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Operation and Maintenance Manual for NB-15 & NB-20 Vapor Phase Units

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1.0 GENERAL

Standard adsorbent is *virgin* granular or pelletized vapor phase coal based activated carbon and is normally installed prior to shipment. These units are designed to operate in the upflow mode. If the inlet organic contaminant concentrations exceed 500 ppm and the flow is less than 50 ft/min, significant heat of adsorption may be generated. Prewetting the adsorbent with water is recommended in these cases, in order to minimize the chance of ignition.

In all cases of a combustible source of air or gases, a suitable **bi-directional detonation flame arrestor** should be installed between the source and the adsorber. TIGG premounts arrestors as ordered; otherwise, carefully observe instructions included with your own arrestor.

If media other than carbon is to be used, contact a TIGG representative for any procedural changes.

2.0 SAFETY CONCERNS

WARNING: Wet drained activated carbon preferentially removes oxygen from air. In closed or partially closed containers, the oxygen concentration can reach dangerously low levels. Therefore, procedures related to entering low-oxygen spaces should be followed by workers that must enter a vessel containing wet carbon.

Activated carbon can react with oxidizing/easily-oxidized substances such as ozone, concentrated oxygen, halogens, ketones etc. to liberate heat in addition to that which is normal for physical adsorption. Regular activated carbon is not recommended with these materials, **especially in intermittent use application.**

If it is used in these applications contact a TIGG representative to discuss the necessary precautions to prevent temperature excursions. In this application **TIGG SAFE** carbon should be used.

3.0 UNLOADING & STARTUP PROCEDURES

3.1 Receiving

When a unit is delivered to the site, it should be checked thoroughly to ensure all required items have been received and the equipment is free of any shipping damage **prior to signing the bill of lading.**

3.2 Rigging

All equipment will arrive at the job site via truck. The units will arrive either with or without activated carbon, depending on the customer's request.
The unit should be carefully removed from the truck in a horizontal position by either a forklift or an overhead

crane. If a crane is used it is advisable to use a properly sized spreader beam and lifting cables.

Following are weights of the units.

UNIT	Empty Wt.	Filled Wt.
NB – 15	9000	21000
NB – 20	15000	31000

Once the adsorber has been removed from the truck, it should be placed on a stable, level surface and oriented to complement the piping and blower arrangement. Four wheels are installed on the units to allow on site movement by a tow motor along a solid ground surface.

3.3 Ducting and Peripheral Equipment

Supply and discharge duct for the units, if provided, is usually installed by others. External ductwork should be connected to the units using flexible connectors and clamps. The ductwork should be properly supported to prevent excessive loading on the adsorber.

A packing list is included with the shipment.

4.0 STARTUP PROCEDURES

4.1 Filling the unit with Fresh Carbon

Fresh carbon will arrive on one truck in 1000-1100 pound super sacks. Upon arrival of the truck, the following steps should be taken:

1. Remove the top hatches by loosening four clamps on each hatch and placing each hatch to the side.

2. Inspect the interior of the adsorber to make sure the grating and screen are not damaged and that no holes are present.

3. Install the **Breakthrough Detector** into the ¾" FNPT fitting on top of the adsorber, if one was supplied. Remove the tape covering the diffusion ports on each end.

   The colored granules will change from violet to a brown color when organics(s) or other oxidizable substance reach the ports – signaling that about 70% of the carbon bed is exhausted for that compound. A low humidity level is required in the air or gas being monitored for the oxidation to occur. A sliding shield, to prevent light from prematurely changing the indicator color, is moved to view the granules.

4. Prepare to load through an end hatch.

5. Suspend a super sack above the hatch and lower it as close to one side of the hatch as possible.

6. Untie the outer bag exposing the inner chute. Untie the inner chute while clasping the inner chute. Remain holding the chute and carefully lower the chute through the hatch. Unclasp the chute and allow the carbon to discharge from the sack. When the bag is empty shake it and invert the chute into the bag.

   If at any time you wish to stop the flow of carbon simply re-grasp the chute up high and cinch. Re-tie the bag.

7. Continue to load super sacks through the hatch until carbon is within 1-2 feet of the opening - approximately (2) super sacks. The carbon will have formed a cone shaped pile which could have an angle of repose between 20 and 30 degrees. Push the carbon toward the sides and ends of the adsorber and then level it.

8. Repeat steps 5 through 7 for the remaining hatches.

9. Level the carbon throughout the entire bed by using a steel or aluminum straight head rake and push/pull the carbon toward and away from the sides of the adsorber until the bed of carbon is level**. Be careful to not damage the high solids epoxy liner while raking the carbon.**

4.2 Removing Spent Carbon

Spent carbon can be removed by using a vacuum source, generally supplied by a vacuum truck. Upon arrival of the truck, the following steps should be taken.

1. Open the hatches and the end door.

2. The vacuum source is generally connected by a hose to a section of plastic pipe, which is inserted into one of the top openings on the adsorber. **Any metal fittings should be protected from touching the plenum and sides of the adsorber in order to prevent damage.**

3. Move the pipe around as the carbon level is lowered. The adsorber may require entry to remove any residual amounts of spent carbon. **Follow appropriate OSHA confined space entry procedures to prevent worker injury.**

4. Thoroughly inspect the interior lining and plenum material for damage once all of the carbon has been removed.

5. If the interior lining is undamaged and the plenum material intact, the adsorber can be filled in accordance with Section 4.1.

5.0 GENERAL PROCESS DESCRIPTION

5.1 Mode of Operation

The adsorber utilizes a horizontal bed of granular vapor phase activated carbon. Influent vapor enters through two duct fittings located on one end of the adsorber.
The vapors are then distributed throughout an open area in the bottom of the adsorber. Influent vapors flow upward through the carbon bed and into the headspace of the adsorber and then into a discharge duct(s).

5.2 Excessive Moisture Accumulation

If excessive moisture is present in process vapors, liquid may accumulate within the open bottom portion of the adsorber. Drain plugs are located at the four corners of the adsorber floor. The drain plugs can be removed from the bottom side of the adsorber.
Note – removal of a drain plug may expose personnel to untreated process vapor and may result in spillage of contaminated liquid. Use appropriate protection.

6.0 TROUBLESHOOTING

This section is intended to identify some of the more common problems which may be encountered during the operation of a vapor phase carbon system. The following discussion is not intended to be all-inclusive since situations and circumstances will vary with each individual system by virtue of design, operating philosophy etc. Therefore, this section should only be considered as a guideline for troubleshooting.

6.1 General

The problems which arise generally fall under the following categories:

- High pressure drop
- Poor adsorption and inefficient carbon usage

6.2 High Pressure Drop

High pressure drop can usually be caused by:

- Excessive moisture accumulation in the plenum and/or
- Blinding of the plenum by particulates

6.2.1 Excessive Moisture Accumulation

As discussed in Section 5.2, if excessive moisture is present in process vapors, liquid may accumulate within the bottom portion of the unit. This accumulation may restrict or completely block portions of the inlet duct connection and the open space beneath the carbon support.

Either restriction or blockage will increase inlet velocities and pressure drop through the unit. This condition may be avoided by periodically draining the inlet lines and drains on the unit.

6.2.2 Blinding the Plenum

The plenum in rental units is constructed of black porous polyethylene support medium attached to angle bracing every 18". The porous polyethylene looks like pelletized carbon bonded together. The porous polyethylene not only supports the carbon, but also provides uniform distribution of the vapor. Alternatively, these units may be supplied with stainless steel bed supports.

If the influent vapor contains an excessive amount of particulates, the particulates may build up on the underside of the screen, causing a restriction of the open area and an increase in the pressure drop. If excessive blinding occurs within the unit, an upstream filter may have to be installed to remove the particulates prior to the adsorption unit.

6.2.3 Poor Adsorption and Inefficient Carbon Usage

Poor adsorption and/or inefficient carbon usage may be caused by the following:

- Channeling – level the bed
- Carbon saturation – change the carbon
- Premature increase in the effluent concentration – check the influent concentration
- Change in types of contaminants in the influent – compare influent analyses with original
- Presence of non-adsorbable organics in effluent – compare influent analyses with original

7.0 MAINTENANCE

These units are designed to require minimum maintenance. The following items should be inspected and maintained as noted:

- Internal inspection of the lining and polyethylene plate should be performed each time the carbon is removed.
- Inspect all attachment hardware for damage
- Check for moisture accumulation by removing drain plugs at least every 2-3 months.
- Check inlet pressure periodically to insure proper operation.
- Inspect process connections periodically for signs of wear and/or leakage.

For reorders, replacement adsorbents or further technical information please contact TIGG Corporation, 1-800-925-0011