GE Winter Readiness – Best Practices

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Overview

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- Winter Readiness Plan
  - Engaging Operations in Preparations
  - Wind Breaks
  - Protecting Cold Weather Critical Components
  - Critical Insulation Inspections
  - Heat Trace and Maintenance
  - Staff Training
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- Conclusion (Food for Thought!)

GE Winter Readiness: Disclaimer

The practices described herein are derived from accumulated observations over the years. They are designed to support Generation Entities in preparing for winter operations and maintaining a state of readiness throughout the season. However, they are not intended to be exhaustive nor to ensure compliance with applicable laws, rules or regulations. Only the Public Utility Commission can determine if any particular practice complies with its rules.

Some of the best practices may go beyond the requirements of applicable regulations. Compliance with Texas Administrative Code (TAC) Chapter §25.55 is now mandatory for winter preparedness.

Winter Readiness Plan, Checklist, or Procedure

- A winter readiness plan, checklist, or procedure is necessary to review and complete all preparations for winter operations.
- Included in this are best practices in the following areas:
  - ✓ Engage Operations in Preparations
  - ✓ Wind Breaks
  - ✓ Protecting Cold Weather Critical Components
  - ✓ Critical Insulation Inspections
  - ✓ Heat Trace Checks and Maintenance
  - ✓ Staff Training
  - ✓ Alternate Fuel Readiness
  - ✓ Adequate Power Supplies
  - ✓ Cold Weather Supplies

Winter Readiness Plan, Checklist, or Procedure (continued)

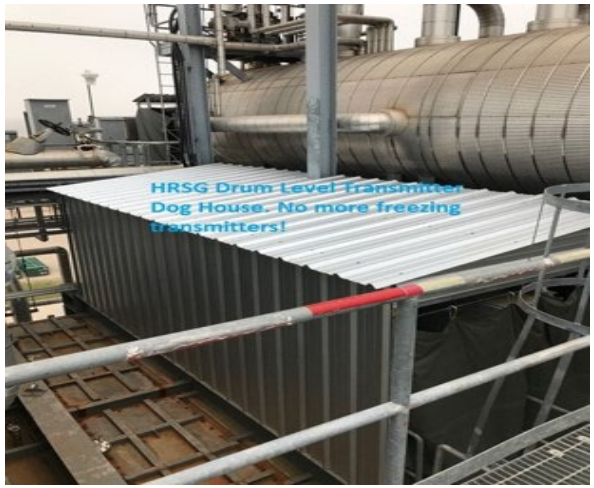
- Assign a winter readiness coordinator responsible for ensuring all preparations are assigned and completed.
- Perform an annual review with reviewable records prior to each winter season.
- Include lessons learned for all freeze-related malfunctions of cold weather critical components with mitigation measures.
- Record completion of pre-winter tasks as well as periodic maintenance and functionality checks for reference during winter inspections.
- Create a repository for winter records and manage them based on your company's requirements.

Engage Operations in Preparations

- Seek feedback from operators asking:
  - ✓ What went well?
  - ✓ What improvements are needed?
  - ✓ What recommendations do operators, or others, have?

Wind Breaks

- Requirement as part of the pre-winter plan, checklist, or procedure.
- Installation of windbreaks that are adequate and resilient to weather/high winds for the entire length of the winter season.
  - ✓ Elevations above the ground floor should consist of materials able to withstand sustained winds. This requires the use of heavy-duty tarps, plywood, durable siding or plank materials.
  - ✓ Flooring to prevent updraft in areas where cold weather critical components are being protected should be evaluated and installed where appropriate.
  - ✓ Ground floor elevations should use heavy-duty tarps, plywood, durable siding or plank materials, and, in some cases, reinforced plastic.
  - ✓ Maintain a map and/or a WO that targets areas for the installation of windbreaks.



Hardened wind break needed on upper levels

Reinforced plastic wind wreaks

Wind Breaks

- Weekly inspections of windbreaks generated by Preventive Maintenance (PM) throughout the winter season.
- Inspect wind breaks prior to and during every extreme cold weather event.

Hardened wind break needed on upper levels

Protecting Cold Weather Critical Components (CWCC)

- Requirement as part of the pre-winter plan, checklist, or procedure.
  - ✓ A CWCC is defined as any component which, if frozen, will lead to a plant trip, derate of more than five percent, or failure to start.
- Maintain a list of CWCCs with documentation of measures to protect from freezing that include:
  - ✓ Critical heat trace circuits.
  - ✓ Verification of insulation integrity.
  - ✓ Installation of windbreaks, as required.
  - ✓ The use of additional heat sources, as required.

Exposed transmitters

Relocated transmitters – protected from elements

Protecting Cold Weather Critical Components (CWCC)

- CWCCs must be in an enclosure capable of maintaining heat.
  - ✓ The enclosure should contain a heat source – preferably one that is turned on by a thermostat or energized as part of heat tracing.
  - ✓ Where possible, avoid using a manual process to plug heat sources to prevent human error.
  - ✓ Inspections on both enclosures and heating devices for proper operation annually prior to each winter season.
- Live monitoring of temperature for each CWCC's enclosure.

Transmitters enclosure with temperature gauge for monitoring inside temperature

Critical Insulation Inspections

- Insulation inspections for CWCCs should be required as part of the pre-winter plan, checklist, or procedure.
- An insulation inspection management plan/program should include the following:
- ✓ An insulation inspection is completed prior to the winter season by a qualified person focusing on piping/sensing lines CWCCs, as determined by the GE.

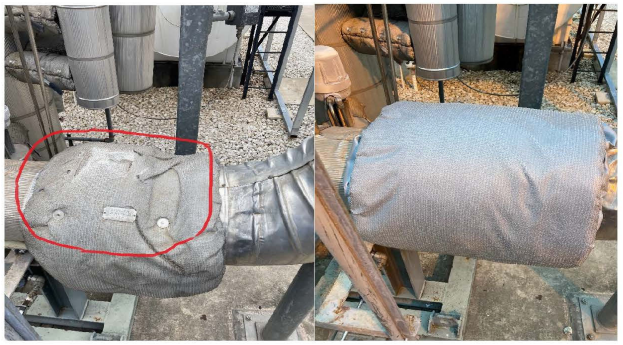


Figure 22-A BEFORE *Figure 22-B AFTER*

19- located west side of the gas coalescer, blanket needs to be re-wired (Figure 23)

Figure 23-A BEFORE *Figure 23-B AFTER*

20- Safety gas relief valves blankets missing (Figure 24)

Critical Insulation Inspections (cont'd)

- The insulation inspection should be incorporated into the GE's workflow management system that tracks work to completion. Records of completion are easily viewable by management.
- Periodic insulation inspections throughout the winter months and repairs as required on critical piping/sensing lines performed, which are trackable to completion.
- Visual verification that work was completed is a required step in the workflow process.

Figure 58-A BEFORE

Figure 58-B AFTER

Figure 59-A BEFORE

Figure 59-B AFTER

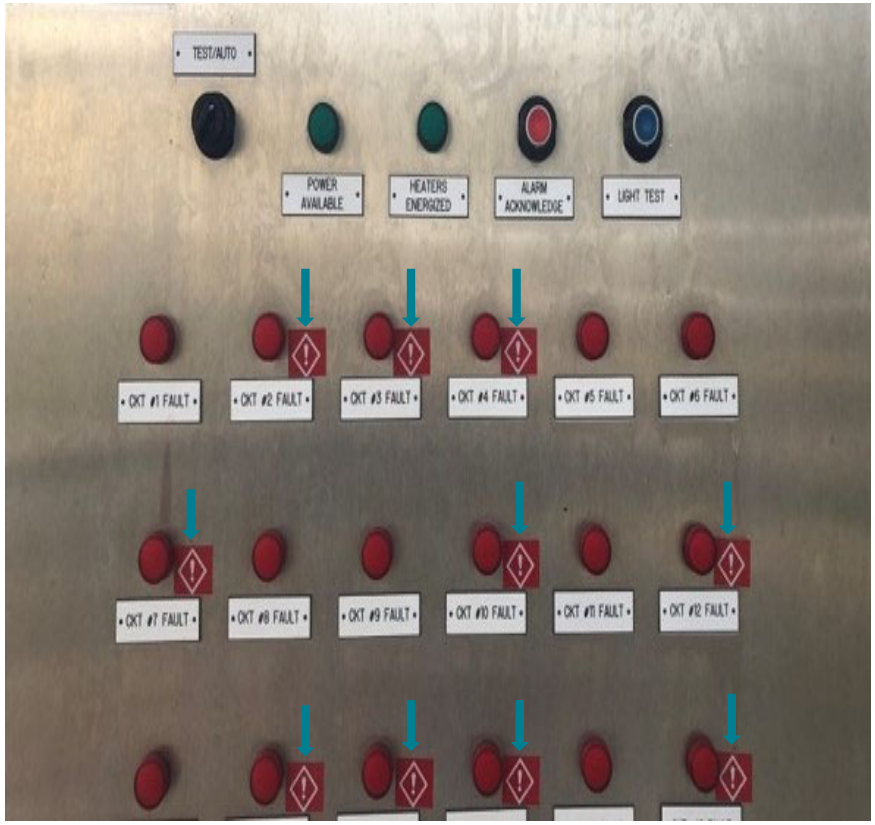
Heat Trace and Maintenance

- Functional testing of heat trace equipment should be a requirement of the pre-winter plan, checklist, or procedure.
- Understanding the type of heat trace – constant wattage, self-regulating, or mineral insulated.
  - ✓ Testing of heat trace should include a panel inspection, a current flow measurement of each circuit to assure amperage is in an appropriate range and may be followed by other appropriate testing such as electrical resistance testing (Megger checks).
  - ✓ Testing results should be recorded in an electronic database for analysis and records management.
  - ✓ Maintain a workflow management process to track repairs to completion.
  - ✓ Failure rates observed with testing on average are *10-15%* from the previous year.

Older style heat trace panel *Smart heat trace panel*

Heat Trace and Maintenance (cont'd)

- Identify cold weather critical heat trace circuits on each local panel.
  - ✓ This will assist staff when making rounds during extreme cold weather events.
- Prior to each extreme cold weather event, verify the cold weather critical component heat trace circuits are functioning.
- Monitor critical component heat trace circuits' functionality during each extreme cold weather event.
- Maintain monthly heat trace functionality checks during the winter season with completion records.



Critical heat trace circuits identified

Training of Relevant Operational Personnel

- Training should be a requirement as part of the pre-winter plan, checklist, or procedure.
  - ✓ Develop a cold weather operator rounds checklist that includes cold weather critical components and is triggered by various temperature/duration levels (i.e., 32°F or below for six hours).
  - ✓ Perform a 'cold weather training drill' prior to the winter season, simulating an actual extreme cold weather event. The benefit of doing this is improved memory recall on what, when, and how to execute activities on the checklist.

Alternate Fuel Readiness

- Functional testing should be requirement as part of the pre-winter plan, checklist, or procedure.
- For plants that have on site storage capacity to run on alternate fuel.
  - ✓ A thorough annual inspection of all associated alternate fuel equipment prior to the winter season.
  - ✓ Testing capabilities of delivering alternate fuel to unit(s), including generating at the Low Sustained Limit (LSL) prior to December 1 of each calendar year.
- From December to March, GEs should monthly test capabilities of delivering alternate fuel to unit(s) by generating at the unit's Low Sustained Limit (LSL) or higher.

Adequate Power Supplies

- Requirement as part of the pre-winter plan, checklist, or procedure
- Ensure availability and proper functionality of power outlets near cold weather critical components - frequently on top of units.
- Consider staging a temporary distribution panel powered by a welding outlet in strategic areas near cold weather critical components.
- Install permanent outlets near cold weather critical components based on history or lessons learned.

Temporary Distribution panels

Cold Weather Supplies

- Requirement as part of the pre-winter plan, checklist, or procedure.
- Maintain a list of materials needed during a cold weather event.
  - ✓ Verify inventory and replenish prior to and during the winter season.
- Assure that electric or fuel-fired portable heaters are in working order and prepared for use.
  - ✓ Strategically stage for use throughout the plant.

Food for Thought……

“do or do not; there is no try.” Yoda – Star Wars

COMPLACENCY: a feeling of being satisfied with how things are and not wanting to try to make them better.

….you say to yourself, “OK, why did it happen? Why did we make those bad engineering decisions we made in 1967 and 1986 with Challenger?” I'll tell you. It's the human element. I suggest that there's a complacency there that comes from success. — Alan Shepard

Best Practices Location

- After todays Workshop, the Best Practices document will be posted on ERCOT.com at https://www.ercot.com/gridinfo/generation/winterready

Thank you!