

Slaughters Compressor Station System Reliability Improvements

In response to the received Boardwalk Pipelines' Texas Gas Transmission Company's ('TGT') Inclement Weather Assessment, Generation Engineering was tasked with visiting the Slaughters, KY Gas Compression Station on 11/30/23 to document inclement weather system improvements.

Slaughters Compression Station was the point of failure for the fuel gas service interruptions that caused derates and prolonged outages to LG&E and KU Generation facilities between 12/23/22 and 12/25/22 during Winter Storm Elliot. This failure prompted a multi-site evaluation of critical equipment and a review of supply points of failure on the TGT system.

Slaughters Station is a gas compression site with 15 separate lines coming in or going out of the site and is one of the largest compressor stations on the TGT system. The site has:

- 1x 13,000 hp Turbine Gas Compressor (T3)
- 1x 12,090 hp Turbine Gas Compressor (T2)
- 2x 2,500 hp Reciprocating Engine Gas Compressor
- 4x 2,000 hp Reciprocating Engine Gas Compressor
- 2x 1,320 hp Reciprocating Engine Gas Compressor
- New installation of 1x 4,800 hp Turbine Gas Compressor and associated piping and valving that will support CenterPoint AB Brown Plant and further existing system reliability

In addition to the system improvements listed below, TGT has acquired increased spare parts for existing equipment and completed a third-party reliability assessment. At the time of the site visit, a copy of the report was requested but has not yet been received.

The T3 Compressor Anti-Surge Valve was the root cause of the service interruption to LG&E and KU during Winter Storm Elliot. With one of its main compressors inoperable, TGT was not able to supply the requisite LG&E and KU demand, curtailing unit load. The following pages illustrate the overall changes at the site, with further details of the T3 Anti-Surge Valve operation.

The documented items from the assessment are as follows:

T2 System Reliability Improvements

1. Building Heaters
2. Fuel Run Weather Shelter
3. Turbine Loading Valve Insulated Weather Box
4. Turbine Vent Valve Insulated Weather Box

T3 System Reliability Improvements

1. Fuel Run Weather Shelter
2. Turbine Anti-Surge Valve Insulated Weather Box
3. Turbine Hot Bypass Valve Insulated Weather Box
4. Turbine Loading Valve Insulated Weather Box
5. Turbine Vent Valve Insulated Weather Box

T2 (GE 1982 Turbine Gas Compressor, 12,090 hp) System Reliability Improvements

1. Building Heaters - **COMPLETE**

The building was previously heated by two small heaters, near the top of the ceiling. These two heaters have been removed and replaced with 14 catalytic heaters closer to building center.



2. Fuel Run Weather Shelter – **COMPLETE**

A protective shelter was erected over the main fuel run equipment to provide protection from moisture. The sides can be covered with canvas or aluminum sheeting for further protection in the case of inclement weather.



3. Turbine Loading Valve Insulated Weather Box - **COMPLETE**

An insulated protective box was constructed around this critical valve. This valve allows a small amount of fuel to pass on startup procedure prior to main fuel gas CV operation. An 8” catalytic heater is onsite and will be installed prior to year-end.



4. Turbine Vent Valve Insulated Weather Box - **COMPLETE**

An insulated protective box was constructed around this critical valve. This valve vents gas out of the fuel line in the case of shutdown. An 8" catalytic heater is onsite and will be installed prior to year-end.



T3 (Solar Turbine Gas Compressor, 13,000 hp) System Reliability Improvements

1. Fuel Run Weather Shelter - **COMPLETE**

A protective shelter was erected over the main fuel run equipment to provide protection from moisture. The sides can be covered with canvas or aluminum sheeting for further protection in the case of inclement weather.



2. Turbine Anti-Surge Valve Insulated Weather Box - **COMPLETE**

As mentioned above, the Anti-Surge Valve was the valve that caused the T3 Compressor to become inoperable between 12/23/22 and 12/25/22.

To prevent surge (occurrence of backflow in the compressor system outlet, and then its sudden reversal) a valve is installed on the compressor discharge side to dump gas back to the inlet for compressor protection. The valve decreases compressor outlet pressure and increases flow through the compressor, correcting the potentially destabilizing operating point.

To start a unit, the anti-surge valve must briefly open and close for start permissives. During the reliability event, the inclement weather caused the control valve component (first photograph, in orange/gold) to fail, resulting in an opening but a refusal to close, and the unit unable to run. Once the CV issue was resolved and the valve could close, the quick dump regulator (second photograph, gray regulator) failed and valve refused to open.

An insulated protective box was constructed around this critical valve. An 8" catalytic heater is onsite and will be installed prior to year-end.



3. Turbine Hot Bypass Valve Insulated Weather Box - **COMPLETE**

An insulated protective box was constructed around this critical valve. An 8" catalytic heater is onsite and will be installed prior to year-end.



4. Turbine Loading Valve Insulated Weather Box - **COMPLETE**

An insulated protective box was constructed around this critical valve. This valve allows a small amount of fuel to pass on startup procedure prior to main fuel gas CV operation. An 8" catalytic heater is onsite and will be installed prior to year-end.



5. Turbine Vent Valve Insulated Weather Box - **COMPLETE**

An insulated protective box was constructed around this critical valve. This valve vents gas out of the fuel line in the case of shutdown. An 8" catalytic heater is onsite and will be installed prior to year-end.

