

Emergency Systems

Location revised 02-02-05

A. Overview

The **Instrument Air System** is a pneumatic system that supplies air for field instruments, the Shutdown Panel, the ESD System, and the Deluge/Fusible Plug System.

The **Shutdown Panel** is a pneumatic panel located in the Deep Pit that allows for the automatic operation of control valves throughout the plant when process conditions exceed normal operating conditions. Some of these valves will cause process fluids to divert to different vessels; other valves will cause vessels, tanks, or wells to shut-in to a safe condition. When the air supply to the Shutdown Panel is removed, each valve will revert to its fail-safe condition. (For example, the casing gas valves will shut-in the well casings, oil to V3 diverts to T1, and oil to V4 diverts to V1.)

The **ESD System** is a pneumatic system that allows the plant operator to manually remove the air supply from the Shutdown Panel. There are eight (8) manual pull stations located throughout the plant (not including the Amine Plant).

The **Deluge/Fusible Plug System** is a pneumatic system that can be manually or automatically activated to operate the deluge/foam fire suppression system and to remove the air supply from the Shutdown Panel. There are eight (8) manual pull stations, one hundred fifty-six (156) fusible plugs, and two (2) electrically operated solenoid valves (currently out of service) throughout the plant (not including the Amine Plant).

The **Flame Detection System** is an electrical system that uses UV/IR flame detectors to detect any open flame throughout the plant. There are twenty (20) detectors located throughout the plant (including the Amine Plant).

B. Instrument Air System

The Instrument Air System is supplied from two (2) air compressors located at the east wall of the lease, near the electrical room. The lead air compressor (top) runs all the time, but will load at a pressure of 115 psig and unload at 130 psig. If the lead air compressor fails to keep up with demand, then the lag air compressor (bottom) will turn on at 90 psig and will turn off at 115 psig. These compressors are electrically fed from Emergency Panel LP-F located near the emergency generator on the west end of the lease.

A 1" pipe delivers instrument air to the shallow pit, deep pit and well cellar at a nominal 125 psig. A flexible tie-in allows instrument air to feed the Amine Plant.

The 1" line in the shallow pit is not in service.

The 1" line in the well cellar leaves through the west wall of the well cellar to the control room where the pressure is regulated down to 50 psig. This 50-psig line provides air to the Amine Plant ESD/Deluge Panel and then returns to the Control Room where it supplies air to the Production ESD/Deluge Panel. Airflow from the Instrument Air System is restricted by a needle valve before entering the Production ESD/Deluge Panel.

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The 1" line in the deep pit runs along the north wall to the Shutdown Panel where it makes two connections to the Shutdown Panel: the first is a sensing-line used to generate a Pressure Alarm Low, Instrument Air (70 psig); the second is the panel supply pressure, which is regulated down to 50 psig before feeding the panel.

C. Shutdown Panel

The Shutdown Panel is fed from the Instrument Air System (after the pressure has been dropped from 125 psig to 50 psig, nominal). The panel consists of thirty-one (31) pilot-actuated 3-way valves, and various gages and sensing-line pilots. The sensing-line pilots compare pressure signals from the field (which represent process levels and pressures) against predetermined setpoints. If the sensing-line pressure is outside the normal operating range, then a 3-way valve exhausts the Shutdown Panel pressure to atmosphere. This loss of panel pressure, in turn, causes valves to travel to their fail states

The most important of these pilots senses the pressure on the ESD and Deluge/Fusible Plug systems (ESD Holding Pressure). This pressure "holds-in" the pilot and allows panel pressure to feed the field devices. Loss of ESD Holding Pressure (below 15 psig), will cause the panel pressure to bleed off, which will close all the casing gas valves and send all the divert valves to their fail position. The ESD Holding Pressure gage will then read 0 psig.

It will not be possible to reset the Shutdown Panel until the ESD Holding Pressure is greater than 45 psig. To reset the Holding Pressure, actuate the pushbutton valve on the cover of the ESD Panel in the Control Room. If it will not reset, check the ESD System, the Deluge/Fusible Plug system, or the Instrument Air System.

D. ESD Panel

The ESD Panel is located in the Control Room and provides the link between the Instrument Air System and the ESD and Deluge/Fusible Plug Systems. The Panel Supply gage (at the bottom of the panel) is the air pressure being supplied to the ESD Panel from the Instrument Air System (after being regulated down to 50 psig, nominal).

The Panel Supply gage should always read about 50 psig.

If it does not, then check the gage on the wall outside the Control Room at the small regulator. This regulator drops the instrument air pressure from 125 psig to 50 psig.

This Regulator gage should always read 50 psig.

If it does not, then check the gage on the wall upstream of the regulator. This gage registers the instrument air supply from the air compressors and should read about 125 psig.

If it does not read 125 psig, then check the instrument air compressor for problems (e.g., no power, overloads tripped, breaker tripped, switch failure, etc.) and the integrity of the 1" instrument air supply line (e.g., leaks, blocked-in supply valves, obstructions in the line).

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If the Upstream gage reads 125 psig, but the regulator gage does not read 50 psig, adjust or replace the regulator.

If the Regulator gage reads 50 psig, but the Panel Supply gage does not read 50 psig, then check along the north wall of the lease. Look for tubing leaks, open valves to atmosphere, or isolation valves that are in the closed position.

If the ESD Panel Supply gage reads 50 psig but either the ESD Holding Pressure gage (at the Shutdown Panel) or the Deluge/Fusible Plug Holding Pressure gage (also at the Shutdown Panel) reads below 45 psig, then these systems need to be charged. Press and hold the pushbutton valve in the center of the ESD Panel. This will connect the panel supply to the ESD and Deluge/Fusible Plug Systems. When these systems are charged to more than 21 psig, the pushbutton valve will latch open and the rest of the charging will take place automatically without having to hold the pushbutton in.

E. ESD System

A regulator reduces the instrument air supply from 125 psig to 50 psig for use with the ESD System. (This is the small regulator outside the Control Room.) A needle valve isolates this system from the air supply and, when an ESD valve is opened, allows the ESD System to bleed off faster than the Instrument Air System can supply more air. When the ESD System pressure (Holding Pressure) drops below 15 psig, the pushbutton valve at the ESD panel closes and positively isolates the two systems. The ESD System can be manually actuated from any of eight (8) field locations.

When a valve at a manual ESD station is opened, ESD System air pressure is bled off. Three quick-exhaust valves in the field quickly exhaust downstream pressure. This reduces the amount of air that must bleed off through the entire tubing system and, therefore, the time it takes for the casing gas valves to close. In addition to closing the casing gas valves, all shutdown valves revert to their fail states (e.g., oil to V3 diverts to T1, and oil to V4 diverts to V1). A Pressure Safety Low, ESD System alarm is generated when the pressure drops below 45 psig.

An ESD System pressure (Holding Pressure) of at least 45 psig is required before the Shutdown Panel in the deep pit can be reset (check the gage on the door of the ESD Panel in the Control Room and charge the system if necessary).

F. Deluge/Fusible Plug System

A regulator reduces the instrument air supply from 125 psig to 50 psig for use with the Deluge/Fusible Plug System. (This is the small regulator outside the Control Room.) A needle valve isolates this system from the air supply and, when a manual valve is actuated, a fusible plug melts, or a solenoid valve is energized, allows the Deluge/Fusible Plug System to bleed off faster than the Instrument Air System can supply more air.

The Deluge/Fusible Plug System can be manually activated from any of eight (8) field locations or automatically activated from any of one hundred fifty-six (156) fusible plugs set to melt at 168°F or two (2) electrically operated solenoid valves (currently out of service). In addition there

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are seven (3) check valves, and five (5) quick exhaust valves that are installed to control how much of the system is bled off.

When air pressure is bled off the Deluge/Fusible Plug System, the deluge valves open, the valve to the foam tank opens, and the fire pump turns on. The fire pump pumps city water through the foam tank (accumulating foam along the way) through the deluge valves and out the nozzles located throughout the plant. There are three deluge valves: one in the deep pit, one in the well cellar, and one in the Amine Plant.

A Deluge/Fusible Plug system pressure (Holding Pressure) of at least 45 psig is required before the Shutdown Panel in the deep pit can be reset (check the gage on the door of the ESD Panel in the Control Room and charge the system if necessary).

G. Flame Detection System

The Flame Detection System uses UV/IR flame detectors to monitor the lease for any open flame. Information regarding flame detection or detector malfunction is communicated to a SCADA system which (1) triggers audio-visual alarms at the operations computer, (2) illuminates a beacon in the plant, and (3) sends a page to an operator-carried pager.

Future work may include using the Flame Detection System to initiate a Deluge/Fusible Plug shutdown.

H. Recommendations

The following notes refer to the page numbers of in the hand-drawn sketches of the ESD/Fusible Plug/Deluge Systems.

General:

1. Bubble-test all tubing lines. Repair any leaks.
2. Scrape paint off all fusible plugs.
3. Install two (2) electrically operated solenoid valves that will dump the Deluge/Fusible Plug air supply when a flame is independently detected by two separate flame detectors.
4. Investigate Amine Plant protection.
5. Verify tubing runs between the north wall of the lease and the fire pump / foam valve area.
6. Replace leaky pushbutton valve in ESD Panel.
7. Check operation of Foam Valve.
8. Order spare fusible plugs.
9. Verify Amine Plant operation.
10. Trace out Fire Pump interlocks.

Page 2:

1. Remove abandoned tubing along the north east corner of the lease.
2. Remove check valve along the northeast corner of the lease.
3. Relocate Amine Plant tie-in and shorten loop tubing.

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Page 3:

1. Replace needle valve in the ESD panel with orifice plate.
2. Replace 2 check valves.

Page 4:

1. New sign for manual Deluge trip at west end of well cellar (not ESD).
2. Add manual Deluge station at east end of well cellar, and install sign.
3. Verify destination of 4 3/8" tubing runs leaving the well cellar at the NW corner.

Page 5:

1. Replace needle valve in pipe chase.

Page 6:

1. No protection on T4.
2. No protection on V2.
3. Replace SOV at V1 and tie in to PLC.

Page 9:

1. Replace 2 quick bleed valves.

Page 10:

1. Remove tubing to sales gas skid.
2. No protection for the sales gas area (no fusible plugs or deluge).

Page 11:

1. Verify destination for (4) 3/8" tubing runs.
2. Verify destination for (6) 3/8" tubing runs.
3. Replace SOV and tie into the PLC.

I. Parts

General Monitors, UV/IR flame detector

Versa, 2-way valve, N.C., pilot,

BPS-2208

Versa, 3-way valve, N.C., pilot,

BPS-3208

Versa, 2-way valve, N.C., panel mount, plain button with guard

BLK-2208-P-67

Versa, pilot actuator

Humphrey Products, quick exhaust, 3/8" ports

QE3

Pneu-trol, check valve, 1/8" port, stainless steel

CP10-SS

Pneu-trol, needle valve, 1/8" port, brass

N10B

Sigma-netics pressure switch

Note:

SV-1 Well cellar deluge valve

SV-2 Deep Pit deluge valve

SV-3 Amine Plant deluge valve

SOV-1 Well Cellar

SOV-2 Deep Pit

SOV-3 Amine Plant