TECHNI/TIPS

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COMPRESSOR MANIFOLD/RECEIVER FIRES AND/OR EXPLOSIONS

Harmful fires or explosions are rare and can be attributed to dirty conditions of the compressor system interior. The most effective approach to the elimination of this hazard is to follow these simple rules.

- Closely monitor the feed rate of the cylinder oil.
- Do not overload the compressor.
- Make sure that intercooling equipment functions properly.
- Keep the system clean. Particles of deposits can become incandescent at high temperatures, break loose and ignite gases in the manifold and/or receiver.

The so called "fire triangle" (oxygen, fuel and an ignition source) exists in any air compressor. Air provides the oxygen and oils provide fuel. Normal discharge temperatures are never high enough to trigger a fire or cause an explosion. The ignition temperature of most air-cylinder lubricating oils is above normal compressor operating temperatures.

Deposits do collect on valves, heads and discharge piping. This may cause leaking discharge valves, so the hot air bypasses (siphons back and forth) and continues to build up heat until auto-ignition can occur. This is the result of inadequate maintenance, such as dirty fins on air-cooled compressors, dirty intercoolers, water jackets clogged with scale, broken or leaking valves, etc. The operator should (1) keep the compressor clean, (2) inspect the valves frequently and (3) remove scale formations in the cooling water jackets.

Fire or explosions have sometimes occurred shortly after compressors were cleaned with combustible products such as kerosene or other light cleaners. These should never be used to clean compressors. A noncombustible cleaner should always be used.

Measures that should be taken to prevent fires or explosions are identical with those that should be taken to prevent abnormally high operating temperatures. In addition, adequate filters should be provided to assure clean suction (inlet) air.

Excessive deposits and high discharge temperatures are practically always involved in a fire or explosion in a compressor discharge system.

Temperatures **much higher** than the flash point of the oil would have to be reached before large amounts of oil vapor would be formed, and still higher temperatures would be necessary for auto-ignition of the oil to occur. Auto-ignition temperatures of oil are about 750°F. (399°C.) or more at atmospheric pressures and less at higher pressures. Such higher temperatures could develop only from some combination of factors relating to abnormal temperatures.

Discharge air temperatures above normal may result from any of several unfavorable or improper operating conditions. The conditions responsible should be determined and corrected immediately, since high temperature operation accelerates oil oxidation and the formation of deposits and, in extreme cases, can result in fires or explosions.

The most common causes of abnormally high operating temperatures are:

- Increased cylinder discharge pressure due to restriction of discharge passages by deposits.
- Recompression (siphoning of the air back and forth) due to leaky discharge valves. Leaking valves can be due to deposit buildup or cracked parts.
- Recompression due to blowby in double acting cylinders. Such blowby may be due to worn rings, liners or inadequate sealing by insufficient oil feed rates.
- Inadequate cooling in water jackets and intercoolers. Cooling water supply may be inadequate or the inlet water temperature may be too high. Heat transfer may be retarded due to scale on the water side surfaces, or silting of the passages due to dirty water.

The prevention of abnormal operating temperatures involves regular inspection and cleaning of inter-coolers, water jackets, air filters, discharge valves and air passages. Valves, piston rings and liners must be kept in good mechanical condition and an adequate flow of cooling medium must be maintained.

Fires or explosions may even occur though the high operating temperature necessary for the auto-ignition of the lubricating oil is not reached. Analyses have shown that the bulk of compressor deposits usually consist of a variety of environmental contaminants (entering with the outside air), many of which are combustible.

Oxygen from the air is also present. At temperatures below auto-ignition temperatures of compressor lubricating oil, but nevertheless abnormally high, it is believed that oxidation of combustible contaminants can proceed within a layer or mass of deposit and that the attendant generation of heat can cause a portion of the deposit to glow. A portion of that glowing deposit, however small, can eventually break off and be carried into the manifold or receiver and be sufficient to start a serious compressor fire or explosion.

Under certain conditions, a considerable mass of deposit may reach glowing temperature in the manner just described. The heat generated within such a mass may so weaken the walls of a discharge pipe or some other part of a discharge system that an explosive rupture may occur. In some cases, fire or explosions occur at points remote from the compressor discharge area, but generally are in the intercooler, manifold or receiver.

Suitably placed pressure gauges and thermometers provide ready means for detecting faulty operation. In addition, safety devices that shut down the machines at predetermined overpressures or over temperatures are recommended, particularly where compressors are attended infrequently.

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