MONOPLACE: HOW TO USE

To be done immediately prior to compression

1 Align the external 3-way valve to the “PRESSURE” position.

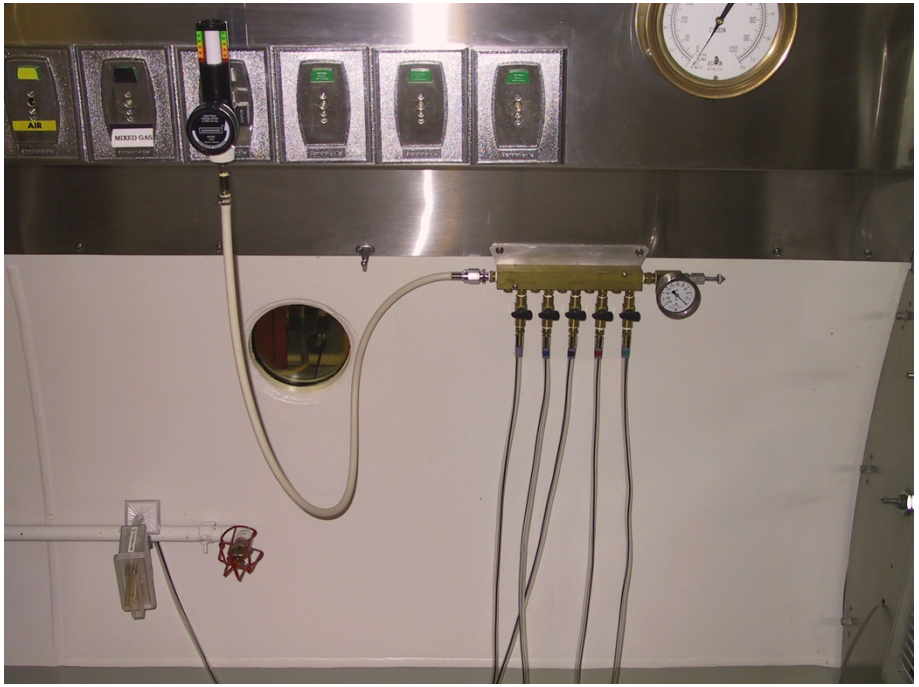
2 Turn the vacuum regulator control valve to the “REG” position.

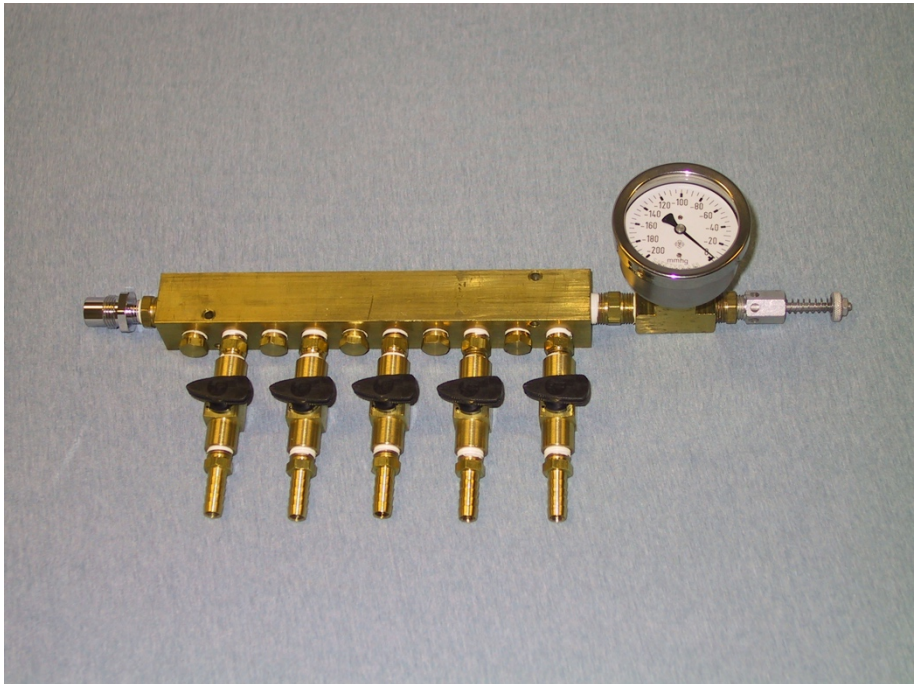
3 Remove the canister from the V.A.C. pump and connect it to the suction tubing from the vacuum regulator. Assure all clamps are open.

4 Administer the hyperbaric oxygen treatment.

5 When the chamber door opens, disconnect the canister and insert it into the V.A.C. pump.

6 Turn on the V.A.C. pump and check for leaks.





MULTIPLACE: HOW TO USE

1 Turn on the portable suction pump.

2 Align the external 3-way valve to the “SURFACE” position.

3 Adjust the Boehringer vacuum regulator to the desired setting.

4 Bring the patient into the chamber with their V.A.C. pump connected.

5 Close the clamps on the dressing and canister tubing.

6 Remove the canister from the V.A.C. pump and connect it to the manifold suction tubing.

7 Open the corresponding manifold shut-off valve. Assure that the valves for all unused tubings are closed.

8 Open the clamps on the dressing and canister tubings.

9 Verify the amount of vacuum delivered to the patient by observing the vacuum gauge on the manifold.

10 Remove the V.A.C. pump from the chamber. It poses a safety hazard and pressurizing the pump may damage it.

11 As the chamber compresses, align the external 3-way valve to the “PRESSURE” position, and turn off the suction pump.

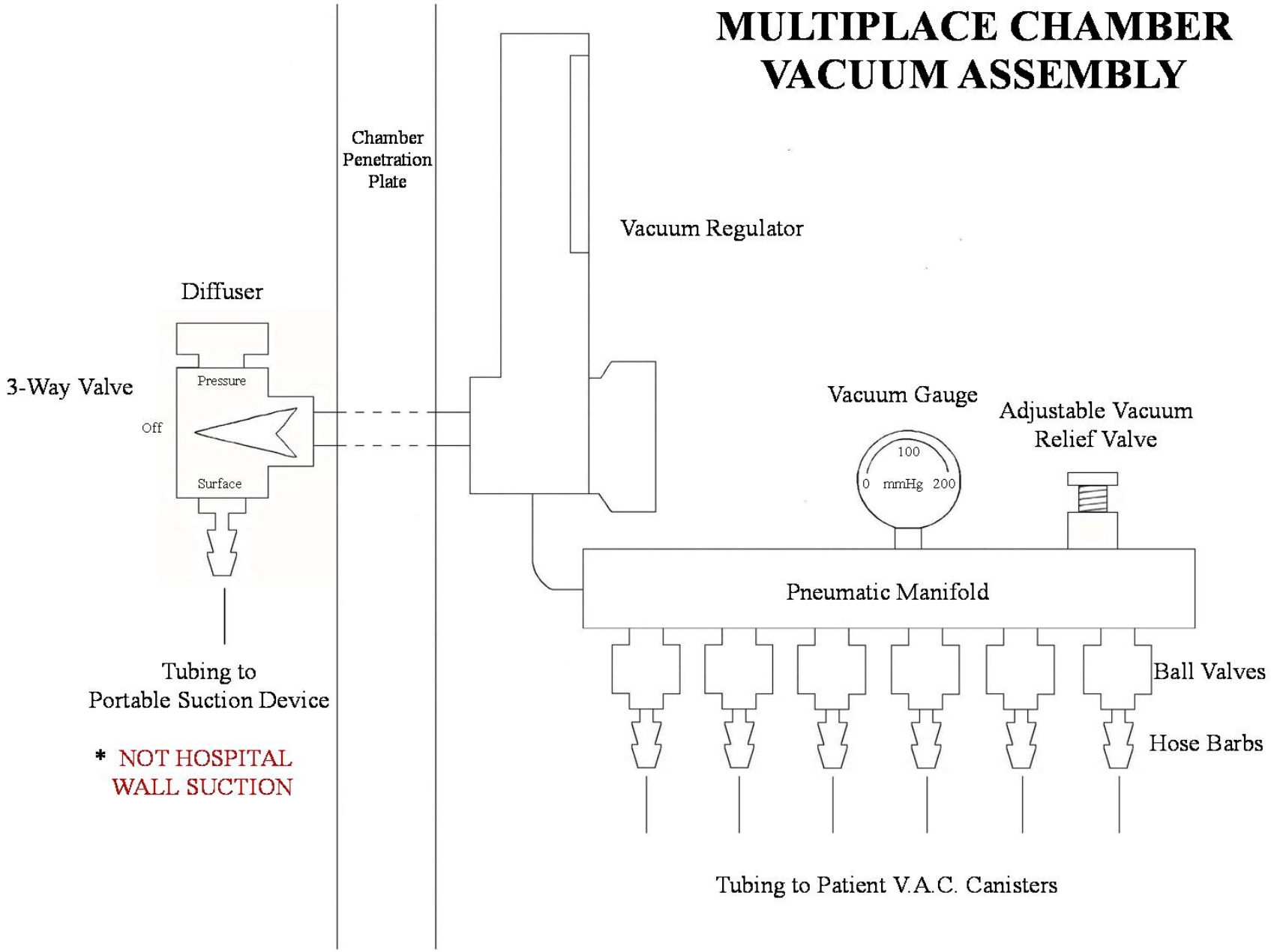
12 As the chamber ascends, turn on the suction pump, and align the external 3-way valve to the “SURFACE” position.

13 When the chamber is at surface pressure, close the clamps on the dressing and canister tubing.

14 Disconnect the patient’s canister from the manifold suction tubing and insert it into the V.A.C. pump.

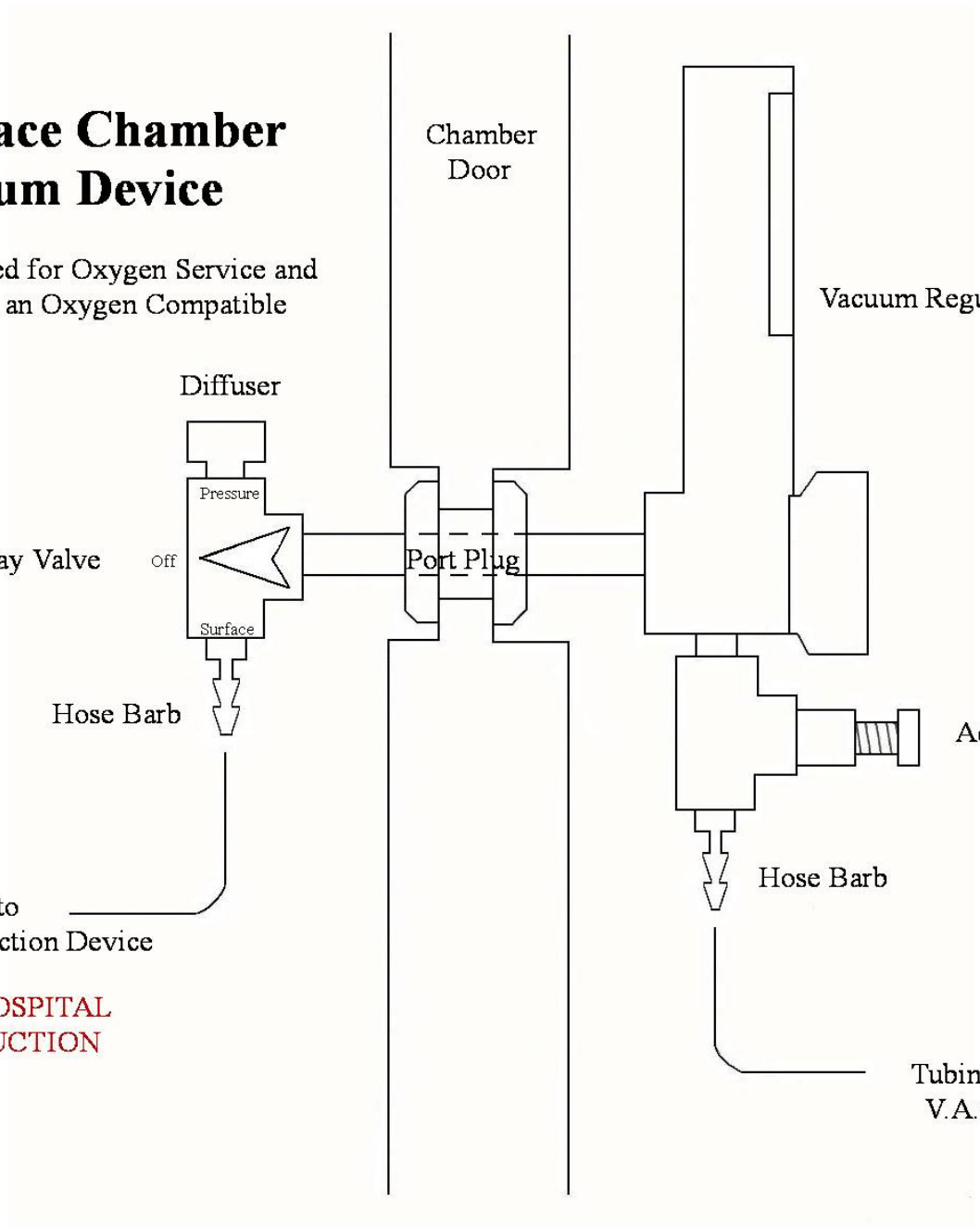
15 Turn on the V.A.C. pump, open the clamps on the dressing and canister tubings, and check for leaks

MULTIPLACE CHAMBER VACUUM ASSEMBLY



Monoplace Chamber Vacuum Device

All Items Cleaned for Oxygen Service and Lubricated With an Oxygen Compatible Lubricant



A VACUUM REGULATION SYSTEM FOR CONTINUING VACUUM ASSISTED CLOSURE THERAPY (V.A.C.®) IN MULTIPLACE AND MONOPLACE HYPERBARIC OXYGEN CHAMBERS.

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BACKGROUND: Vacuum Assisted Closure (V.A.C.®) (KCI USA Inc. San Antonio, TX) is a non-invasive active therapy using controlled, localized negative pressure to promote moist wound healing. The manufacturer recommends that V.A.C. therapy be maintained at least 22 hours per day. For those patients receiving concomitant hyperbaric oxygen therapy this is problematic. The V.A.C. pump is not allowed inside hyperbaric chambers due to safety concerns, thus daily hyperbaric oxygen therapy sessions may necessitate interruption of V.A.C. therapy longer than manufacturer recommendations. KCI literature states there are two potential options to consider when V.A.C. treated patients undergo hyperbaric oxygen therapy treatments.
Option One: Remove the V.A.C. dressing before the dive and cover the wound with a moist (saline) gauze or other dressing. After the dive is completed, replace the V.A.C. dressing and initiate V.A.C. therapy.
Option Two: Removal of the dressing prior to each dive may become too irritating to the surrounding tissue or uncomfortable for the patient and cause added cost. In these cases, disconnect the V.A.C. pump and canister from the V.A.C. dressings. The connector should be covered by a 4 x 4 or other absorbent dressing to contain any secretions in the tube, unclamp the tube to allow pressure changes in the V.A.C. tube and dressing. After the dive, reconnect the V.A.C. pump to the dressing and turn the therapy on.

GOAL: Our goal was to provide a third option that allowed simultaneous use of V.A.C. therapy during a patient's hyperbaric oxygen treatment. The desired system design parameters included: Regulation of the therapeutic vacuum, safeguard against application of excessive vacuum, provide vacuum for up to five patients simultaneously, be relatively low cost to build and operate, adaptable to both of our multiplace chambers and the PERRY Sigma 34 monoplace hyperbaric oxygen chamber, and be simple to use.

MATERIALS AND METHODS: When the chamber is pressurized, vacuum is generated by the pressure gradient across the chamber hull. When the chamber is at surface pressure, a portable suction pump is connected externally via a 3-way valve. A Boehringer® model 3700 suction regulator (Boehringer Laboratories, Norristown, PA) is used to control the amount of negative pressure. An inline adjustable vacuum relief valve assures that vacuum does not exceed prescribed limits. A vacuum gauge is located downstream from the regulator to detect leaks in the patient collection circuit. A manifold distributes the vacuum to multiple (1-5) patient V.A.C. canisters. Each line has its own shut-off valve and biological filtering to prevent system contamination.

RESULTS: At 2.4 ATA (45 fsw) the system is able to generate and regulate vacuum of 10-150 mmHg for up to five patients simultaneously while inside a multiplace hyperbaric chamber or for a single patient in a monoplace chamber. The adjustable vacuum relief valve did not allow vacuum levels to exceed 180 mmHg during simulated regulator failure.

CONCLUSIONS: A safe, effective vacuum system for maintaining V.A.C. therapy inside monoplace and multiplace hyperbaric chambers can be economically constructed.

REFERENCES
1. V.A.C. Recommended Guidelines for use Physician & Caregiver Reference Manual. KCI USA, Inc. 2001:18
2. Weaver LK. A Functional Suction Apparatus Within the Monoplace Hyperbaric Chamber. J Hyper Med 1988; 3(3):165-171.

GENERAL CONSIDERATIONS

This system provides only continuous negative pressure, it is not capable of intermittent suction.

The system does not have alarms. It must be monitored by the chamber attendant / operator.

The vacuum relief valve should be adjusted to relieve at a slightly greater vacuum than the therapeutic setting.

The pressure relief valve must be properly sized and tested to assure it provides enough flow so adequate relief is obtained in case of regulator failure.

When the chamber is not pressurized, vacuum can be provided by connecting a portable suction device to the system. *NEVER CONNECT THE CHAMBER SYSTEM TO THE HOSPITAL'S WALL SUCTION!

The brazed brass diffuser / muffler breaks up the stream of gas as it escapes the chamber and reduces the amount of noise.

The patient's V.A.C. canister serves as the drainage collection device while in the hyperbaric chamber. The V.A.C. canister does not contain a biological filter, so one should be placed inline on each patient's suction tubing to prevent contamination of the system.

MULTIPLACE CONSIDERATIONS

All patient's in the chamber will receive the same level of vacuum.

The vacuum gauge located on the pneumatic manifold is used to verify the amount of vacuum delivered to the patient. The Boehringer vacuum regulator is compensated for changes in the patient collection circuit and may not be reflective of the actual amount of vacuum delivered to the patient if there is a leak in the system.

Each patient tubing has a shut-off valve to prevent loss of vacuum from a line that is not in use.

Color coding the suction tubing helps identify what lines are in use.

MONOPLACE CONSIDERATIONS

The system as shown, is fitted for a PERRY Sigma 34 monoplace hyperbaric oxygen chamber. An access port in the door was drilled and tapped to receive ¼ inch NPT fittings, and serves as the mounting hardware for the 3-way valve and the vacuum regulator.

The entire system can be permanently mounted on the chamber door. However, removal is simple. The Boehringer regulator has an internal 3-way control valve that allows you to shut off the vacuum when not in use. When set to the "OFF" position, no gas will escape through the system. The 3-way valve located outside the chamber can be used to shut off the vacuum if the regulator fails.

When the chamber is at surface, vacuum can be applied by either a suction pump connected to the 3-way valve or by reconnecting the patient's V.A.C. pump.

The regulator should be tested and adjusted to a predetermined vacuum level while the chamber is at its standard treatment pressure. The regulator adjustment knob should be secured with the set screw to prevent inadvertent changes.

Because of the 100% oxygen environment of monoplace hyperbaric chambers, all components including the vacuum regulator have been cleaned for oxygen service and lubricated with an oxygen compatible lubricant as necessary.