SYSTEM SAFETY REPORT FOR METHANE UTILIZATION FROM COALBEDS FOR POWER GENERATION AT BETHLEHEM MINES CORPORATION MARIANNA MINE NO. 58 MARIANNA, PENNSYLVANIA

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Approval: A. Kocis
A. Kocis
Safety Administrator

C. L. Sturgill
C. L. Sturgill
Project Manager

Prepared by:

WESTINGHOUSE ELECTRIC CORPORATION
ADVANCED ENERGY SYSTEMS DIVISION
PITTSBURGH, PENNSYLVANIA

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Originated by

WESTINGHOUSE ELECTRIC CORPORATION
OCEANIC DIVISION

Frederick Eliot
Systems Safety Director

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For Bethlehem Mines Corporation, Well 32-13,
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per
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with revisions by

WESTINGHOUSE ELECTRIC CORPORATION
ADVANCED ENERGY SYSTEMS DIVISION

for

Methane Utilization from Coalbeds
for Power Generation at
Bethlehem Mines Corporation

Marianna Mine No. 58 - Marianna, Pennsylvania

April, 1980

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MINE METHANE UTILIZATION PROGRAM SYSTEM SAFETY REPORT

I. INTRODUCTION

Since the inception of this program, the engineering effort has been directed towards designing in safety features instead of reviewing them in. This was accomplished by identifying the hazards associated with the coal bed gas mixture program and then specifying equipment, systems and procedures that would eliminate, control or provide early warning of these potential hazards. The system safety was also enhanced by specifying or selecting proven equipment from known vendors and by adhering to the requirements of established safety codes and criteria. No part of this system was considered beyond the state-of-the-art. Flammable gases are compressed safely every day and there are many installations of turbine-generator units running on liquid fuel or natural gas. Even while selecting known equipment though, engineering still incorporated additional safety features to further increase the system's overall safety. As the primary potential hazard of this program is in the utilization of a methane-air mixture, which in the percentage range of 5 to 15 percent is highly flammable, the major system safety engineering effort has been directed towards this.mixture's safe control. It can be utilized safely by not allowing it to approach its limits of flammability until it is in the turbine system and by controlling extraneous sources of ignition. Appendix A, the Westinghouse General Safety Policy and the following paragraphs will point out the features specified and incorporated to achieve these controls. Safety training for operating personnel will be provided by the Westinghouse Advanced Energy Systems Division Safety Department at a safety seminar with training sessions. Personnel will be trained in the use of fire fighting equipment, emergency use of oxygen and in the use of first did equipment. One person on each. shift will be certified in first aid procedures.

II. COMPRESSOR DESIGN CONSIDERATIONS*

A. Isolation Valves

Three isolation valves, V2, V3 and V4, have been incorporated in the compressor pallet assembly that allow isolation via V2 of the compressor intake from the

*See Appendix B for Gas Compressor Pallet Assembly Specification

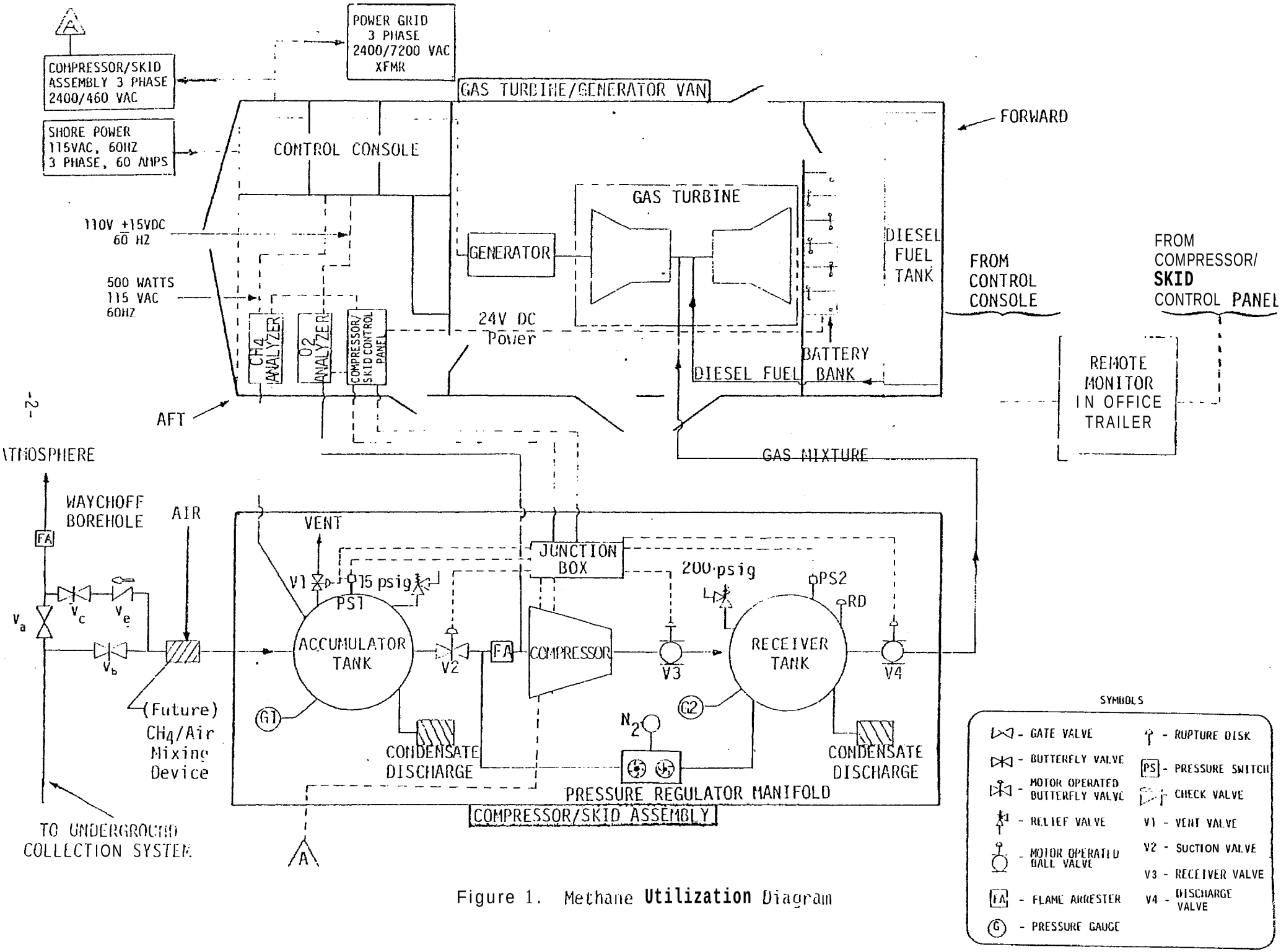

Figure 1. Methane **Utilization** Diagram

accumulator output, isoiation via V3 of the compressor output from the high pressure receiver input and isolation via V4 of the receiver output from the turbine input. See Figure 1. These valves are operated automatically in the normal operations mode hut can be electrically overridden and operated or operated manually. These valves serve to permit maintenance or inspection on any part of the system without disturbing the rest of the system as well as to isolate the system in case of a failure or casualty.

B. Shutdown of Valves

There are, three valves on the compressor/skid assembly that are programmed to shutdown simultaneously for maximum safety and system protection. These include the three valves mentioned in paragraph A. The accumulator ten-inch vent valve (V1) is not used for the Marianna No. 58 Mine case because its original purpose was to ensure that no back pressurz occurred on the mine ventilation system at Bethlehem Mines No. 32-13 borehole, Ebensburg, Pennsylvania. Valve V1 will remain shut and electrically inoperative. As valves V2, V3 and V4 are electrically-operated ,valves, emergency power for their operation in case of snore power failure is provided by an inverter which receives its input power from the gas turbine van battery supply. If a shore power failure should occur, the shore power relay TDSP drops out closing the circuit to the output of the inverter. The 115-volt inverter output is then applied simultaneously to the Suction Valve, V2, Receiver Valve, V3 and the Discharge Valve V4. Valves V2, V3 and V4 are driven fully shut on shore power failure.

C. Alarms and Status Lights

The compressor pallet assembly control panel, located in the turbine van control room, contains all of the control indicator lights and alarms needed to safely operate and supervise the compressor's operation. Safety-related items that are indicated on this panel are:

- Suction pressure indication in the accumulator tank
- Discharge pressure indication in the receiver tank
- Discharge Valve positions (open or close)

- Receiver Valve positions (open or close)
- Suction Valve positions (open or close)
- Vent Valve positions (in operation or out of operation)
- *Methane content below 30 percent
- *Oxygen content above 10 percent
- *Loss of oxygen or methane analyzers
- *Receiver high liquid level
- *High suction pressure

In addition, the following compressor-related functions and conditions are monitored and displayed:

- Low water pressure alarm
- Compressor loaded
- *Low o'il pressure
- *Lubricator no flow
- *High discharge temperature, cylinder one
- *High discharge temperature, cylinder two
- *Low suction pressure
- *High discharge pressure
- *High interstage pressure
- *Conpressor vibration
- *High compressor jacket water temperature
- *High liquid level suction scrubber
- *High liquid level interstage scrubber
- *Lubrication low oil level

*Initiates shutdown

In operation, when an alarm is received, a red status light will light, a flashing light will light and an alarm horn will sound. Pressing the reset button will silence the horn and extinguish the flashing light but leave the red status light illuminated until the condition that caused it is cleared or returned to normal. An alarm event automatically shuts down the compressor pallet assembly which in turn shuts down the turbine van unit.

D. Redundant Gas Mixture Monitoring

As noted earlier, the flammability limits of methane is 5 to 15 percent in air. To guarantee a safe operation, it is necessary to monitor the coalbed gas mixture as it is received by the compressor intake to ensure that it does not approach the limits of flammability. While the coalbed gas mixture could be monitored with a single gas analyzer, this system incorporates two separate analyzers. The system can operate safely until methane level reaches 30 percent of the gas mixture but the alarm will be set for 60 percent. The second analyzer monitors the oxygen content of the mixture and alarms if it exceeds 8 percent. An alarm event automatically shuts down the compressor pallet assembly which in turn shuts down the turbine van unit,

E. Compressor Unloading Valves

To add an additional degree of safety to the system, on system shutdown, whether it be a normal shutdown or one caused by an alarm, the compressor will automatically load., This design feature precludes recirculating compressor discharge to the inlet during system shutdown. However, recirculation to the inlet via a flow by-pass system external to the compressor could occur during normal operations, for variable, flow capability purposes, caused by a changing power demand.

F. Positive Valve Position Indication

Each of the three valves discussed in section B above has its position indicated by open or closed lights on the control panel, Although Vent Valve V1 is closed and inoperative its status will be indicated.

G. Pressure Relief

Both the accumulator and receiver pressure vessels are built to ASME requirements and code stamped. In addition, each have redundant pressure relief devices installed. In addition to the code required pressure relief valve, a rupture disc is also installed as a safety backup. The accumulator vessel is expected to operate at a negative pressure (i.e., 8 psia) because the coal-bed gas mixture is pulled from the borehole 7500 feet away.

III. VAN SAFETY CONSIDERATIONS

A. Code Compliance

Article 500-1 of National Electric Code (NEC) under scope, states in part, "It is intended that each .room, section or area (including turbine and generator rooms and room for the enclosure of control equipment) shall be considered individually in determining its classifications." Based upon this, the "control room" and the "turbine/generator room" are distinct and separate rooms within the van.

The NEC has several hazardous classifications. Class I deals with flammable gases or vapors. Within Class I, there are two divisions. Division 2 is for locations in which the gases are used but are normally confined within the closed system. In addition, methane is listed as Group D Atmosphere.

If the turbine/generator room were to be operated with all of its vents, doors and louvers closed, it would be classified as Class 1, Division 2 location. Requirements for such a location include:

- Wiring in threaded rigid metal conduit or special cables
- Breakers in Class I enclosures, hermetically sealed or under oil

- Generators - no sliding contacts unless explosion proof or enclosed
- Lightning protected from physical damage

None of these requirements is met or could be met with the present configuration of equipment installed. Therefore, the turbine/generator when piped up to methane must always have all vents opened fully so that no methane will be entrapped should any escape. With all vents open, the turbine/generator is not considered to be located in a room and, thus, the NEC hazardous classification does not apply.

The control room, to be safe and to comply with the NEC, must only be operated when it is sealed off from the turbine/generator room. This requires that the door to the turbine/generator room be sealed closed whenever methane is being utilized as the fuel and all other openings (wire passageways, etc.) be sealed. Prior to any equipment, lights or heaters being energized in the control room, a safe reading must be obtained with a portable qualified methane gas detector.

B. Generator Set Protective Devices

Included in the gas turbine/generator set are several protective devices. They are as follows:

a Fail-to-Start - If the turbine fails to reach 5 percent speed in 10 seconds, cranking will cease. If 70 percent speed is not attained in 60 seconds, ignition is terminated, lighting the FAIL-TO-START malfunction lamp on the Engine Control Panel.

*• Turbine Overspeed - If the turbine accelerates to 107 percent of the rated speed or greater, ignition is terminated, lighting the OVERSPEED lamp on the Engine Control Panel and the TURBINE OVERSPEED BREAKER TRIP circuit in the annunciator.

*• Lube Oil Temperature - If the lube oil temperature exceeds 225°, the turbine will shutdown lighting the HIGH OIL TEMP lamp on the Engine Control Panel and activate the TURBINE HIGH OIL TEMPERATURE BREAKER TRIP circuit in the annunciator.

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*Initiates shutdown disconnecting the mine grid and compressor/skid assembly.

*• High Turbine Temperature - If the exhaust temperature of the turbine exceeds 900°, the HIGH EXHAUST TEMP lamp on the Engine Control Panel will light activating the TURBINE HIGH EXHAUST TEMPERATURE BREAKER TRIP circuit in the annunciator.

• High Vibration - If vibration of the turbine exceeds a set limit, the vibration monitor is activated lighting the HIGH VIBRATION lamp on the Engine Control Panel.

• Lube Oil and Fuel Differential Pressures - Pressure differential between input and output lines of the fuel and lube oil filters is measured during operation. If the differential pressures exceed a preset limit, the circuits light the corresponding lamps on the Engine Control Panel, indicating a restriction of one of the filters.

• Undervoltage - If, when the system is on the line, the voltage output should drop below 90 percent of rated voltage, the annunciator will signal GENERATOR UNDERVOLTAGE ALARM.

• Overvoltage - If, when the system is on line, the voltage output should increase to 115 percent of the rated voltage, the GEEIERATOR OVER VOLTAGE ALARM 115-percent circuit in the annunciator will be activated.

*If voltage increases to 125 percent of the rated voltage, a time delay overvoltage relay is activated. If the voltage does not drop within the time delay period (adjustable from 0.8 to 15 seconds), the GENERATOR OVERVOLTAGE 125-percent circuit in the annunciator is activated.

*a Turbine Low Lubricating Oil Pressure - Should lubricating oil pressure drop below 15 psi, lubrication oil pressure switch (LOPS) is activated dropping out all starting relays. LOW OIL PRESSURE BREAKER TRIP in the annunciator circuit lights and effects turbine shutdown.

*• Reverse Power - the GENERATOR REVERSE POWER BREAKER TRIP circuit in the annunciator is energized if the generator begins drawing power from the system {motoring) instead of supplying it.

• Overcurrent - If the output current should exceed 115 percent of the rated value, the GENERATOR OVERCURRENT ALARM 115-percent circuit in the annunciator will be activated.

*If current exceeds 125 percent of the rated value, overcurrent time delay relay is activated. If current does not return to normal within delay period, OCR-T closes, tripping ACB and closing overcurrent auxiliary relay (OCR-1). OCR-1 in turn activates GENERATOR OVERCURRENT 125 oercent BREAKER TRIP circuit in the annunciator.

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*Initiates shutdown disconnecting the mine grid and compressor/skid assembly,

- Low Fuel Level - If the fuel level drops below a set level, the TURBINE LOW FUEL LEVEL ALARM circuit in the annunciator will be activated.

In addition to the above, the main power circuit breaker is tripped off the bus if the unit is shutdown for any reason,

IV. SYSTEM DESIGN CONSIDERATIONS

A. Shutdown Modes

Because the system is configured a; a bootstrap system, failures or malfunctions in one system will automatically secure all systems. Also, manual shutdown of any one unit automatically shuts down the entire system. When the system is being prepared to go on-line, the turbine is started first on diesel fuel. When it is operating, part of the generator output is used to start the compressor on the pallet assembly. When high pressure gas is available in the receiver, the turbine is switched from liquid fuel to gas fuel. A turbine shutdown will thus remove power from the compressor pallet assembly and it will automatically shutdown. If power is restored, it will not restart unless the starting sequence is again initiated. On the compressor pallet assembly, malfunctions detected by the alarms noted in II.C by an asteris!; will cause it to secure. On the turbine/generator, malfunctions detected by the alarms noted by an asterisk in III.B will secure the turbine/generator.

B. System Eonding

To ensure that a static electric discharge cannot serve as an unwanted source of ignition, a continuous bonding system will be installed across all metal-to-metal connections through which the coalbed gas mixture passes. This bonding system will in turn be grounded to a grounding electrode system that will comply with NEC Article 250. Resistance measurements of both systems will be taken at the site after system installation and before system start-up to assure minimum resistance between all components and ground is obtained. The system will not be operated until these requirements are met.

C. Flame Arresters

A flame arrester is installed in the line between the compressor intake and the accumulator to prevent any ignition of the gas in the accumulator from a fault in the compressor. Flame arresters are only required when operating on methane/air mixture. Although this system will be operated on a high methane ratio (>95% CH_4) supplied by the mine degasification system, provisions have to be made to mix air with this methane to demonstrate system operation down to 60 percent CH_4. This air would be added prior to the accumulator to ensure mixing.

0. Nitrogen Purge System

To ensure a safe operation, it is necessary to preclude unintentisnally adding air to the coalbed gas mixture that is processed. To remove entrapped air in the system, a nitrogen purge is utilized. Prior to system start-up, nitrogen will be forced under pressure through the compressor, receiver and the interconnecting 1ines to remove air remaining after system assembly. The oxygen content will be monitored to dstermine when 'purging is complete. The accumulator will be purged of air by allowing coalbed methane to vent to the atmosphere and monitor oxygen content.

E. Subsystem Location

A built-in safety feature is the location and separation of the major sub-assemblies of the system. The pallet assembly will be located about seventy-five feet from the mine ventilation fan. It is designed for outdoor operation but utilizes explosion-proof mining methods of rigid conduit and explosion-proof valve operators and switches. Its outdoor location will reduce any hazards resulting from a coalbed gas leak at the pallet assembly. The van will be located approximately fifty feet from the pallet assembly.

V. ELECTRICAL INTERFACE

A. Grid Protection

The actual tie-in to the mine grid and to the compressor motor will be accomplished, tested and approved by Bethlehem Mine personnel to the applicable

codes and standards. The grid 'protection includes over-current relays on all three phases, phase balance relay, and manual shutdown at the feeder substation.

VI. 014-SITE SAFETY CHECK

A. Initial Start-Up

Before the compressor pallet assembly is tested the turbine van will be operated on liquid fuel. After it is checked out, it will be switched into the mine grid and to the compressor motor to ensure there are no interface problems and that a11 required parameters can be monitored. After compressor installation at the site, the piping will be pressurized and leak checked. Then, the compressor will be operated on air while all of the valves, switches, overrides and safety devices are operated and checked. A thorough nitrogen purge will follow before the compressor is operated on coal bed gas. A reliable communication system will be established. Operaring, emergency and maintenance procedures will also be verified and approved during this phase. Any potential .problems identified or arising during the initial phase will be satisfactory and safety resolved before the systsm will be allowed to go on-line.

APPENDIX A

WESTINGHOUSE ELECTRIC CORPORATION

GENERAL SAFETY POLICY

A. WESTINGHOUSE GENERAL SAFETY POLICY

The Westinghouse Electric Corporation Corporate Management Manual states that "It is Westinghouse policy to take all practical steps to eliminate, or reduce, exposure of employes to accidental injury, or to conditions adversely affecting their health, while on the job. It is also Westinghouse policy to inform employes concerning off-the-job hazards and what can be done to minimize those hazards." The Westinghouse Electric Corporation is a charter member of the National Safety Council and the operating divisions have received numerous National Safety Council Awards of Honor and Awards of Merit. Centralized Safety Services are available to all operating divisions.

The responsibility for compliance with the corporate policy rests with the General Managers of the operating divisions. Headquarters departments of Industrial Hygiene and Safety and Works Engineering are responsible for assisting the operating divisions by providing instruction manuals, professional training programs, guides, information bulletins, and consultation services and for conducting audits of division performance in these areas. Typical of the manuals provided are the Safe Practice Data Sheets and the Environmental Control Manual. The corporation maintains a Headquarters Industrial Hygiene and Safety Laboratory where research and evaluation of potential toxicity, fire and explosion hazards of materials and the efficacy of protective measures is conducted. Special instrumentation and analytical services maintained at headquarters are available to the operating divisions.

The cited Management Policy requires the operating divisions to implement the policy by providing either a professional Industrial Hygiene and Safety staff or a coordinator to work with Headquarters and the staff of all allied divisions; an Industrial Hygiene and Safety Manual; an Industrial Hygiene and Safety Policy Committee; Industrial Hygiene and Safety training programs; appropriate protective equipment and devices; those systems and records required to assure compliance with OSHA, EPA, DOE, NRC and state and local regulations and standards. Typical specific division actions are:

- Prepare and maintain an Industrial Safety Manual, and Emergency Procedures Manual and, where applicable, a Radiation Safety Manual

- Establish an Industrial Hygiene and Safety Committee and, where applicable, Stored Energy, Nuclear Safety, and Radiation Safety Committees with responsibility to review and approve new equipment, processes and procedures prior to operation

- Establish and maintain personnel radiation exposure records, where applicable, in accordance with Nuclear Regulatory Commission regulations

- Establish and maintain industrial accident and illness records consistent with OSHA requirements

- Encourage participation in corporate and division sponsored training programs

- Provide American Red Cross First Aid Training and C.P.R., and Safety Observer training

- Establish crane and industrial vehicle operator certification

- Establish x-ray operator radiological certification

- Establish a system of operator certification and specific job permits for off-station welding and burning

- Conduct sling and crane inspection programs to, at least, OSHA requirements

- Conduct regular, frequent general safety inspections and establish a system for recording action on recommendations

- Conduct frequent inspections of fire fighting equipment and for identification of potential fire hazards

- Conduct building evacuation drills

- Conduct monthly inspections of hood and ventilation systems

- Maintain current files of NRC and OSHA rules and regulations

- Establish and enforce no smoking, eye protection, personal protective clothing and exclusion areas

B. CORPORATE SAFETY ASSISTANCE

Industrial Hygiene and Safety activities at the Advanced Energy Systems Division are administered by a full-time safety administrator. Corporate level assistance and guidance is available through the Corporate Director of Resources Loss Prevention, Manager of Corporate Industrial Hygiene, and Manager Corporate Safety and their staffs.

The development programs and research conducted by Westinghouse have provided experience in safe operations with hydrogen, oxygen, air and gases at high temperature and pressure, cryogenics, high voltage and heavy machinery assembly/disassembly, operations and maintenance. Thus, a major amount of experience, procedures and guidelines are available within Westinghouse for application to operations as required.

The project manager and safety administrator will have available the total resources of these organizations to assist in the establishment of the safety program and, subsequently, in the planning and execution of safety training programs and safety related activities, in the review of local safety procedures and operating procedures, and in the resolution of health and safety problems where needed. This assistance 'and support will be supplied on an as required basis and at no direct charge to the contract.

APPENDIX B

SPECIFICATION FOR
GAS COMPRESSOR PALLET ASSEMBLY

originated by

WESTIMGHOUSE ELECTRIC CORPORATION
OCEANIC DIVISION

with revisions by

WESTINGHOUSE ELECTRIC CORPORATION
ADVANCED ENERGY SYSTEMS DIVISION

Revision C (Draft)

1.0 SCOPE

This specification describes and sets forth the requirement; for the Gas Compressor Pallet Assembly. The Gas Compressor Assembly (or Compressor/Skid Assembly) shall be herein referred as the Pallet Assembly.

2.0 APPLICABLE DOCUMENTS

ASME Boiler and Pressure Vessel Code, Section VIII
ANSI-831.2 Fuel Gas Piping
National Electrical Code (Latest Edition)

3.0 REQUIREMENTS

3.1 Equipment Description and Requirements

The Pallet Assembly (Figures A and B) will be used to pressurize "gob" gas (See *) for consumption by a gas turbine. The Pailet Assembly will be operated, controlled and monitored from the Remote Control Panel. The Pallet Assembly shall consist of the following sub-assemblies.

3.1.1 Turbine Feed Compressor

The Turbine Feed Compressor shall be a Joy Compressor, Model WBJ-12x7 stroke, driven by a 150 HP Westinghouse (or equal) electric motor. The compressor shall be capable of pressurizing "gob" gas from inlet pressures of 8 psia to 14.7 psia to at least 160 psig. The cooler shall be an air-to-air heat exchanger.(See 3.3.1 Operating Characteristics)

3.1.2 Accumulator Assembly

The Accumulator Assembly shall provide storage and pressure stabilization of "gob" gas for the Turbine Feed Compressor. The Accumulator Assembly shall interface with the fuel source. (Ref. para. 3.2.1). The Accumulator Assembly shall consist of the following components described below.

3.1.2.1 Accumulator Holding Tank

Accumulator holding tank shall be ASME code stamped and constructed and shall be rated for 50 psig W.P. at 300°F. The tank shall be 4 ft. diameter x 6 ft. long, and shall provide support and interfaces for the vent valve, pressure sensor, pressure gage, analyzer sampling lines and the condensate removal system. The tank shall provide mounting surfaces for installation on the pallet, and shall provide appropriate interface for piping to the rest of the Pallet Assembly.

*(a mixture of CH_4 and air with methane ratios varying from 100% to 30% by volume)

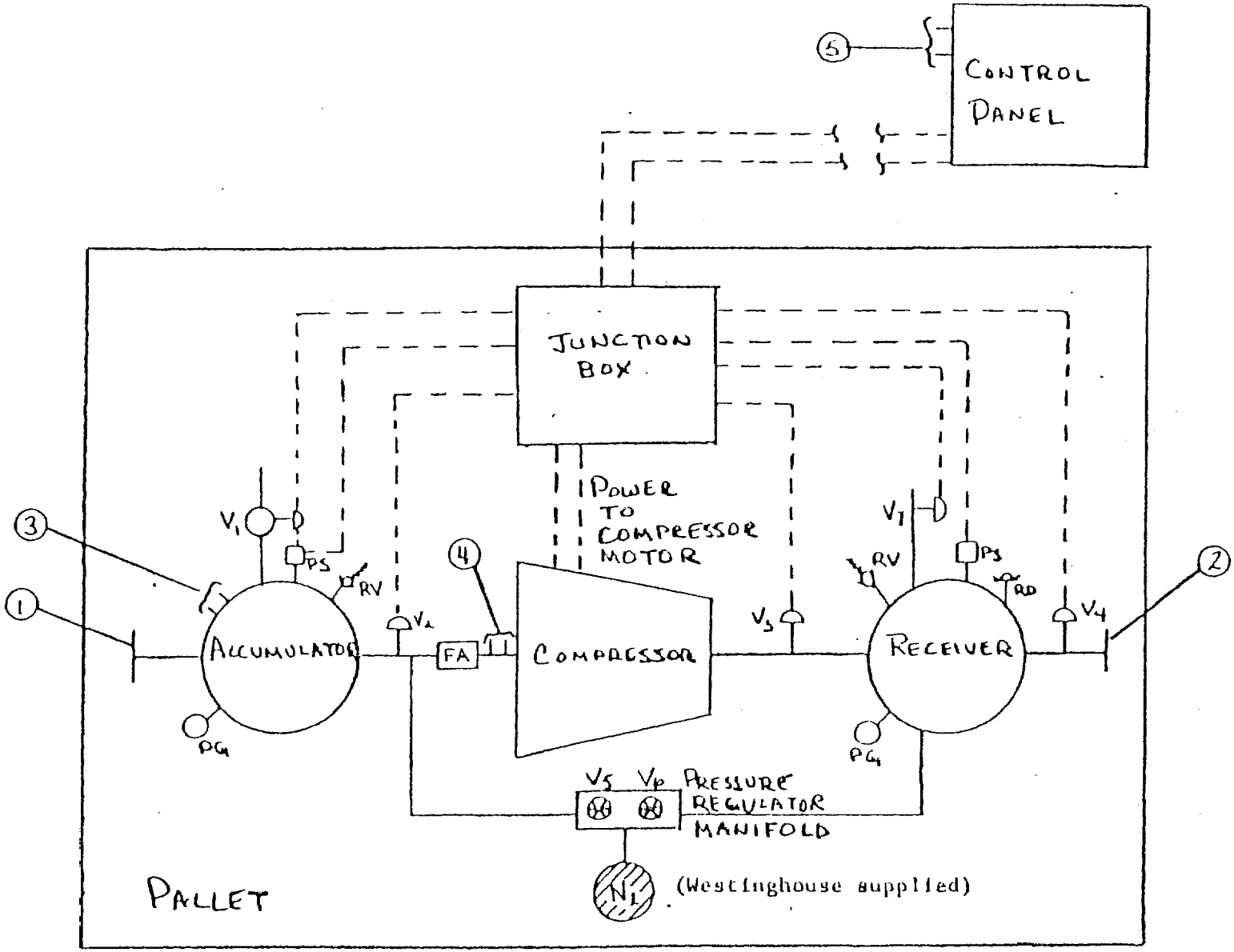


Figure A, Gas Compressor Pallet Assembly

FA	FLAME ARRESTER
PG	PRESSURE GAUGE
PS	PRESSURE SENSOR
RD	RUPTURE DISC
RV	RELIEF VALVE
V1	ACCUMULATOR VENT VALVE
V2	ACCUMULATOR-COMPRESSOR ISOLATION VALVE
V3	COMPRESSOR-RECEIVER ISOLATION VALVE
V4	RECEIVER-TURBINE ISOLATION VALVE
V5,V6	NITROGEN PURGE VALVES

1	ACCUMULATOR-MINE VSNT INTERFACE FLANGE
2	RECEIVER-TURBINE INTERFACE FLANGE
3	"GOB" GAS ANALYZER SAMPLE LINE INTERFACE
4	O_2 ANALYZER. SAMPLE LINE INTERFACE
5	ANALYZER SIGNAL LINE INTERFACES

Figure B. Notations and Symbols

3.1.2.2 Accumulator Vent Valve

The accumulator vent valve shall be a 10 in. control valve, electrically actuated with provisions for readout or monitoring valve position. The throttling action of the valve shall be controlled throuah the output of a pressure sensor (10" of H_2O).

NOTE: DUE TO THE REVISED REQUIREMENTS OF 3.1.1, i.e. 8 PSIA/ 14.7 PSIA INLET PRESSURE, AUTOMATIC OPERATION OF THIS CONTROL SYSTEM SHALL BE ELECTRICALLY DEFEATED. VENT VALVE SHALL REMAIN CLOSED DURING ALL COMPRESSOR OPERATION EVENTS. MANUAL AND OVERRIDE OPERATION SHALL BE RETAINED.

3.1.2.3 Pressure Sensor

The pressure sensor shall monitor accumulator pressure and shall provide signals to control the vent valve. Accumulator pressure shall be monitored at the control panel.

NOTE: CONTROL SIGNAL FUNCTIONS SHALL BE INACTIVE PER NOTE IN 3.1.2.2. PRESSURE INDICATION (8 PSIA/14 PSIA) OM PANEL SHALL BE RETAINED.

3.1.2.4 Pressure Gauge

The pressure gauge shall be mounted on the accumulator holding tank and shall provide local monitoring of accumulator pressure. The pressure gauge range shall be appropriate for use in this 'portion of the Pallet Assembly.

3.1.2.5 Condensate Removal Provisions

Provisions for condensate removal shall consist of a mist extractor, liquid level gauge, high liquid level shutdown switch, and an automatic liquid drainer. The condensate shall be expelled to the environment.

3.1.2.6 Relief Valve

The relief valve shall serve as a fail safe if the accumulator holding tank pressure exceeds 15 psig which is the rating of the flame arrester installed at the compressor inlet.

3.1.2.7 Rupture Disc

The rupture disc shall provide fail safe pressure relief of the accumulator holding tank.

3.1.3 Receiver Assembly

The Receiver Assembly shall store pressurized "gob" gas from the Turbine Fred Compressor and shall provide pressure stabilization

prior to use by the turbine. The Receiver Assembly shall interface with the turbine fuel intake (Ref. para. 3.2.2). The Receiver Assembly shall consist of the following components described below.

3.1.3.1 Receiver Holding Tank

The receiver holding tank shall be ASME code stamped and constructed and shall be rated for 250 psig W.P. at 300°F. The tank shall be 4 ft. diameter x 6 ft. long and shall provide support and interfaces for pressure sensor, pressure gauge, rupture disc, automatic relief valve and the condensate removal system. The tank shall provide mounting surfaces for installation on the Pallet and shall provide appropriate interfaces for piping to the rest of the Pallet Assembly.

3.1.3.2 Receiver Vent Valve

(Deleted)

3.1.3.3 Relief Valve

The relief valve shall be capable of relieving pressures slightly below the rated pressure of the receiver holding tank. This relieving pressure set point shall be adjustable. ,

3.1.3.4 Pressure Gauge

The pressure gauge shall be mounted on the receiver holding tank ahd shall provide local monitoring of receiver pressure. The pressure gauge range sh'all be appropriate for use in this portion of the Pallet Assembly.

3.1.3.5 Rupture Disc

The rupture disc shall provide fail safe pressure relief of the receiver holding tank.

3.1.3.7 Condensate Removal Provisions

Provisions for condensate removal shall consist of a mist extractor, liquid level gauge, high liquid level shutdown switch and an automatic liquid drainer. The condensate shall be expelled to the environment.

3.1.4 Pallet

The pallet shall be a pre-stress, steel reinforced concrete skid. The dimensions of the pallet shall be adequate to provide support and mounting surfaces for all the components of the Pallet Assembly. The pallet shall be transportable and shall require little site preparation at installation.

3.1.5 Control Panel

The control panel shall contain all gauges, meters, alarms, status lights, power and command distribution network and control logic electronics for the Pallet Assembly. The control panel shall be located in the turbine van control room. The panel, switches, and markings shall conform to accepted human engineering design and practices. Override switches shall be protected against inadvertent operation and to ensure correct positions prior to normal start up.

3.1.6 Interconnecting Piping and Valving

All interconnecting piping and valving shall be sized and constructed for proper use and operation under the requirements of this specification. There shall be isolation valves between: (a) the acumulator and the compressor intake; (b) the compressor discharge and the receiver; and (c) the receiver discharge and the turbine flange interface. These valves shall be electrically actuated and shall be operated from the control panel. Valve positions shall be monitored from the status lights on the control panel.

3.1.6.1 Compressor Intake Valve

The compressor intake valve shall be normally closed in the unactuated mode or in the event of electrical power failure to the actuator or system.

3.1.6.2 Valve Actuators

The valve actuators shall be entirely electric as specified, in this document, with the exception of valves within the compressor itself. Deviations from this requirement shall require written submittal and approval by Westinghouse prior to incorporation into the design.

3.1.6.3 Flame Arrester

A flame arrester shall be placed in-line between the compressor intake and the accumulator discharge as shown in Figures A and B.

3.1.7 System Purpe

The system shall be purged with gaseous nitrogen (N_2) (a) prior to startup of compressor and turbine; and (b) after breaking any lines that may introduce air into the system. All components and piping on the downstream side of the accumulator compressor intake valve (3.1.6.1) shall be purged. Proper piping, valving and pressure regulation shall be provided. Support for the Westinghouse supplied nitrogen bottles shall be provided on the pallet.

3.2 System Interface Requirements

3.2.1 Accumulator-Fuel Source Interface

The accumulator-fuel source interface shall be a 10 in., 150# ANSI flange. The mating flange shall be bolted and gasketed, The location of the interface shall be mutually agreed upon by Westinghouse and the supplier.

3.2.2 Receiver-Turbine Interface

The receiver-turbine interface shall be a 3-inch, 1509 ANSI flange. The mating flange shall be bolted and gasketed. The location of the interface shall be mutually agreed upon by Westinghouse and the supplier.

3.2.3 Analyzer Interface

3.2.3.1 "Gob" Gas Sample Line

The accumulator tank shall provide two (2) 1/2 in. NPT bosses for sample line interface. The location shall be such that condensate cannot collect in ths sample lines.

3.2.3.2 Oxygen Sample Line

Two (2) 1/2 in. MPT bosses shall be provided near the compressor intake for the oxygen sample lines. The location shall be such that condensate cannot col'lect in the sample line.

3.2.3.3 Analyzer Signal

The control circuitry shall sense a switch closure or opening from the alarm circuitry of the Westinghouse supplied Gas Analyzers. The Control Panel shall provide wiring to an external terminal board on the Gas Analyzer Rack via a keyed cable (Ref. 3.2.5).

3.2.4 Motor-Starter Interface

Starters for the electric motors on the Pallet Assembly shall be provided by Westinghouse and mounted on the Pallet Assembly by the supplier. Supplier shall provide all necessary interface between the motors and the starters.

3.2.5 Power Interface

The Control Panel shall provide appropriate wiring to the Turbine Van DC Power Supplies. Provisions shall be made to protect the Van Power Supply from damage in the event of Control Panel malfunction. The Electric Motor Power Interface shall be that described in Paragraph 3.2.4 (Ref. 3.3.5-Power). Keyed cable connectors

shall be provided to facilitate assembly and disassembly of all cables for signal circuits.

3.2.6 Control Panel Interface

The Control Panel shall occupy a space, 36"L x 26"D x 60"H, in the Turbine Van Control Room, The Control Panel shall be freestanding and all wiring keyed cable connected per Paragraph 3.2.5.

3.3 Requirements

3.3.1 Operating Characteristics

The Pallet Assembly shall provide "gob" gas at 160 psig, 120°F with capacity control between 150,000 SCFD and 320,000 SCFD via cylinder inlet valve unloaders in concert with an automatic by-pass system. The assembly shall be capable of operating continuously 24 hours.

3.3.2 Shutdown Functions and Switches

The following shutdown functions shall be incorporated in the Pallet Assembly. The actuation of any switch shall cause both an audible alarm and a flashing light indicating that a malfunction has occurred. The shutdown shall be immediate. A manual alarm silence switch shall not disengage any shutdown switches/ relays or corresponding lights on the Control Panel. Shutdown switches/ relays and corresponding lights shall disengage upon correction of the fault.

a) Low compressor lube oil pressure
b) High compressor water jacket temperature
c) Low lubricator oil level
d) Vibration
e) High/low first interstage pressure
f) High/low discharge pressure
g) High discharge temperature, cylinder #1
h) High discharge temperature, cylinder #2
i) High liquid level, accumulator
j) High liquid level, first interstage
k) High liquia level, receiver
1) Low "gob" gas content
m) High oxygen content
n) Loss of either analyzer signals
o) High suction pressure (accumulator)
p) Low suction pressure
q) Lubrication no flow

3.3.3 Control Features

The control panel shall have the followinp control features.

a) Pressure 'transducer controlled accumulator vent valve (Ref. 3.1.2.2 Note)
b) Valve and motor status lights
c) Compressor motor start-up
d) Pressure readout on Control Panel for Accumulator and Receiver Tank
e) Automatic shutdown of valves (Ref. 3.3.2 & 3.3.6.2)
f) Individual control of valve actuators
g) Audible and visual alarm prior to shutdown
h) Lockout time switch
i) Power on-off switches
j) Annunciators
k) Alarm silencer

3.3.4 Compressor Motor-Starter Interface

(Deleted)

3.3.5 Power

The Control Panel shall use 24 VDC, 5 amps max, which shall be available, whereas, 460 VAC, 3 Ø, 60 Hz, shall be available for the electric motors and 120 AC, 1 Ø, 60 Hz, shall be available for the valves actuators.

3.3.6 Valve Positions and Shutdown

3.3.6.1 Valve Operating Positions

The various control valve's and isolation valves shall assume the positions listed in Table I for the different modes of operation. See Figures A and B for valve locations and designations.

TABLE 1

Mode/ Valve	1	2	3	4	5	6
Purge	C	C	O	O	O	O
Normal Run	C	O	O	O	C	C
Non-operating	C	C	C	C	C	C
Emergency Shutdown	C	C	C	C	C	C

3.3.6.2 Shutdown

In the event of compressor shutdown the electrical operated valves shall automatically go to their non-operating mode as follows:

V1	Inoperative automatically (always closed)
V2, V3, V4	Shall close simultaneously
V5, V6	Manually operated and closed during Compressor operation

3.4 Other Requirements

3.4.1 Environmental

The Pallet Assembly shall be capable of continuous operation during exposure to all natural environments that may occur in western Pennsylvania.

3.4.2 Safety

All precautions shall be taken to prevent any hazards to personnel due to electrical shock, "gob" gas leakage, or any situation which may cause injury to personnel. Safety design practices for use of "gob" gas shall be incorporated in the Pallet Assembly design.

3.4.3 Human Engineering

The Pallet Assembly shall be designed using accepted human engineering practices in industry.

3.4.4 Bonding

All Equipment on the Pallet Assembly shall be bonded together via (a) a common bonding wire, or (b) good mechanicai metal to metal joint. Any joint or attachment that is separated by an insulating material such as, gaskets, paint or pipe tape, shall be bonded to the rest of the system with a bonding shunt. The resistance measured at any point of the Pallet Assembly with any other 'point on the Assembly shall be less than 0.1 ohm. See Figure C for a suggested bonding method.

3.5 Materials, Processes and Parts

3.5.1 Materials

All materials used in construction of the Pallet Assembly shall withstand exposure to the environments in 3.4.1 and normal operation of this equipment.

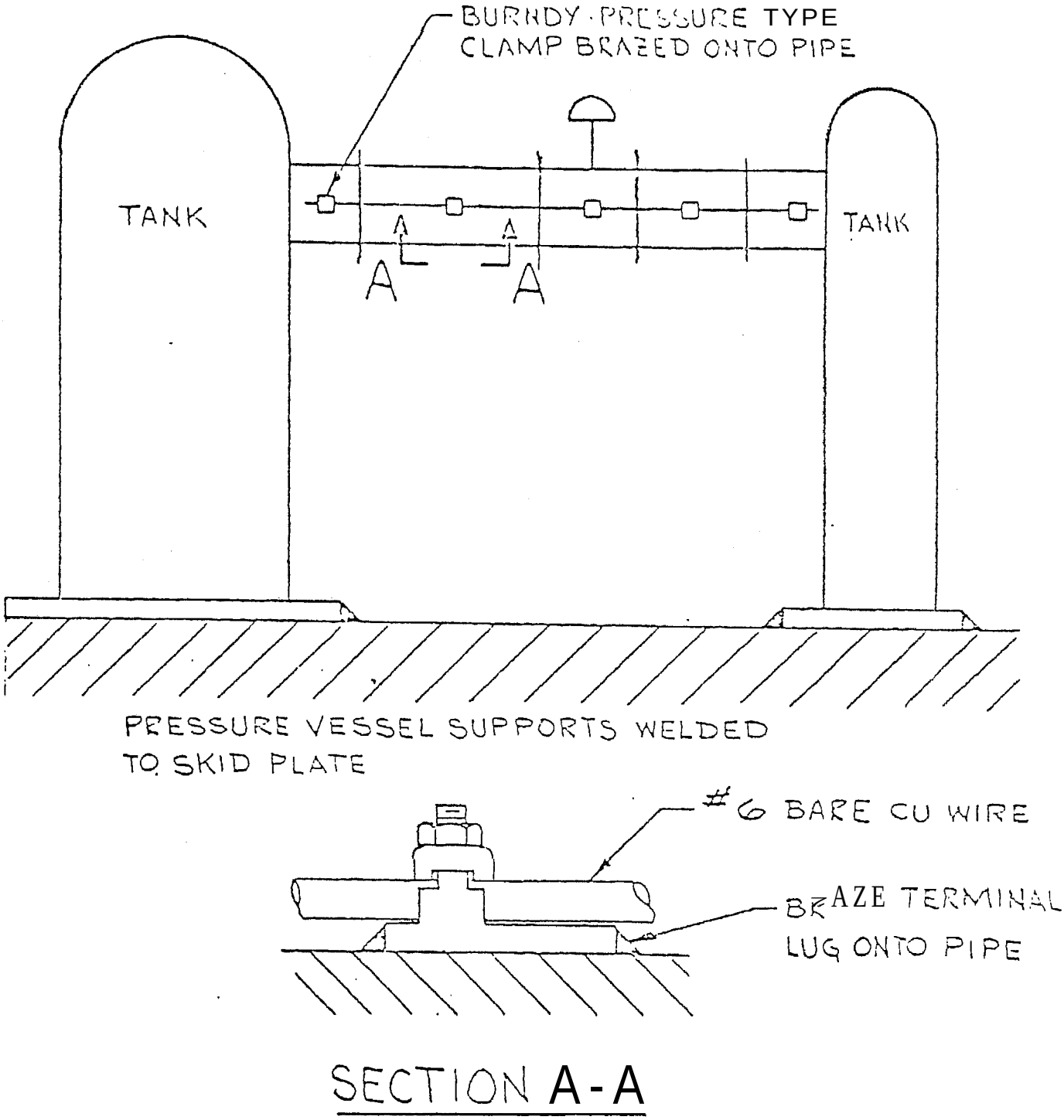


Figure C. Suggested Bonding Method

3.5.2 Parts

All parts chosen for the design of the Pallet Assembly shall be left to the discretion of the supplier except for the type of valve actuators. (Ref. 3.1.6.2).

3.6 Documentation

Preliminary drawings and schematics shall be submitted 21 - 30 days after receipt of order for Westinghouse approval prior to fabrication. Final drawings and schematics shall be delivered 10 - 12 weeks after receipt of order. Three (3) sets of operating handbooks shall be delivered with the equipment. A start-up procedure shall be provided.

4.0 QUALITY ASSURANCE PROVISIONS

The Pallet Assembly shall be tested under simulated conditions prior to shipment. A test procedure shall be written and submitted for Westinghouse approval. Westinghouse shall be notified of the date of the test and shall witness performance of the test. The Supplier shall provide personnel and initial on-site adjustment and set-up of equipment and to instruct operators for proper operation and maintenance of the equipment.

SAFETY INDOCTRINATION

METHANE UTILIZATION FROM COALBEDS FOR POWER GENERATORS

WESTINGHOUSE ELECTRIC CORPORATION
ADVANCED ENERGY SYSTEMS DIVISION

AGENDA

I.	INTRODUCTION.	R. E. Hogue, Manager Personnel Relations 8:30-9:00 AM
II.	OVERVIEW, ...	A. D. Kocis, Safety/ Security Administrator 9:00-9:20 AM
III.	PROGRAM OSJECTIVES.	R. M. Malinchak Technology Programs 9:30-10:00 AM
IV.	SAFETY CONSIDERATIONS.	A. D. Kocis 10:00 AM-12:00 PM
V.	LUNCH.	12:00-1:00 PM
VI.	PRACTICAL USE OF EXTINGUISHERS (FIRE FIGHTING). . .	A. D. Kocis 1:00-3:00 PM
VII.	REVIEW, QUESTIONS AND ANSWERS.	3:00 PM

SAFETY CONSIDERATIONS

SAFETY CONSIDERATIOMS

1. EMERGENCY RESPONSE, LOCAL AMBULANCE SERVICE, BETHLEHEM MINE EMERGENCY FACILITIES, SITE FIRST AID EQUIPMENT, AND EMERGENCY *OXYGEN UNITS.

2. ADVANCED ENERGY SYSTEMS DIVISION PROCEDURES: PERSONAL PROTECTIVE DEVICES - EYE, HEAD, FOOT, AND NOISE,

3, FLAMMABLE COMBUSTIBLE LIQUIDS.

41 FIRE EXTINGUISHERS1

51 ELECTRICAL SAFETY,

6. METHANE.

PERSONAL PROTECTIVE DEVICES

- EYE
- HEAD
- FOOT
- NOISE

MONTHEY SAFETY TRAINING TOPIC

KEEP YOUR EYES ON THE JOB

One flying chip, a bir of dust, a small chemical splash or a bit of radiant energy can damage the sight of an eye and this happens about a 1000 times a day in industry. Why invire this danger? It can be avoided if proper eye protection is always worn on the job.

WEAR...

At all tines on the job, wear the industrial quality safety goggles or spectacles required. They won't protect you if they are in your procket or in your locker.

The right way to wear safety glasses is properly positioned in front of your syes. If eyewear is perched on the end of your nose or on the top of your head, your eye protection has disappeared.

The fit must be right to be effective. The frames should feel comfortable and not rub, chafe or be irritating In any way, All lenses, especially bifocal and corrective, must be positioned precisely I o give correct vision. Loose fitting glasses are distracting and become a safety hazard.

It takas time to become ascustomed to wearing safety goggles or glasses. If you are new to wearing safety eyeware, you may see a glare. This Is because you are looking a: *the* lenses, not through them. You may also think that objects are magnified. This is an optical illusion that is created when something Is framed and stray light eliminated, causing your eyes to focus more sharply. These effects will soon disappear.

and CARE

Your equipment protects you best If It's In perfect shape.

Inspection should be done routinely. Pitting, etching and scratching can weaken the lenses and reduce impact resistance and visibility. Cracked, worn or eroded parts may weaken the frame. Damaged eyewear should be discarded.

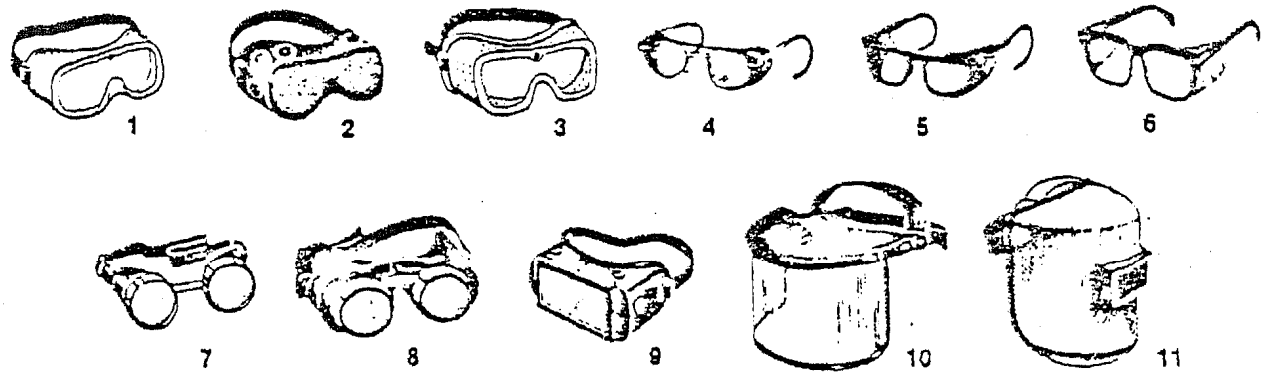
Cleansing wlth soap and water or an appropriate cleaning agent or tissua should be done on a regular basis. Use the special cleaning materials supplied for plastic lenses. If you wear contact lenses, carry proper solutions with you for cleaning them.

Disinfection of all equipment should be done periodically.

Repair and adjustments should be done by a vision speclalist.

Storage of eyewear not in use should be In a clean dustproof case. Never rest your glasses or goggles on the lenses; both glass and plastic can be scratched by minute dust particles.

Table E-1 — Eye and Face *Protector* Selection Guide



1. GOGGLES, Flexible Fitting, Regular Ventilation
2. GOGGLES, Flexible Fitting, Hooded Ventilation
3. GOGGLES, Cushioned Fitting, Rigid Body
*4. SPECTACLES, Metal Frame, with Sideshields
*5. SPECTACLES, Plastic Frame with Sideshields
*6. SPECTACLES, Metal-Plastic Frame, with Sideshields
**7. WELDING GOGGLES, Eyecup Type, Tinisd Lenses (Illustrated)
7A. CHIPPING GOGGLES, Eye Type, Clear Safety Lenses (Hat Illustrated)
**8. WELDING GOGGLES, Coverspec Type, Tinted Lenses (Illustrated)
8A. CHIPPING GOGGLES. Coverspec Type, Clear Safety Lenses (Not Illustrated)
**9. WELDING GOGGLES, Coverspec Type, Tinted Plate Lens
10. FACESHIELD (Available with Plastic or Mesh Window)
**11. WELDING HELMETS

APPLICATIONS

OPERATION	HAZARDS	RECOMMENDED PROTECTORS: Bold Type Numbers Signify Preferred Protection
ACETYLENE—BURNING ACETYLEHE—CUTTING ACETYLENE—WELDING	SPARKS. HARMFUL RAYS, MOLTEN METAL FLYING PARTICLES	7, 8, 9
CHEMICAL HANDLING	SPLASH, ACID BURNS, FUMES	2, 10 (For severe exposure add 10 over 2)
CHIPPING	FLYING PARTICLES	1, 3, 4, 5, 6. 7A, LA
ELECTRIC (ARC) WELDING	SPARKS, INTENSE RAYS, MOLTEN METAL	9, 11 (11 In combination with 4, 5, 6, In tinted lenses, advisable)
FURNACE OPERATIONS	GLARE. HEAT. MOLTEN METAL	7, 8, 9 (For severe exposure odd 10)
GRINDING — LIGHT	FLYING PARTICLES	1. 3, 4, 5, 6, 10
GRINDING — HEAVY	FLYING PARTICLES	1, 3; 7A, 8A (For severe exposure add 10)
LABORATORY	CHEMICAL SPLASH, GLASS BREAKAGE	2 (10 when In combination with 4, 5, 6)
MACHINING	FLYING PARTICLES	1, 3, 4, 5, 8, 10
MOLTEN METALS	HEAT, GLARE. SPARKS, SPLASH	7, 8 (10 In combination with 4, 5, 6, In tinted lenses)
SPOT WELDING	FLYING PARTICLES, SPARKS	1, 3, 4, 5, 8, 10

*Non-sideshield spectacles are available for limited hazard use requiring only frontal protection.
**See Table E-2, In this section, Filter Lens Shade Numbers for Protection Against Radiant Energy.

MONTHLY SAFETY TRAINING TOPIC

SOME HARD FACTS ABOUT HARD HATS

DO:

- Report any damage to the shell or the Inner cradle for repair or replacement.
- Adjust the suspension to provide a 1¼-inch clear. ance from the helmet's shell to the top of your head.
- Wear the hat so the protective shell sits squarely on the head — not tipped back or on one side.
- Keep headgear clean and store it in a cool, dust-free, well-ventilated location.
- Treat hard hats and caps of all types with reason-sonable care. They are engineered to protect you but can lose much of their protective value when damaged.

DON'T:

- Subject protective hats and caps to unnecessary abuse. Don't throw them, drop them, sit on them, or do anything else that might weaken them.
- Wear a hard hat on top of any other cap or head-gear. (In cold weather close-fitting winter liners designed for use with hard hats can be worn.)
- Drill holes in the shell for ventilation or any other purpose. Holes will weaken the shell and destroy its dielectric qualities.
- Paint the shell. Solvents In the paint may soften the shell material and reduce its dielectric quali-ties.
- Try to repair a cracked shell. Once a hard hat or cap is cracked, It Is useless for protection from electricity and heavy impact.
- Wear an electrical hard hat that looks defective in any way. If there is any doubt, get a replacement.

THE BASICS OF FOOT PROTECTION

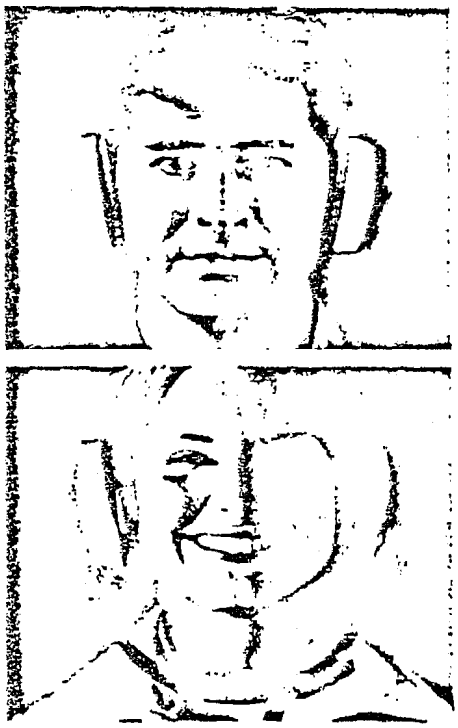
TO MAW PEOPLE, FOOT PROTECTION MEANS JUST ONE THING--PROTECTION AGAINST SERIOUS FOOT INJURY—ACCIDENTS INVOLVING HEAVY DROPPED OR FALLING OBJECTS, OR WHEELS RUNNING OVER SOMEONE'S ,TOES.

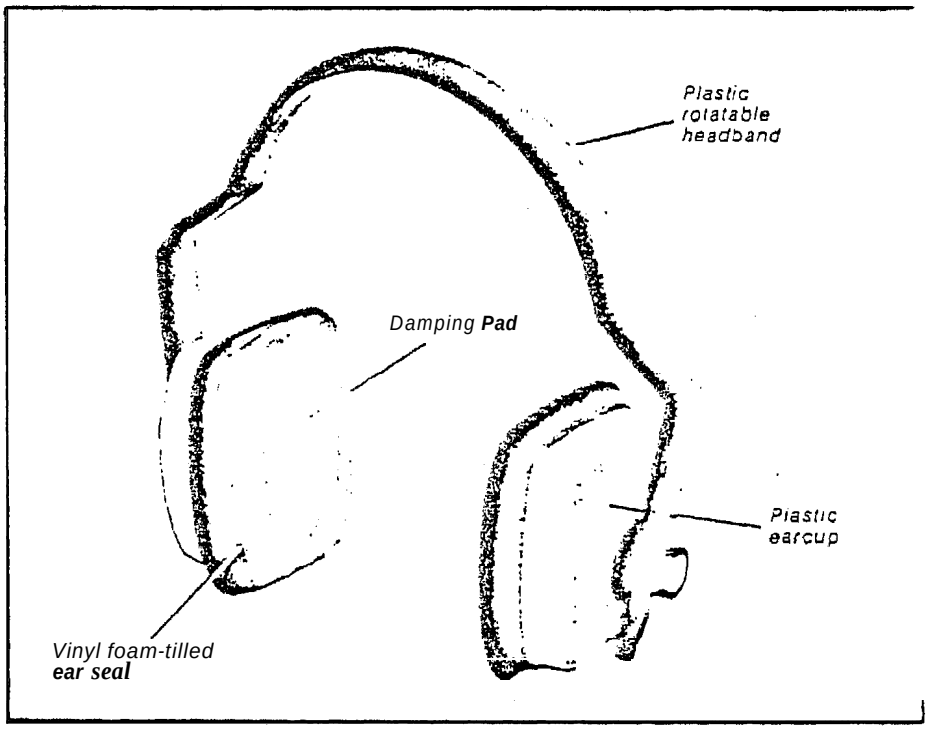
- SOME OTHER HAZARDS OF FOOT PROTECTION INCLUDE PUNCTURES OF THE SOLE, CHEMICALS ELECTRICITY, SPARK GENERATION, MOLTEN-METAL SPLASH AND HEAT.

- CRUSHING HAZARDS ARE THE MOST FREQUENTLY ENCOUNTERED FOOT DANGERS.

- SAFETY SHOES AND FOOT PROTECTION IS RECOMMENDED FOR WORKING AT HOME, IN THE GARAGE MOWING LAWNS AND WHEN USING POWER TOOLS.

Comfo™ 500 Ear Muffs



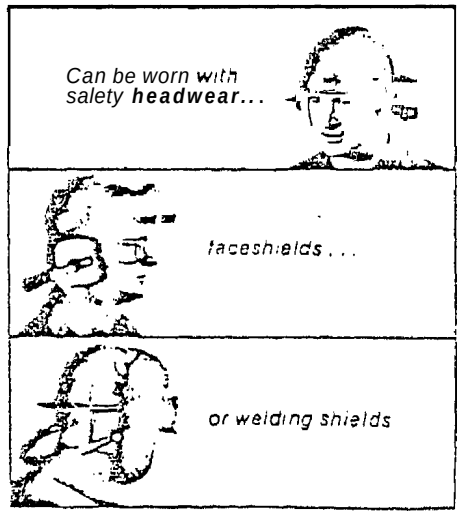


Application

Comfo 500 Ear Muffs provide circumaural protection in a broad range of industrial uses where 15- to 20-dB attenuation at the most sensitive frequencies is tha maximum requirement.

Description

Comfo 500 Ear Muffs are moderate-attenuation circumaural protectors. The lightweight muffs have one-piece, high-impact-resistant plastic earcups with soft vinyl foam-filled ear seals that cushion the cups against the head. The all-plastic headband can rotate 360 degrees about the earcups; unit can **be** worn with the suspension over the head, in back of the head, or under the chin. Can also be worn alone or with protective hats, welding shields, and faceshields. Has no metal parts—a consideration in some electrical environments.



SAFE STORAGE AND HANDLING

FLAMMABLE AND COMBUSTIBLE LIQUIDS/GAS

SAFE STORAGE AND HANDLING OF FLAMMABLE AND COMBUSTIBLE LIQUIDS

TODAY'S DISCUSSION WILL BE ON HAZARDS AND SAFE CONTROL OF FLAMMABLE AND COMBUSTIBLE LIQUIDS,

DEFINITIONS

1, FLASH POINT - THE FLASH POINT OF THE LIQUID SHALL MEAN THE TEMPERATURE AT WHICH IT GIVES OFF VAPOR SUFFICIENT TO FORM AN IGMITABLE MIXTURE WITH THE AIR NEAR THE SURFACE OF THE LIQUID,

2. LIQUID - LIQUID MEANS ANY MATERIAL THAT HAS A FLUIDITY GREATER THAN 300 PENETRATION ASPHALT WHEN TESTED, A LIQUID CAN BE POURED,

3. . COMBUSTIBLE LIQUID - MEANS ANY LIQUID HAVING A FLASH POINT AT OR ABOVE 140°F,

4. FLAMMABLE LIQUIDS - MEANS ANY LIQUID HAVING A FLASH POINT BELOW 140°F AND HAVING A VAPOR PRESSURE OF 40 POUNDS PER SQUARE INCH OR LESS,

ALL FLAMMABLE LIQUIDS EVAPORATE QUICKLY AND ARE CONTINUALLY GIVING OFF VAPORS, THE VAPORS CANNOT BE SEEN BY THE NAKED EYE, MOST VAPORS ARE HEAVIER THAN AIR AND FALL TOWARDS THE FLOOR. VAPORS WILL FLOW DOWN STAIR WELLS, ELEVATOR SHAFTS, AND TO AIR DUCTS, VAPORS TRAVEL FROM THEIR SOURCE AND CREATE A CONSTANT FIRE HAZARD,

HAZARDS

IT IS THE VAPORS OF FLAMMABLE LIQUIDS WHICH IGNITE QUICKLY AND NOT THE LIQUIDS THEMSELF, LIQUIDS STORED IN A WARM ATMOSPHERE OR CLOSE TO HEAT GIVE OFF VAPORS AT AN ACCELERATED RATE,

IF THE VAPOR ABOVE THE LIQUID IS IENITED, THE TEMPERATURE OF THE LIQUID IS RAISED, VAPORS ARE RELEASED WITH GREATER SPEED AND IN GREATER VOLUME, THIS CAUSES THE FIRE TO BURN HOT WITH INTENSE HEAT BECAUSE THE VAPORS FEED THE FLAME,

EXPLOSIVE RANGE

THE EXPLOSIVE RANGE IS EETWEEN THE LOWEST POINT WHERE THERE IS NOT ENOUGH CONCENTRATION OF VAPORS IN THE AIR TO PERMIT PROPAGATION OF FLAME WHEN CONTACTED WITH A SOURCE OF IGNITION, AND THE HIGHEST POINT ABOVE WHERE THE CONCENTRATION OF VAPORS IS TOO HIGH TO PERMIT THE PROPAGATION OF FLAME. THE UPPER AND LOWER BOUNDARY-LINE MIXTURES ARE TERMED THE "EXPLOSIVE LIMITS," IN MEASURING FOR AN EXPLOSIVE ATMOSPHERE, AN EXPLOSION METER IS USED.

SOURCES OF IGNITION

A SINGLE SPARK WILL CAUSE FLAMMABLE LIQUID VAPORS TO IGNITE AND CAUSE A FIRE TO SPREAD. IT IS ALMOST IMPOSSIBLE TO ELIMINATE THE OCCURRENCE OF SPARKS, SPARKS MAY BE CAUSED BY A NAIL IN YOUR SHOE WHEN SCRAPED ON A CEMENT FLOOR, OR BY A FALLING TOOL ONTO THE FLOOR, THESE ARE FRICTION SPARKS,

STATIC ELECTRICITY NAY PRODUCE SPARKS OR FLASHES WHICH CAN IGNITE FLAMMABLE VAPORS, STATIC CHARGES ARE PRODUCED BY THE FLOW OF FLAMMABLE LIQUIDS THROUGH PIPES, HOSES, AND FLOWING FROM 55 GAL, DRUMS, STATIC ELECTRICITY IS PREVENTED BY GROUNDING AND BONDING,

ANOTHER SOURCE OF IGNITION IS SPONTAMEOUS COMBUSTION, CAUSED BY CARELESSNESS, IMPROPER STORAGE OF OILY RAGS, SOLVENT SOAKED RAGS, AND OILY WORK CLOTHES IN LOCKERS. IGNITION IS CAUSED BY A CHEMICAL REACTION RATKER THAN BY A SPARK OF FLAME, SPONTANEOUS COMBUSTION IS A SLOW OXIDATION WHICH GENERATES HEAT,

THE MOST HAZARDOUS ELEMENTS THAT CAUSE FIRE, DESTRUCTION, INJURY AND SOMETIMES DEATH ARE FLAMMABLE LIQUID VAPORS,

SAFETY CONCEPT

1. GOOD HOUSEKEEPING

2. PROPER GROUNDS ON FLAMMABLE LIQUIDS

3. GOOD VENTILATION AND EXHAUST

4. PROPER STORAGE OF LIQUIDS

5. KNOW YOUR FIRE EXTINGUISHER LOCATIONS

FIRE EXTINGUISHERS

USE/TYPES

FIRE EXTINGUISHERS - YOUR FIRST LINE OF DEFENSE

PROPER USE OF THE RIGHT EXTINGUISHER AT THE RIGHT TIME OFTEN IS THE DIFFERENCE BETWEEN INCONVENIENCE AND TRAGEDY. TO USE PORTABLE EXTINGUISHERS MOST EFFECTIVELY, THE NATIONAL FIRE PROTECTION ASSOCIATION RECOMMENDS THE FOLLOWING PROCEDURES:

- PLACE EXTINGUISHERS IN LOCATIONS THAT ARE READILY ACCESSIBLE, NOT OBSTRUCTED AND NEAR EXITS.

- CHOOSE EXTINGUISHERS THAT WILL PUT OUT FIRES IN ONE OF THE FOUR HAZARD GROUPS.

- FOUR COMMON HAZARD GROUPS

  1. CLASS "A" HAZARD - FIRES IN ORDINARY MATERIALS SUCH AS WOOD, CLOTH, PAPER, RUBBER AND PLASTICS.

  2. CLASS "B" FIRES - FIRES IN LIQUIDS AND GASES SUCH AS OILS, GASOLINE, GREASES, LACQUERS, OIL SASE PAINTS, PROPANE, ACETYLENE AND NATURAL GAS.

  3. CLASS "C" FIRES - FIRES THAT INVOLVE ELECTRICAL EQUIPMENT IN OPERATION.

  4. CLASS "D" FIRES - FIRES IN METALS SUCH AS MAGNESIUM, TITANIUM, SODIUM, AND POTASSIUM. (VERY RARE FIRE.)

- CLASSES OF HAZARDS - LIGHT, ORDINARY AND EXTRA

1. LIGHT HAZARD - IN AREAS WHERE SMALL FIRES CAN BE EXPECTED, OFFICES, SCHOOL ROOMS, CHURCHES, HALLS AND KITCHENS.

2. ORDINARY HAZARD - MERCANTILE STORAGE, DISPLAYS, SHOWROOMS, PARKING GARAGES, LIGHT MANUFACTURING PLANTS AND WAREHOUSES.

3. EXTRA HAZARD - SEVERE FIRES IN AUTO PAINT SHOPS, WOODWORKING AND LUMBER YARDS, PLANTS HANDLING FLAMMABLE LIQUIDS, PAINTING AND DIPPING OPERATIONS.

- FIRE EXTINGUISHERS ARE TYPED ACCORDING TO THE SAME CLASSIFICATION SYSTEMS AS THE FIRES THEMSELVES.

EXTTNGUISHERS

CLASS A - WATER TYPES.

CLASS B - CARBON DIOXIDE, DRY CHEMICAL, FOAM AND MULTIPURPOSE DRY CHEMICAL.

CLASS C - CARBON DIOXIDE, DRY CHEMICAL AND MULTIPURPOSE DRY CHEMICAL.

CLASS D - DRY POWDER COOLS AND SMOTHERS HOT FIRES.

- INSPECTION - MAINTENANCE AND HYDROSTATIC TESTS

1. ALL EXTINGUISHERS MUST BE INSPECTED MONTHLY.
2. MAINTENANCE INSPECTION AT LEAST OM AN ANNUAL BASIS.
3. HYDROSTATIC TEST MUST BE MADE EVERY 5 YEARS.

ELECTRICAL SAFETY

ELECTRICAL SAFETY

High-voltage electrical systems do not create a great threat, mainly, because they are clearly marked and it is obvious to keep away and keep clear of them.

Low-voltage systems are seldom marked, and there is evidence that low-voltage shock can kill.

Examine your own work place for potential shock hazards. If you observe any hazards, report them to your Supervisor immediately.

As you check your work place, look for the following:

- Is there any water standing that could act as a conductor of electrical current?
- Are the extension cords you use made of rubber and in good condition?
- Are the non-current metal parts of portable electrical power tools properly grounded?
- Are the interiors or electrical switch boxes marked and visible? Are switch boxes locked where necessary to prevent unauthorized access?
- Are there any low-voltage lines that have been cut off, changed, or rearranged that might still be alive?
- Report any of these conditions to your Supervisor or the Safety Office.

ELECTRICAL SAFETY (CONTINUED)

- Remember when electrical repairs are necessary in your work place, have repairs done by the Site electricians.

Wherever there are electrical outlets, plugs, wiring, connections and extension cords, there is danger of electrical shock or injury.

- Don't use worn wires or extension cords, frayed or damaged wires are electrical hazards.
- Replace connections immediately when there is any sign of thinning insulation.
- Use connections that are incased in heavy rubber, and make sure that the wire is dry before plugging into a circuit.
- Ground all apparatus, using a 3-prong plug.
- Don't handle any electrical connections or wires with damp hands or 'when standing in or near water.
- Don't continue to run a motor after liquid has been spilled on it. Turn it off and allow it to dry thoroughly inside and out before attempting to use it again.

METHANE

METHANE

GENERAL INFORMATION

- SYNONYMS: MARSH GAS, METHYL HYDRIDE
- DESCRIPTION: COLORLESS, ODORLESS, TASTELESS GAS

HAZARD ANALYSIS

- ACUTE LOCAL: NONE - NO HARM UNDER ANY CONDITIONS
- INHALATION: SLIGHT - CAUSES READILY REVERSIBLE CHANGES WHICH DISAPPEAR AFTER END OF EXPOSURE
- FIRE HAZARD: DANGEROUS, WHEN EXPOSED TO HEAT OR FLAME
- NO SPONTANEOUS HEATING
- EXPLOSION HAZARD: DANGEROUS, WHEN EXPOSED TO HEAT OR FLAME
- DISASTER HAZARD: DANGEROUS

COUNTERMEASURES

- VENTILATION CONTROL: IN LOCAL EXHAUST VEMTILATION, AIR-BORN CONTAMINANTS ARE REMOVED OR CAPTURED FROM THE ENVIRONMENT AT OR AS CLOSE AS POSSIBLE TO THE SOURCE
- TO FIGHT FIRE: STOP FLOW OF GAS, CARBON DIOXIDE OR DRY CHEMICAL
- STORAGE AND HANDLING: OBEY ALL POSTED AREA SIGNS, GOOD HOUSEKEEPING MUST BE ENFORCED, REPORT' ANY DISCREPANCIES