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GE Power Systems
Gas Turbine

Gas Turbine Drain Design Requirements

These instructions do not purport to cover all details or variations in equipment nor to provide for every possible contingency to be met in connection with installation, operation or maintenance. Should further information be desired or should particular problems arise which are not covered sufficiently for the purchaser's purposes the matter should be referred to the GE Company.

I. SCOPE

This document presents guidelines and requirements for the design of drain piping for gas turbine systems. Proper drain design and installation is essential for the safe and reliable operation of the gas turbine. General practices applicable to all gas turbine systems and some system-recommendations are presented. These requirements are based on GE Product Safety Reviews

II. GENERAL REQUIREMENTS

Drain connections, medium and flow conditions (flow rate, temperature, pressure) are identified on the piping schematics and Process and Instrumentation Diagrams (P&IDs) issued for each project. Information regarding drain location, size, material and connection details may be found on skid outline drawings, the Mechanical Outline (MLI 0306), the Outline, GT Package Connections-Piping (MLI 0313) and Notes, GT Package Connections (MLI 0314). In the absence of other, more specific information in other documents, the following practices should be applied to drain design and installation.

1. In general, drain line size should be equal to the size of the connection on the GE equipment.

2. Drain piping should be sized such that at the maximum flow rate indicated on the pertinent piping schematic, the pipe is only half full.

3. Drain piping should be continuously sloped a minimum of ¼ inch per foot. Flat spots in drain systems should be kept to a minimum.

4. It is recommended that each drain line be run separately. Where several drains are to be combined in a common manifold, care must be taken that minor pressure variations from drain to drain do not impede the flow from the individual drains. The cross sectional area of the manifold should be approximately ten times the area of the individual drain lines. For example, four one inch diameter lines (A=3.14 sq in) should be combined in a six inch pipe (A=28.25 sq in)..

5. Drain funnels may be used where several drains are to be combined to avoid crossflow.

6. In situations where it is necessary to reduce the size of a drain, eccentric reducers with the flat side on the bottom should be used to avoid the fluid trap that would occur with a concentric reducer..

7. When several smaller lines are connected to a larger line, the connections should be made at the top of the larger line to allow free flow into the header.

8. Drain tank vents must be large enough to avoid back pressure in the drain lines leading to the tank. Drain funnels may be used to further reduce back pressure.

9. Drain piping material must be compatible with the fluid, since corrosion in the drain line may lead to blockage or leakage.

10. The number of fittings and other restrictions in a drain line should be minimized to avoid flow restrictions and dirt traps.

III. DRAINS FOR HAZARDOUS FLUIDS

Extra measures must be taken when the drain may contain high temperature, flammable or explosive mixtures. Material selection, drain isolation and configuration must be considered.

Atmospheric breaks/air gaps ("funnels") must be included in drain piping systems containing high temperature, flammable or explosive mixtures to protect drain tanks from over-pressurization and over-temperature. These funnels also prevent entry of flammable or hazardous gases into the turbine or into other undesirable or potentially dangerous locations. Atmospheric break/air gap drains also provide for visual inspection or verification of drain processes.

Atmospheric breaks/air gaps are generally located just upstream of drain tanks. An air gap break is simply a break in the drain line which provides a release of air pressure to the atmosphere while containing the fluid within the piping and discharging to the appropriate tank (example photos provided).

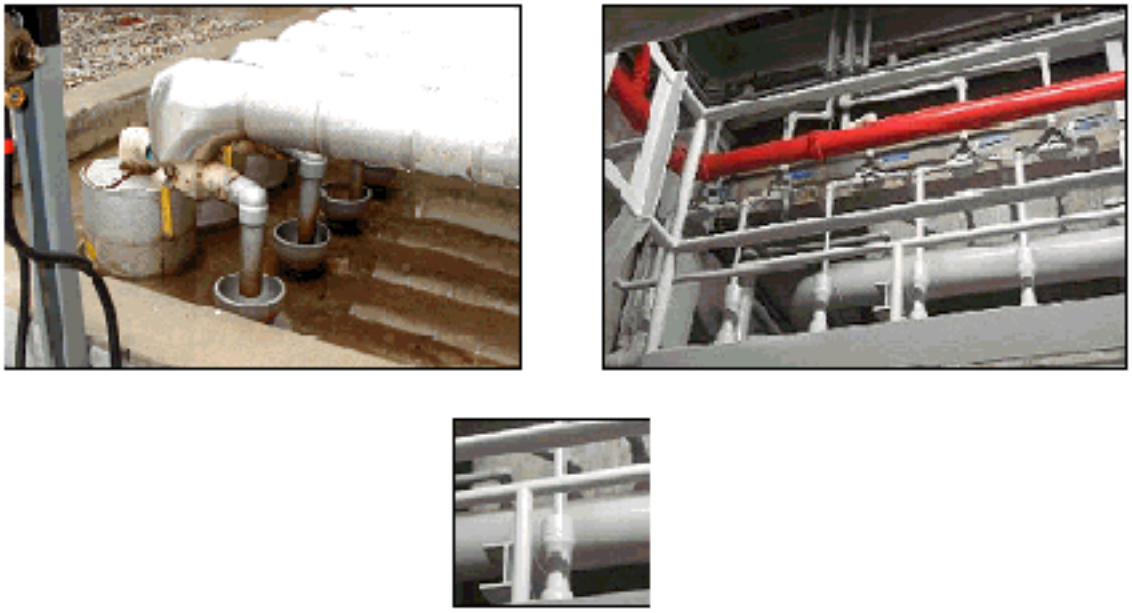

Figure 1. Atmospheric Breaks/Air Gaps

IV. VERTICAL AIR GAP

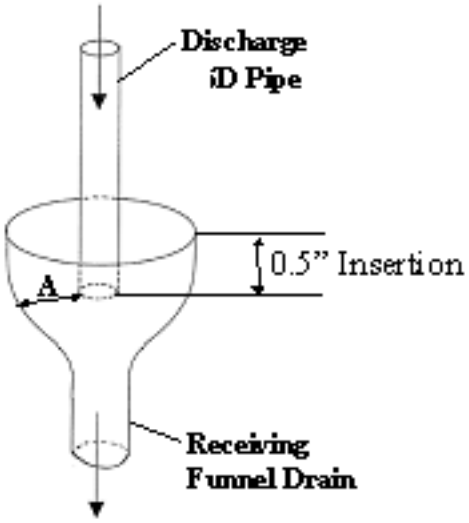

Figure 2. * Dimension "A" should provide a minimum annular clearance of one inch.

Requirements for drains containing hazardous fluids:

1. Drains which may contain hot gases must not be run directly to tanks containing flammable or explosive liquids or vapors. Funnels must be used in such drains.

2. Drains containing flammable fluids must not be combined with drains carrying high temperature fluids.

3. Funnels must be used on drains containing hazardous or flammable fluids to prevent cross flow from one drain to another.

4. The area around a drain funnel or a tank vent may be a hazardous area, depending on the fluid carried in the drain or tank. Drain funnels and tank vents must be shown on site hazardous area maps when this is the case. For this reason it is recommended that funnels be located close to the drain tank to minimize the number of hazardous areas.

5. Some drains, such as the false start drain system, may carry air at elevated temperatures and pressures. Funnels in such systems must be located or guarded in such a way as to prevent personnel exposure or damage to surrounding equipment.

6. Most compartments are equipped with exhaust fans resulting in negative internal pressure. Floor drain lines must be equipped with funnels if the drain leads to a tank or manifold potentially containing hazardous gases, so that gases are not drawn into the compartment.

CAUTION

Electrical devices and construction methods used in some compartments are unsuitable for hazardous atmospheres. Introduction of hazardous gasses into such compartments can create a dangerous situation..

7. Drain tank material must be capable of withstanding the temperatures and pressures to which it may be exposed. If plastic false start drain tanks are used, funnels must be placed upstream of the tank to drop the pressure and temperature.

V. OTHER CONSIDERATIONS

Several other items must be considered to insure safe, reliable gas turbine operation:

1. Drains carrying water must be heat traced and insulated if subjected to freezing temperatures. Frozen drain lines may prevent proper actuation of water-operated valves, or overflow of water in traps and coalescing filters.

2. Air lines subject to condensation should be heat traced and insulated.

3. False start drains should be separated from water wash drains. Detergent in the water wash effluent may prevent proper operation of oil separation equipment in the false start drain system.

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