insert a blind plate to stop process pressure build up
- Blind register is available and maintained
- Maintain nitrogen blanket for tank containing flammable liquid during plant shut down. Flammable vapor is still released.
- Do not just rely on pressure gauge indication to make sure zero pressure. Open all available drain or vent valves to release the remaining pressure. Beware of pressure that trapped in a dead zone
- Do not store flammable solvents (barrels stored to be sent to recovery plant) in the plant area and ensure stored at proper storage area
- Used drums are usually used during plant shutdown in order to recover lubrication oils, chemicals or catalysts. Use only used drums that are originally used for those chemicals or ones that have been washed, decontaminated and cleaned up as per approved procedure
- Stroke Test to be carried out periodically for all rotating process equipment as per OEM guidelines by the trained personnel as per the procedure till normalcy restored
- Ensure temperature controlled chemical storage area are maintained at recommended temperatures
- Ensure Critical equipment are supported with backup power like scrubber, Refrigeration system, Nitrogen plant etc.,
- Ensure competent person available at plan to ensure operational condition of critical equipment and Ensure buddy system in place
- Ensure the facility’s lockout/tagout program requires that equipment is rendered safe before opening for inspection or maintenance
- Equipment opening procedures should contain a stop work provision that requires higher levels of management’s review and approval when safe opening conditions, such as equipment depressurization, cannot be verified
- Ensure that operators are supervised and supported by experienced, technically trained personnel during unit start-ups and shutdowns
- Daily inspection check list to be maintained for Chemical Storage area
## Safety Critical Equipment Checks

- Verify valve lock Open/ Close list for all the pressure relief devices
- Check for all the Pressure / Flow tapping lines for its root valve opening
- Have the interlock check performed from the sensor to final element or all safety critical loops and DCS instruments?
- Ensure the calibration of gas sensors and fire detectors prior to startup
- Ensure the alternate power supply for Safety critical PLC and DCS are available and healthy prior to startup
- Ensure the HVAC unit for control room is up and healthy
- Ensure the alternate power supply for Safety critical PLC and DCS are available and healthy prior to startup
- Stroke check all control valves and shutdown valves.
- Ensure all the bypasses and overrides are removed prior to startup
- Stuck valves and low point restrictions in flow. Use an infrared camera to identify these.
- Boilers and fired heaters. Ensure the setting (brickwork, refractory and insulation materials) is thoroughly dry. Use portable heaters where necessary to make certain all refractory materials are dry.
- Burners. Do not fire these until a burner technician has checked them. An explosion could occur if the combustion controls don't function properly.
Machine Shop Checks

- Follow the work permit procedure for removal of energy isolation and confined space entry
- Check all components are mounted securely and in a manner that will prevent component becoming loose.
- Before starting, inspect hardwires for any damages / conditioning of the power switching element.
- Before starting ensure the earthing arrangement are intact. Perform earth continuity test
- Check for Functioning of emergency stop switches / trip switches /photo electric sensors / interlocking arrangements
- Check for contamination in hydraulic fluid. Inspect breather caps, breather filters
- Functioning of brake system (hydraulic & Pneumatic)
- Check for abnormal noise, heat, vibrations etc., during starting of the machine
- Ensure functioning of extraction units dust & collection systems
- Ensure Pressure relief valves are not bypassed / valves are not closed.
HVAC Checks

- Area sanitization before start up
- Disinfect and Clean the filters, grilles, diffusers & internal surfaces, condensate drain pan and coils
- Open all the doors and windows of the space.
- Ensure that all cleaning protocols as advised above are complete
- Run the fresh air system at the maximum intake of air setting
- Encourage your employees to bring the food from their home till the normalcy restore
- Start and run the exhaust systems if available.
- Start the air conditioning system in fan mode only, without filters and run it for minimum of two to four hours with doors open and exhaust system operational.
- Install the clean & sanitized filters
- Start the AC in normal mode and run for two hours with doors open and then close the doors and windows.
- The fresh air and ventilation system should be kept on throughout the off cycle and on the weekend and holidays in air circulation mode.

Electrical Safety Checks

- Ensure Insulation Resistance measurement within the limit
- Follow LOTO Procedure
- Ensure foreign materials like tools are not within the equipment enclosures
- Ensure there is no combustibles around electric panels, outlets and hotspots.
- Ensure protection system and interlocks are in place
- Maintain safe working clearance from energized conductors
- Emergency backup system are in place such as DG, UPS, Batteries etc.
- Ensures appropriate skilled personnel are involved operating systems
- Ensure PPEs with appropriate rating
Fire Protection System Checks

- Check working status of fire alarm panel – On indication
- Ensure LED indication is visible/blinkin in all detectors.
- Check functioning of public announcement system
- Check the power supply for fire pumps and pumps are in auto mode.
- Check all isolation valves along sprinkler discharge pipeline, riser and deluge system are open and locked in its intended position
- Check drain line valves in the sprinkler risers are in closed and locked in its intended position.
- Verify pressure gauges along sprinkler pipeline, riser and deluge system shows required pressure
- Frequently touched parts in the fire pumps shall be disinfected using approved disinfectant. Safe work permit shall be followed while disinfecting electrical panel/equipment and the activity shall be done under supervision of electrical engineer
- Check water level in the fire water tank, priming tank and overhead tank
- Check diesel pump battery voltage and electrolyte level
- Check fuel level in the diesel day tank of diesel pump.
- Ensure Pressure relief valves are not bypassed / valves are not closed.
- Ensure hydrant hoses are available inside the hydrant box along with branch pipe.

References

- Healthy Workplaces - A European Campaign on Safe Maintenance, ISSN 1608-4144
- Guidelines for Performing Effective Pre-start-up Safety Reviews, Centre for Chemical Process Safety
- Process Safety Management of Highly Hazardous Chemicals – OSHA 1910.119
- Chemical Safety Board Investigation Reports
- ISHRAE COVID-19 Guidance Document for Air Conditioning and Ventilation
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