

# McLouth Steel

Blast Furnace Department

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BLAST FURNACE GAS

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MANUAL

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Emergency First Aid - 2012

Blast Furnace Department

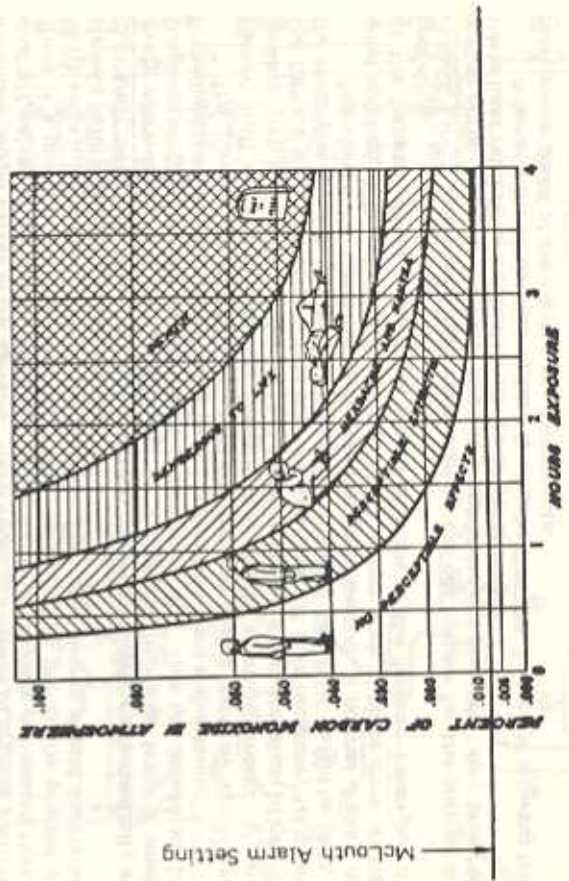
Blast Furnace Gas

One of the hazards inherent in blast furnace operations is blast furnace gas. The blast of heated air coming from the turbo blowers burn coke in the furnace at the tuyere zone and forms carbon monoxide. This carbon monoxide is the "working gas" which transforms the pellets into iron by removing oxygen. A large percentage of carbon monoxide remains in the gas coming off the top of the furnace and it is because of that gas that it can be burned in stoves and boilers. Blast furnace gas will contain about 20 to 25% carbon monoxide and has a BTU value of about 90.

Blast furnace gas sometimes has a detectable odor but carbon monoxide itself is colorless, odorless, and tasteless. It can be detected only by instrumentation. As you know, automobiles all give off enough carbon monoxide to be fatal in enclosed areas and cigarettes give off enough to be detected by our alarms. When carbon monoxide is breathed, it enters the blood stream and causes various symptoms depending on exposure. Everyone should learn the symptoms of gas poisoning - NAUSEA, DIZZINESS, HEADACHE, AND WEAKNESS OF THE KNEES. Large doses cause unconsciousness, small concentration often show no symptoms. The following chart shows the effect of various concentrations of carbon monoxide for various exposure times:

**EFFECTS OF CARBON MONOXIDE  
FOR A GIVEN TIME ON HUMAN BEINGS**

Data from Bureau of Standards Technical Paper 313



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## BLAST FURNACE GAS SOURCES

The sources of blast furnace gas in the blast furnace department are:

1. **STOVE FANS** These are the largest sources of gas in the area. Stove fans supply air to burn blast furnace gas in the stoves. When the stove fan is off, gas can escape back through the fan opening. For this reason, stove gas valves (Pratt Valves) must be closed tight at the end of the firing cycle. In the event of a fan failure, there is another butterfly valve in the gas line called a modulating valve which will automatically shut and prevent gas from escaping thru the fan. Anytime maintenance work is done on these stove fans, they should be checked for gas.
2. **DUSTCATCHERS** Collect large particles of dust blown over from the furnace top. This dust is dumped daily and is during this time that gas can escape. When the dustcatcher "blows dry", the valve should be closed and any leaks sealed.
3. **WATER SEALS** The venturi scrubber, gas cooler, and precipitators are all used to clean blast furnace gas and depend on a water seal in the bottom to remove any dirt from the gas and prevent gas from escaping. There is a possibility of blowing these seals by an increase in pressure of the system. This can be caused by a furnace "kick" or a malfunction of the gas control system which will allow this pressure to push the water seal out. This situation can normally be controlled by opening bleeders and/or checking down the furnace depending upon the situation.
4. **DRIP LEGS** There are (9) drip legs or water seals in the gas main in the area. These locations are as follows:
  - a. (2) on either side of both thermal expansion valves.
  - b. (1) in each stove gas main.
  - c. (1) on the bottom of each gas igniter which discharge on the stove platform at each end of the pyrometer room.
  - d. (1) on #2 fce. precipitator by-pass.
 Except as noted, these discharge into the gas system sumps. In the event one of these seals blows, it can be controlled by reducing gas main pressure as in (3) above or sometimes by adding water to the drip leg.

**GOGGLE VALVES** There are (2) thermal expansion and (1) mechanically expanded goggle valves in our system. The purpose of these is to provide positive shut off valves in various parts of the gas system. If they are not sealed tight, there is a possibility of gas leakage. When these valves are in the process of being swung, large quantities of gas escape. The general area should always be cleared before swinging goggle valves.

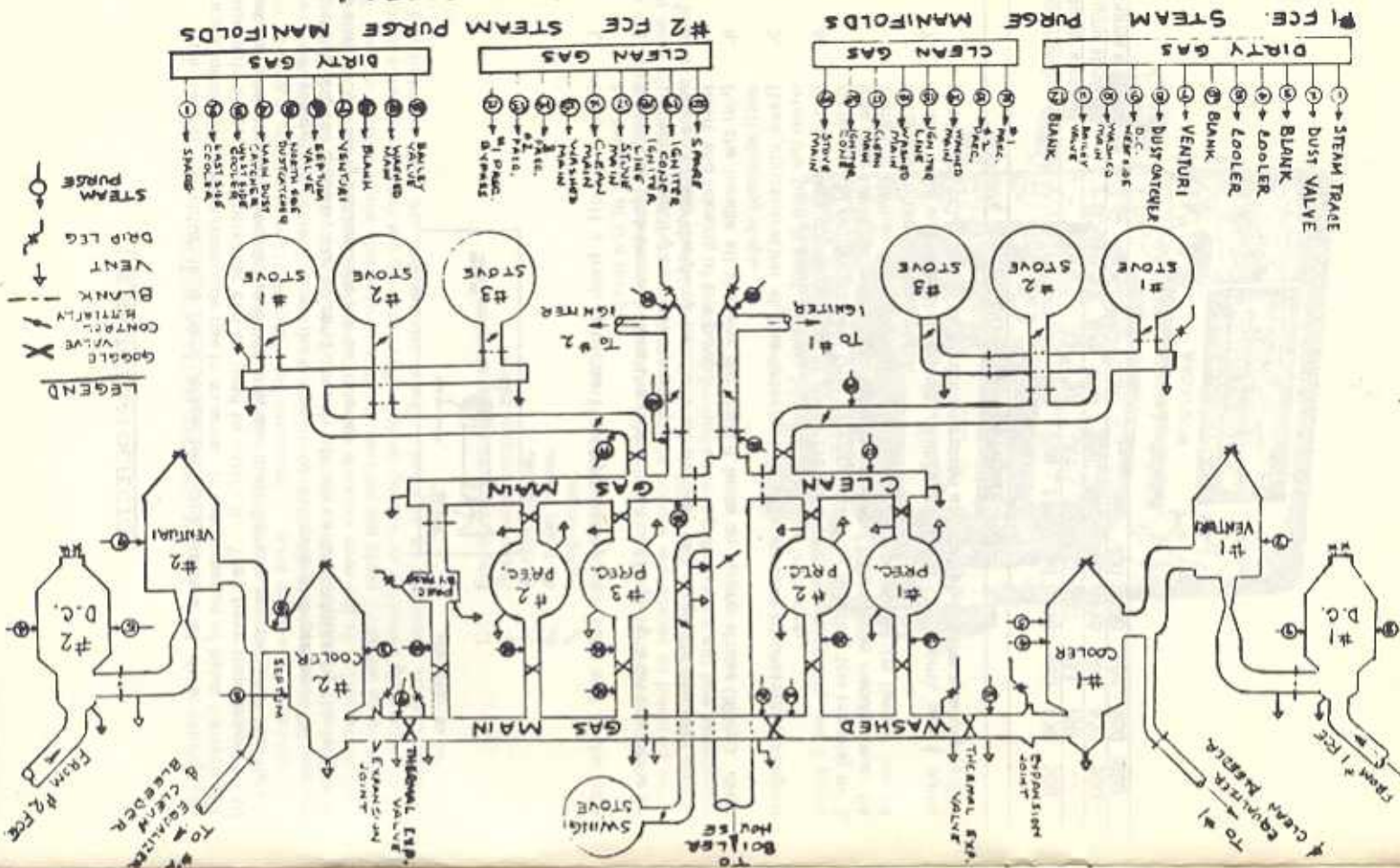
**FURNACE PROPER** The blast furnace itself sometimes leaks gas potentially at every place there is a joint. The top of the hearth normally leaks a small quantity of gas but this controlled by keeping it lit. This gas should be lit immediately after the furnace is put back in operation from a shutdown.

The furnace stack contains over 600 cooling plates each of which are packed with refractory material. There is normally a small amount of gas leaking from these stack plates so that there is always a concentration of gas on the furnace shell platforms during operating periods. If it is necessary to go on the stack platforms during operating periods, a SCOTT AIR-PAK should be used.

The top of the furnace always contains gas, however, a normal amount of wind will keep it from becoming concentrated. When work is to be done on top of the furnace, either a gas mask should be worn or the furnace taken out of operation.

**PURGE LINES** are steam lines connected to the gas system for the purpose of adding purge steam to the main when it is not under gas pressure. Any break in these lines represents a potential source of gas leakage.

A schematic of the gas system is attached on the next page showing the relative locations of the various gas components.



## BLAST FURNACE GAS SYSTEM



## THE GASTEC GAS DETECTOR

The Gastec detector is a hand operated rapid method of determining low concentrations of carbon monoxide gas in an area. If the presence of blast furnace gas is suspected, this hand detector can be used to verify it. They have been issued to all blast furnace turn foremen, furnace blowers, and blast furnace maintenance foremen.

The yellow tubes will turn dark brown to indicate the presence of carbon monoxide and the quantity can be read directly off the calibrated tube by the length of the stain. Operating instructions are as follows:



1. Break tips off a fresh detector tube by bending each tube end in the tube tip breaker of the pump.
2. Insert the tube securely into the rubber inlet of the pump with the arrow on the tube pointing towards the pump.
3. Make certain the pump handle is all the way in. Align the red dots on the shaft and housing of the pump.
4. Pull the handle all the way out until it locks on 1 pump stroke (100cc). Wait until staining stops.
5. Read concentration at the interface of the stained-to-unstained reagent when the tube is kept approx. 50 cm (20") away from eye.
6. For accurate measurement of up to 150 ppm of concentration, use 3 pump strokes (300 cc) and obtain true concentration by dividing the reading by 3 (see the table below). For 3 pump strokes (300cc), the handle must be turned  $\frac{1}{2}$  turn in either direction to unlock the pump so the handle can be returned to the starting point.
7. If the stain exceeds the highest calibration mark (500 ppm), use  $\frac{1}{2}$  pump stroke (50 cc). Obtain true concentration by multiplying the reading by 2.

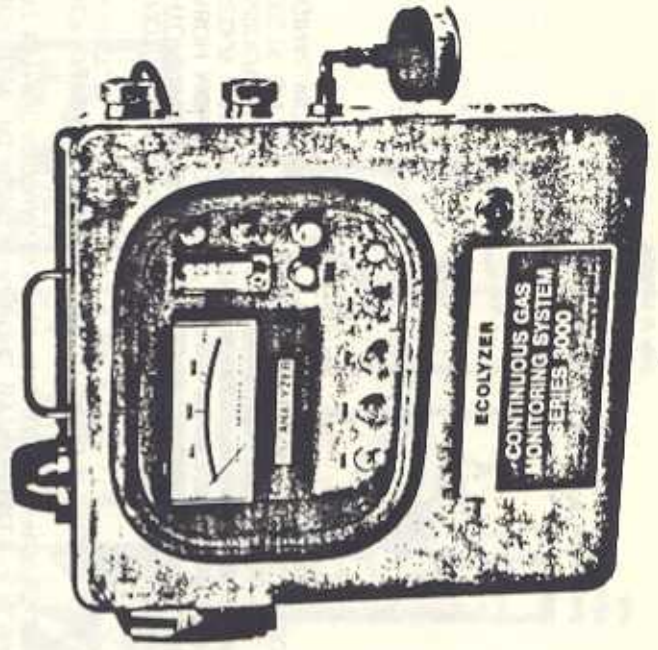
	TRUE CONCENTRATION (PPM)											
Tube reading (ppm)	25	50	75	100	150	200	250	300	350	400	450	500
$\frac{1}{2}$ pump strokes	8	17	25	33	50	67	83	100	117	133	150	--
1 pump strokes	25	50	75	100	150	200	250	300	350	400	450	500
$\frac{1}{2}$ pump strokes	--	--	--	--	--	--	500	600	700	800	900	1000

## THE ECOLYZER GAS MONITOR

The Ecolyzer gas monitor is an instrument for measuring the carbon monoxide concentration in a given area. It measures the concentration of carbon monoxide from zero to 2000 parts per million (ppm) and is extremely sensitive. This instrument has a visual alarm (red light) and an audible alarm (horn) which will be set off when the carbon monoxide in the area exceeds the set point of the instrument. Our instruments are set to go off at 75 parts per million which is a relatively small amount of gas. This is an extremely sensitive detecting device. The escaping gas from a cigarette contains enough carbon monoxide to register. These instruments are wall mounted and are located as follows:

1. Employees locker room.
2. Pyrometer control room.
3. #1 hoist house.
4. #2 hoist house.
5. Pump house.
6. Superintendent's office.

Whenever the alarm sounds, a foreman should immediately be contacted. He will then proceed to locate the source of the gas and correct the situation. In case of a large concentration of gas (1000 parts or more) the immediate area should be evacuated and the surrounding areas checked for gas.





## THE SCOTT AIR-PAK

The Scott Air-Pak is a self contained breathing apparatus that will enable the user to enter a gaseous area either to rescue personnel or rectify a gaseous situation. If gas is known or suspected to be in an area, always put on a Scott Air-Pak before proceeding into the area. The Scott Air-Paks together with the Pneolators are stored in the following locations:

1. Blast Furnace Foreman's Office
2. #1 Hoist House
3. #2 Hoist House

The air tank contains about 15 minutes of breathing air when it is full. Full pressure is 2500 psi. Always check the amount of air in the tank before using the air-pak. To bring air up to the facepiece, open the cylinder valve and make sure the yellow valve on the regulator valve is open. In the event of a regulator failure the red by-pass valve can be opened. The air-pak has a built-in alarm in the regulator to indicate when the air tank is empty. It will sound when there is about 2 minutes of breathing air remaining. When this alarm sounds, the user should immediately leave the gaseous area.

Following is the recommended method for donning the Scott Air-Pak:



Lift Sling-Pak® from carrying case by shoulder strap.



Swing shoulder strap over head while supporting cylinder with left hand.



To adjust, pull shoulder strap while positioning cylinder with left hand.



Snap hook to "D" Ring and adjust waist belt by pulling end.



Don Scottovamic facepiece, open cylinder valve and connect breathing hose to regulator.

## GAS RESCUE PROCEDURE

1. GET HELP - SOUND THE GAS ALARM - CALL FOR AN AMBULANCE.
2. TEST FOR GAS IF IN DOUBT. IF GAS IS PRESENT, BUT ON A SCOTT AIR-PAK GAS MASK BEFORE ENTERING THE GASEOUS AREA.
3. REMOVE THE VICTIM OR VICTIMS TO A GAS FREE AREA.
4. ADMINISTER OXYGEN WITH A PNEOLATOR. KEEP THE VICTIM WARM AND COMFORTABLE.

## POINTS TO REMEMBER

1. NEVER TRY TO RESCUE ANYONE BY YOURSELF - ALWAYS GET HELP! THAT IS THE CARDINAL RULE OF GAS RESCUE PROCEDURE.
2. NEVER ENTER A GASEOUS AREA WITHOUT A MASK - IF IN DOUBT, TAKE A GAS TEST.
3. DO NOT PANIC! A PERSON UNCONSCIOUS FROM GAS IS BREATHING VERY LIGHTLY, THEREFORE HIS BLOOD IS ABSORBING SMALLER AMOUNTS OF CARBON MONOXIDE. ANY WOULD-BE RESCUER WITHOUT A MASK IN A GASEOUS AREA IS EXERTING HIMSELF AND HIS BLOOD IS ABSORBING CONSIDERABLY MORE CARBON MONOXIDE THAN THE VICTIM. THE EFFECTS ON HIM CAN POSSIBLY BE MUCH MORE SERIOUS THAN THE ORIGINAL VICTIM.

EMERGENCY FIRST AID - EXT. 212



The purpose of the pneolator is to give automatic artificial respiration to victims of the Blast Furnace gas. When a person is asphyxiated, i.e., inhaled sufficient quantities of carbon monoxide, immediate artificial respiration is necessary. The pneolator can function either as a respirator or as an inhalator. For a victim who has stopped breathing, the pneolator can be used as a respirator. The pneolator "breathes" for a person by inflating the lungs to a predetermined pressure and then allowing exhalation by the natural recoil of the chest. When the victim starts to breathe, the pneolator can function as an inhalator by simply opening the airway below the mask.

There are two valves that must be opened during the artificial respiration. One is the cylinder valve. When this is open, the high pressure gage indicates the cylinder pressure. The other is the pneolator control valve. This is an adjusting valve to set the oxygen flow for an infant, child or adult as indicated on the low pressure gage. It compensates for the lungs of varying capacities without harming them.

Before giving oxygen to the victim, check his tongue and make sure it is not blocking his air passage. It may be necessary to place a proper size airway over and behind his tongue. Then, using the proper mask (adult or infant), hold it tight over the victim's face. The pneolator will now breathe for the person. If there is an obstruction in the patient's wind passage, then the valve below the face mask will chatter. If this happens, remove the mask and check the patient's mouth. If his tongue is obstructing, straighten it with an airway and place a proper size airway over and below the tongue. If it is a blockage by a liquid, etc., use the "aspirator" to remove it. By inserting the tube of the aspirator in the patient's air passage and depressing the knob, the vacuum in the tube will suck the liquid out. When the obstruction is removed, re-apply the mask.

Once the patient starts to breathe voluntarily, the pneolator can be changed into an inhalator by opening the airway below the face mask. Just turn the knob clockwise. Then turn the pneolator adjustment valve such that the low pressure gage needle is at the "aspirator" position.

An auxiliary unit is available and may be connected directly to the main unit at the aspirator connection. It is exactly the same as the main unit but does not have its own oxygen supply.

Select an area gas free to give oxygen to a victim. Keep the patient warm and watch closely his breathing effort. Make sure the cylinder is not running out of oxygen. Most importantly, familiarize yourself with the pneolator in spare time so that there is no need to panic when the need arises.



Cylinder valve

Control valve

# SCOTTORAMIC® FACEPIECE

## DONNING PROCEDURE AND MAINTENANCE 801450 & 801500 SERIES



**DONNING PROCEDURE:**

1. Adjust the head straps to a full outward position.
2. Hold the head harness out of the way with one hand or fold back over the lens.
3. Place the facepiece on the face with chin properly located in the chin pocket.
4. Pull the head harness over the head and tighten the neck straps by pulling on the two appropriate tabs. PHOTO 1.
5. Stroke the head harness down to the back using one or both hands. PHOTO 2.
6. Tighten the two temple straps. PHOTO 3.
7. Retighten neck straps if required.
8. In most cases, the top head strap will be tight on the "Full out" position.
9. Check the seal by closing off the inhalation tube with your hand and slowly inhale. No leakage should be detected and the facepiece should be drawn onto the face. PHOTO 4.

**NOTE:**

In training sessions, each user of the Scottoram facepieces should determine the general geometry and tightness of the head harness to provide the best seal, greatest comfort and maximum security for each particular face characteristic.



**MAINTENANCE**

The lens in this facepiece is molded of polycarbonate plastic to provide a high degree of impact resistance, optical qualities and dimensional stability.

To replace the lens, remove the 15 clips with a coin or thin pry tool. Align center marks on new lens with facepiece center parting lines. Force lens to bottom of grooves in rubber and install clips to retain lens frame.

**CLEANING**

Wash in warm soap or detergent solution. Rinse completely in clean warm water and air dry or dry with a soft clean cloth.

Disinfect in 70% ethyl, methyl, or isopropyl alcohol, a quaternary ammonium solution or a hypochlorite solution (50 PPM of chlorine minimum).

**NOTE:**

All plastic lenses require care in handling and cleaning. They can be damaged by abrasive or harsh cleaners and softened by some solvents. While most household cleaners, disinfectants and plastic cleaners are satisfactory, it is necessary to first test them on the edge of a lens. Avoid abrasive cleaners, acetone, paint and lacquer thinners, benzene, dry cleaning fluids, strong phenol and creosol solutions. Do not polish with paper towels as most paper contains abrasives. Do not automobile.