

U.S. Department of Labor
Mine Safety and Health Administration
Technical Support
Approval and Certification Center
Engineering and Testing Division
Engineering Support Branch

Investigative Report

Thermo-Tech Heating Devices, Inc.

Belt Deicing Systems

Pertains to : MRS No. 010104

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*** ABSTRACT

Technical assistance was provided to Coal Mine Safety and Health at the request of Allyn Davis, Chief, Division of Safety in the form of an evaluation of the suitability of Thermo-Tech Heating Devices, Incorporated's, Belt Deicing Systems for use on conveyor belts at surface coal mine applications. When installed in accordance with applicable National Fire Protection Association codes, these units will provide a safe and reliable method of deicing and/or defrosting belts and drive rollers in surface mine applications.

***INTRODUCTION

On March 7, 1994, a memorandum was received from Allyn Davis, Chief, Division of Safety, Coal Mine Safety and Health. This memorandum requested that the Approval and Certification Center evaluate the suitability of Thermo-Tech's Belt Deicing Systems for use on conveyor belts at surface coal mine applications.

In the past, numerous techniques have been used to prevent drive rollers and materials on belts from slipping during inclement weather conditions. Examples of techniques used have been personnel dumping sand or other materials between the belt and drive roller to increase friction, and salamanders and/or containers filled with mixtures of rags and kerosene and ignited to provide heat to rid the belts of ice or frost build-up. The use of such techniques has not been effective and in some cases, resulted in potentially hazardous use conditions.

DISCUSSION

Two types of belt deicers were evaluated under this investigation, fuel oil and LP gas fired units. Both units incorporate the following components:

1. An Underwriter Laboratories listed fuel oil or LP gas burner,
2. An Eagle tac switch with proximity sensor, and
3. A manufacturer's constructed stainless steel housing with a stainless steel heat directional chamber

Both types of units offer optional thermostatic controls.

According to the manufacturer, 138 fuel oil fired units have been manufactured. Each unit is serialized in ascending order of manufacture and records are maintained to track purchasers and how the units are used. Eight units are installed as furnaces heating mine entrance air and the remaining 130 units are installed on conveyor belts to defrost and deice the belts.

Since this product is similar to a fuel oil or LP gas fired home heating furnace, Underwriter Laboratory standard 727 for Oil-Fired Central Furnaces and American National Standards Institute Z21.64-1988 for Direct Vent Central Furnaces were reviewed for applicable safeguards. Following is a list of items which appear to be reasonable and applicable to the installation and use of this product.

1. Safety Control - automatic controls (including relays, switches, and other auxiliary equipment used in conjunction therewith to form a safety control system) that are intended to prevent unsafe operation of the controlled equipment.
2. Safety Combustion Control - a primary safety control responsive directly to the flame properties; sensing the presence of flame and causing fuel to be shut off in the event of flame failure.
3. Thermostat - an automatic control actuated by temperature change to maintain temperatures between certain limits.
4. Fuel Control Safety Valve - a normally closed valve of the "on" and "off" type, without any bypass to the burner, that is actuated by a safety control or by an emergency device.

A review of literature provided by the manufacturer and subsequent tests conducted at the manufacturing plant demonstrated that both the fuel oil fired units' and the LP gas fired units' Safety Control Systems provide a Safety Combustion Control and Fuel Control Safety Valve. The fuel oil fired unit accomplishes this through use of a cadmium sulfide cell while the LP gas unit uses an air purging feature and the flame rectification of an AC voltage.

The cadmium sulfide cell is a light sensing element that is installed at the entrance of the combustion chamber. It detects light from the burning fuel and provides unit shut down if the light is extinguished. Another feature provided by the cadmium position and light is detected in the combustion chamber from any source.

The air purging feature on the LP gas units forces air through the combustion chamber for 30 seconds prior to permitting fuel flow and ignition. This feature is intended to circumvent ignition of unwanted gas accumulations in the combustion chamber that could result in an uncontrolled explosion.

On March 22, 1994, a trip was made to Thermo-Tech Heating Devices, Inc., and Buffalo Coal Company. At Thermo-Tech, two Model A units, one fuel oil fired and one LP Gas fired, were tested to verify the operation of various safety devices. Following is a list of tests conducted on the fuel oil fired unit and results of the unit's performance.

1. Opening a lead to the cadmium sulfide cell produced unit shut down in approximately 45 seconds.
2. Preventing light from reaching the cadmium sulfide cell permitted the unit to start, but produced a unit shut down in approximately 45 seconds.
3. Shorting the cadmium sulfide cell prior to start up did not permit the unit to start.
4. Shorting the cadmium sulfide cell while operating did not shut the unit down, but would not permit the unit to restart following any other shut down.
5. Interrupting the arc produced immediate shut down.

The LP gas unit was tested by opening the flame rectification circuit. Opening this circuit produced unit shut down.

As expected, interrupting the flow of fuel on either the LP gas or the fuel oil unit produced unit shut down. The motors in all units are thermally protected and have manual resets.

After examination of the above units, the trip continued on to Buffalo Coal Company's preparation plant where the installation of seven (7) fuel oil fired units was observed. A meeting was held with Plant Superintendent Dave Bell in which it was reported that, "absolutely no problems have been experienced with any units after the initial debugging." Specific tests or compliance inspections were not conducted on the installed units.

National Fire Protection Association 31, Standard for the Installation of Oil-Burning Equipment was reviewed for applicable information. This standard contains sections that are reasonable and applicable to the fuel oil fired unit as designed and used. Applicable sections are:

1. Chapter 1 - General Provisions, Sections 1-1 Application and Scope, 1-2 Definitions, 1-4.2, 1-4.4, and 1-4.5 on unit installations, and 1-9 Electrical Wiring and Equipment.
2. Chapter 2 - Tank Storage, all Sections,
3. Chapter 3 - Piping, Pumps, and Valves, all Sections, and

4. Chapter 4 - Installation of Oil Burners and Oil-Fired Units, Section 4-3 Controls.

National Fire Protection Association 54-1992, National Fuel Gas Code was reviewed for applicable information. This standard also contains sections that are applicable to the LP-Gas fired product as designed and used. Applicable sections are:

1. Part 1 - General, Sections 1.1 Scope, 1.2 Alternate Materials, Equipment, and Procedures, 1.4 Qualified Agency, 1.6 Prevention of Accidental Ignition, and 1.7 Definitions,
2. Part 2 - Gas Piping System Design, Materials, and Components, Sections 2.3 Interconnection Between Gas Piping Systems, 2.4 Sizing of Gas Piping Systems, 2.5 Piping System Operating Pressure Limitations, 2.6 Acceptable Piping Materials and Joining Methods, 2.8 Gas Pressure Regulators, 2.9 Overpressure Protection Devices, and 2.10 Back Pressure Protection,
3. Part 3 - Gas Piping Installation, all Sections,
4. Part 4 - Inspection, Testing, and Purging, all Sections
5. Part 5 - Equipment Installation, all Sections
6. Part 8 - Procedures to be followed to place equipment in Operation, all Sections, and
4. Part 10 - Sizing Table for supply lines

All electrical connections made between belt deicing systems and electrical supplies and/or plant wiring should conform with National Fire Protection Association 70, National Electrical Code.

*** CONCLUSIONS

Fuel oil and LP Gas fired Belt Deicers, Models A, B, and C manufactured by Thermo-Tech Heating Devices, Inc. function as reported by Thermo-Tech's Heating Solutions brochure. When installed in accordance with the above mentioned sections of the National Fire Protection Association Codes, these units would be expected to provide a safe and reliable method of deicing and/or defrosting belts and drive rollers in surface mine applications.

*** RECOMMENDATIONS

It is recommended that fuel oil and LP Gas fired Belt Deicers manufactured by Thermo-Tech Heating Devices, Inc. be installed and used in accordance with the following provisions.

1. The installation shall be performed by qualified competent personnel in accordance with the manufacturer's installation instructions.
2. Before placing into operation, fuel oil and LP Gas fired Belt Deicers shall be performance tested to insure that all controls and safety devices are properly functioning and that supply lines and fittings are leak free.
3. All electrical wiring and equipment shall be installed in accordance with the National Electrical Code.
4. Tanks used as fuel supply or storage tanks shall be listed by Underwriters Laboratories, Inc.
5. Fuel oil supply or storage tanks shall be vented to prevent the development of a vacuum or pressure that exceeds the design pressure of the tank.
6. Fuel oil and LP Gas supply tanks shall be guarded to alert equipment and vehicle operators of the tank location.
7. Fuel oil and LP Gas supply lines and fittings shall be brass or copper tubing, wrought-iron, or steel and installed to prevent accidental rupture by falling objects, moving equipment or vehicles.
8. Fuel oil and LP Gas fired belt deicers shall not be modified in any manner from that supplied by the manufacturer.
9. When fuel oil is used, facilities shall be provided to contain and prevent accidental discharge from entering neighboring waterways. The capacity of the containment area(s) shall not be less than the capacity of the tank(s) utilized.

In instances where Underwriters Laboratories, Inc., listed tanks cannot be obtained, the tank shall be designed in accordance with National Fire Protection Association 31, Standard for the Installation of Oil-Burning Equipment or National Fire Protection Association 54-1992, National Fuel Gas Code as appropriate.

We are available to provide technical assistance in this area, if the need arises.