Technical Reference Manual

MODIFIED AIR-OXYGEN BLENDER

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Revision History

Date	Document Revision	HW Version	Changes

Introduction

In hospitals, oxygen is administered to the medical patients in various mix as per the requirement of the patient. An Air-Oxygen Blender or Oxygen Blender is a medical device that is intended for use by qualified and trained medical personnel under the direction of a physician in institutional environments where delivery of fraction of inspired oxygen (FIO_2) mixture is required. It mixes the medical air and hospital grade oxygen (O_2) into a gas source ranging from 21% (normal) to 100% (max) oxygen in a reliable and precise manner. The blender uses source air and oxygen at a pressure of 50 psi (345 kPa) connected to two DISS fittings on the bottom of the blender. Each fitting has a built-in 30-micron particulate filter. The gas source passes through a duckbill check valve which prevents reverse gas flows from either source.

Usually the Air-Oxygen Blender is manually controlled. However, it has been motorized and controlled automatically or manually through the controlling circuitry using a stepper motor. A manual Air-Oxygen Blender has been converted into motorized assembly using readily available 'commercial of the shelf' (COTS) items.

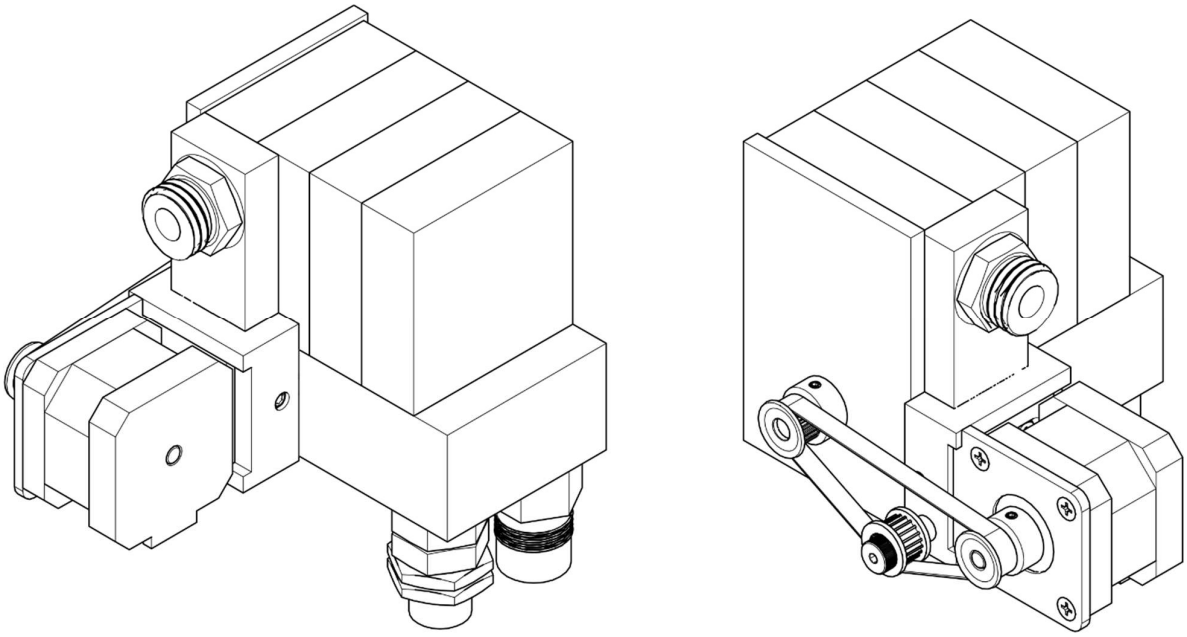


Figure 1. Air-Oxygen Blender

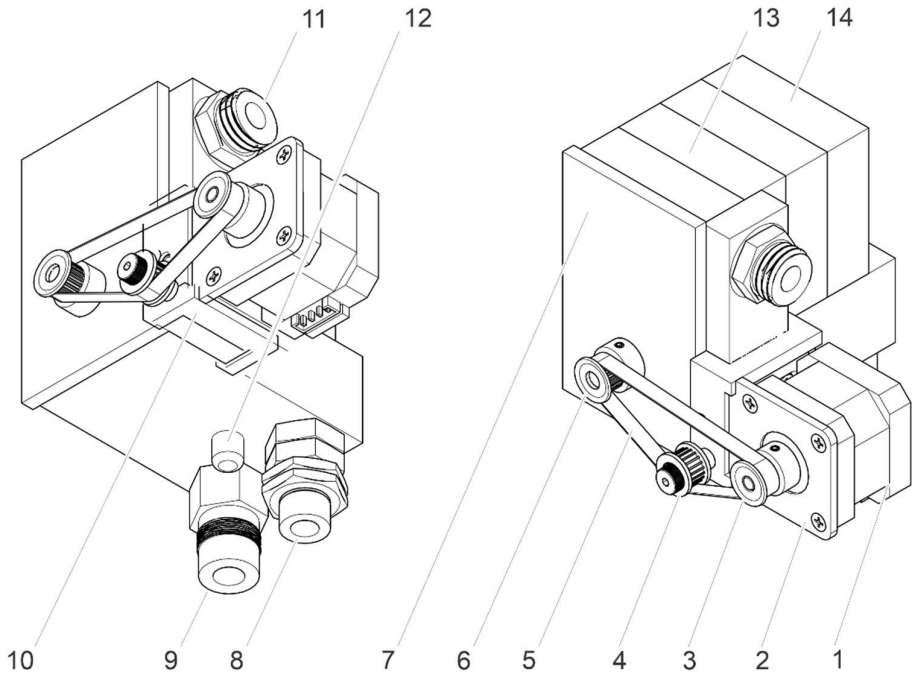
Purpose

The purpose of this manual is to explain the motorized Air-Oxygen Blender along with removal and installation of motor and allied components.

Intended Use

The Air-Oxygen Blender is designed to dispense a continuous blend of Medical Air and Oxygen via outlet ports to infant, pediatric and adult patients.

Major Components



1	Stepper Motor	8	Oxygen Inlet port
2	Motor Bracket	9	Air Inlet port
3	Motor Pulley	10	Motor Bracket Block
4	Idler Pulley	11	Outlet port
5	Belt	12	Audible Alarm
6	Blender Pulley	13	Proportioning Module
7	Air-Oxygen Blender	14	Low Pressure Module

Figure 2. Motorized Air-Oxygen Blender Components

Gas Outlet and Inlet Ports

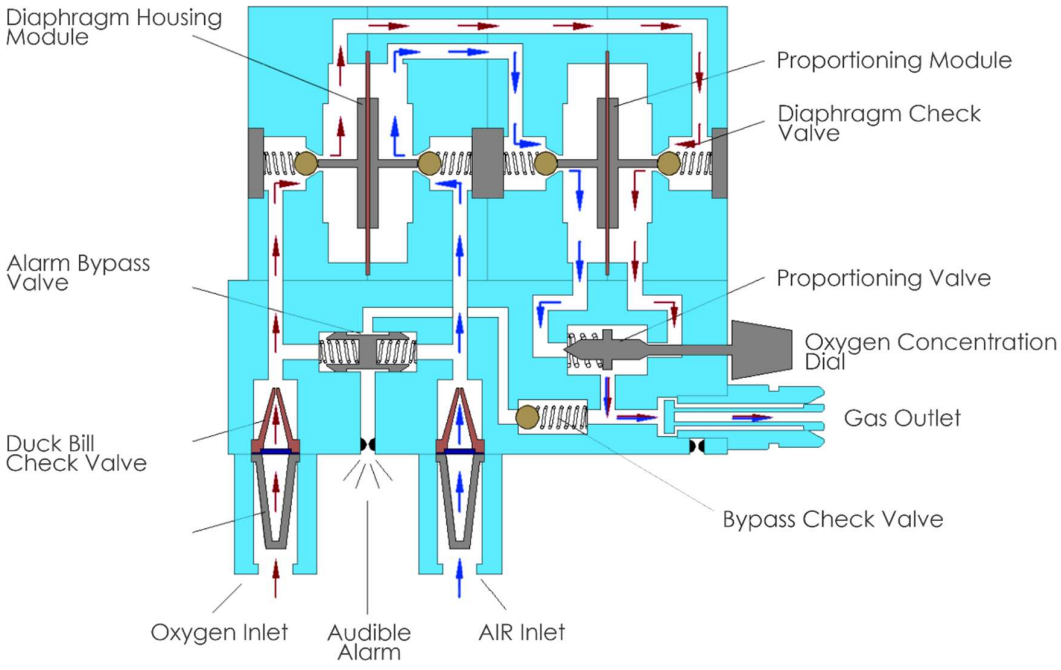
The outlet port (11) is male DISS oxygen fitting with check valve that delivers gas once connected. Two separate (oxygen and air) inlet fittings are located at the bottom of the air-oxygen blender. The air and oxygen source gas enters through these gas specific fittings. Each inlet connector contains a particulate filter and duckbill check valves to prevent reverse gas flow from either the air or oxygen supply systems.

- Oxygen Inlet (8) - A female Diameter Indexed Safety System (DISS) or Non-Interchangeable Screw Thread (NIST) oxygen fitting with one-way valve that is used to connect with high pressure oxygen supply hose.
- Air Inlet (9) - A female Diameter Indexed Safety System (DISS) or Non-Interchangeable Screw Thread (NIST) air fitting with one-way valve that is used to connect with high pressure air supply hose.

Operation

The Air-Oxygen Blender uses two stage diaphragm balancing module system. Gases come into first 'Diaphragm Housing' module (14) and equalizes the operating pressure of the gas sources at lower pressure. The diaphragm within the module responds to the difference in pressure and directs the movement of each check valve assembly contained within the air and oxygen chambers. The movement of each ball adjusts the amount of gas flowing through the diaphragm housing, equalizing the air and oxygen pressures to the lower pressure.

From the Diaphragm Housing Module, the gases flow into the Proportioning Module (13) and are mixed according to the oxygen percentage selected on the Oxygen Concentration Dial. This module consists of a double ended (proportioning) valve which is positioned between two valve seats, each valve controlling the passage of either gas (air and oxygen) into the outlet. At this point, the two gases have been blended according to the oxygen percentage selected on the Oxygen Concentration Dial. With the Oxygen Concentration Dial at the full counterclockwise position (21%), the double ended (proportioning) valve will completely close off the flow of oxygen, allowing only the air to flow with natural concentration of 21% oxygen in air. By adjusting the Oxygen Concentration Dial to the full clockwise position (100%), the flow of air is blocked, permitting only the flow of oxygen through the air-oxygen blender outlet.



An audible alarm located on the bottom of the Blender that signals when the difference in pressure between the two inlet gasses exceeds 20 psi. When the two source gases are near equal in pressure, the alarm bypass poppet is positioned over the bypass channel, blocking the flow of both gases. The poppet will remain seated for unequal pressures up

to 20 psi (1.41 kg/cm2). Once a 20 psi (1.41 kg/cm2) difference is sensed by the poppet, the higher gas pressure will overcome the spring force and pressure will overcome the spring force and pressure at its opposite end, thus creating a path for gas (air or oxygen) to flow into the alarm channel. The gas with the higher pressure will also flow directly to the Blender outlet port by passing the Balance and Proportioning Modules. The gas is also directed to the bottom of the unit to the reed alarm, thus creating and audible warning. The oxygen concentration will be that of the gas at the higher pressure. The Blender in the alarm/bypass mode will deliver the oxygen (100%) or air (21%) until the bypass mechanism resets when the source gas pressure is restored to a differential of approximately 6 psi (0.42 kg/cm2). If the Blender is set at 21% and the OXYGEN source pressure is reduced sufficiently to produce a 20 psi (1.41 kg/cm2) or greater differential, the unit will not alarm because it will continue to deliver 21% concentration according to the setting. If the control is moved slightly from the 21% setting, the alarm will sound. Similarly, if the Blender is set to deliver 100% oxygen concentration and AIR source pressure is reduced or lost, the unit will not alarm because it will continue to deliver the selected 100% concentration. The alarm will not function when there is no flow to the Blender.

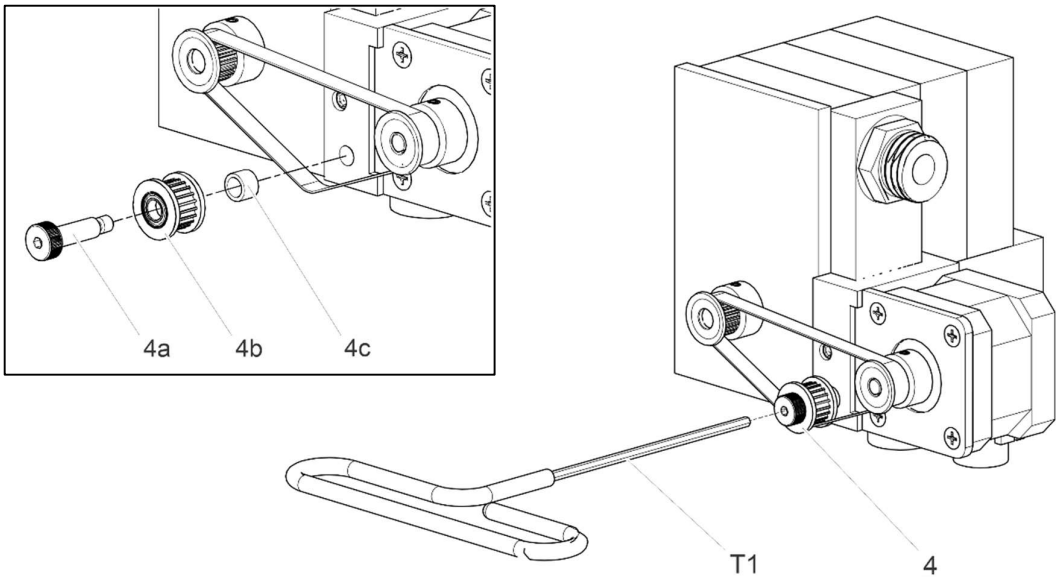
Removal

a. Disconnect all pipes from the Air-Oxygen Blender.
b. Remove the Air-Oxygen Blender from its installed location (either pole, wall, or rail).
c. Externally clean the Air-Oxygen Blender with cloth.

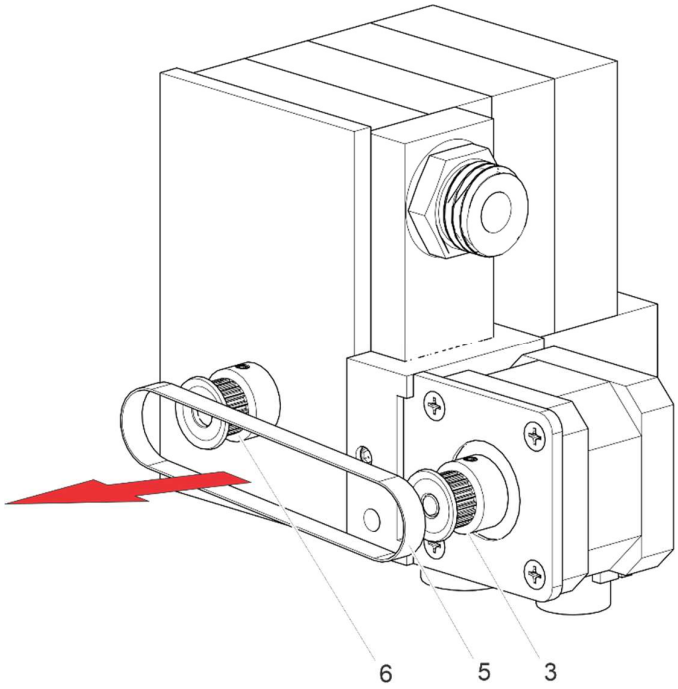
Disassembly

a. Disassembly of Air-Oxygen Blender (7) is not given. Only removal of stepper motor and associated components is given in this manual.

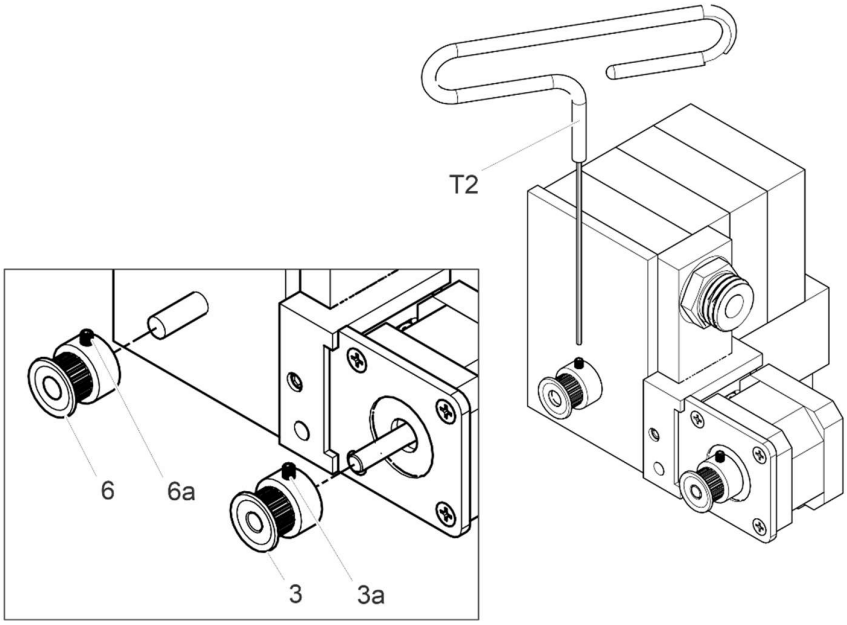
b. Using 2.5mm hex screw driver (T1), remove Idler pulley shoulder screws (4a). Idler pulley (4b) and collar (4c) is to be removed in order to remove the belt.



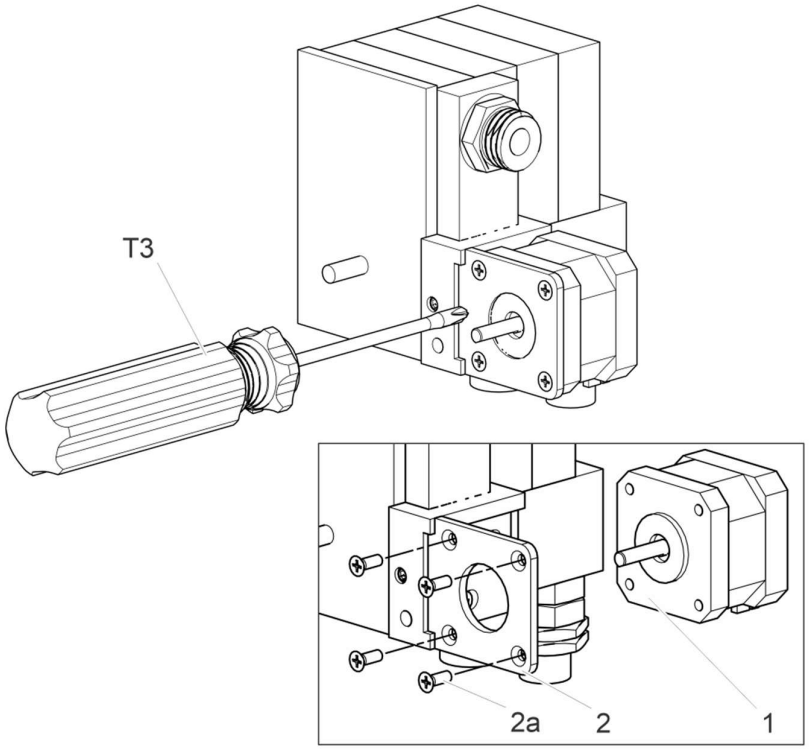
c. Loose the belt (5) and remove the loosen belt from motor pulley (3) and blender pulley (6) as indicated by red arrow.



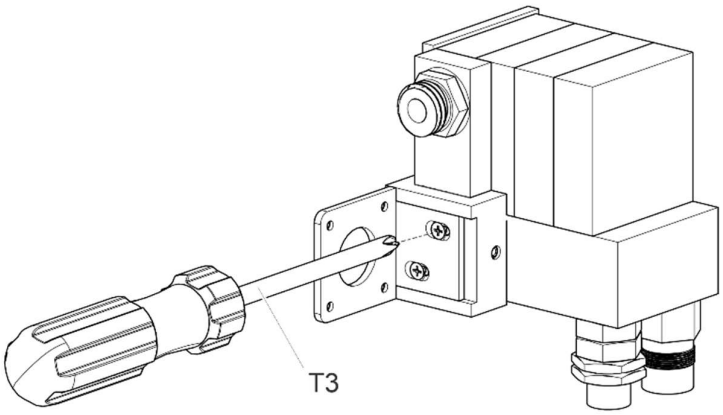
d. Using 1.5mm hex screw driver (T2), loose set screws (3a & 6a) on both motor pulley (3) and blender pulley (6). Remove both the pulleys.

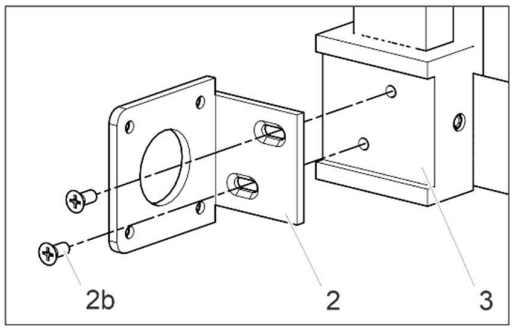


e. Using Phillips Screw Driver (T3), remove 4 screws (2a) so as to remove Stepper Motor (1) from the Motor Bracket (2).

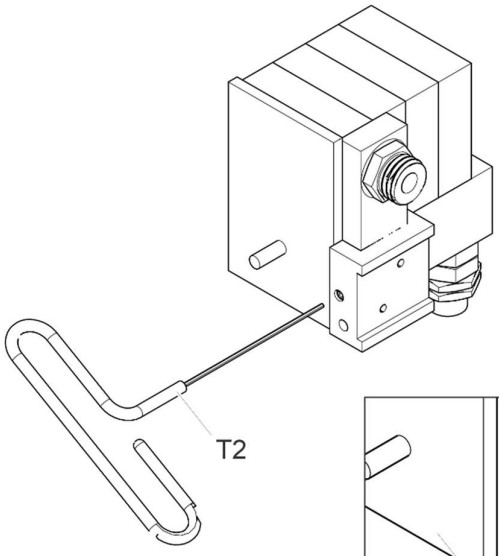


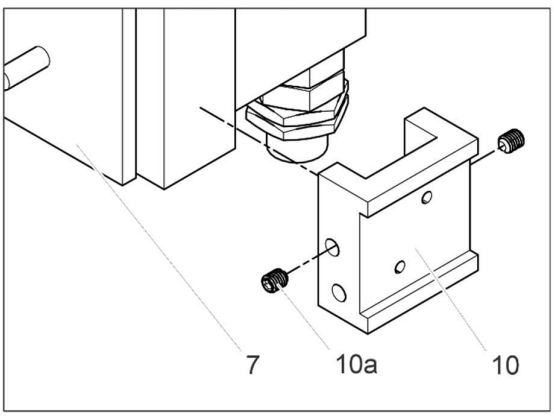
f. Using Phillips Screw Driver (T3), remove 2 screws (2b) so as to remove Motor Bracket (2) from the Motor Block (3).





g. Using 2.5mm hex screw driver (T2), unscrew 2 set screws (10a) to loosen Motor Block (10) from Air-Oxygen Blender (7).





Assembly

Assembly of the motor is done in the exact reverse order of the disassembly.

Specifications

Usage	Ventilators, nasal cannulas, mask CPAP and resuscitation bags
Device-Specific Standards	Complies with ISO 11195 : 1995
Oxygen % Range	21 to 100%
Oxygen % Accuracy	±3% of full scale
Supply Pressure	Both supplies within range of 30-75 PSI (207-517 kPa) and Air & oxygen must be within 10 psi (69 kPa) of each other
Pressure Drop	<6 psi (42 kPa) at 50 psi (345 kPa) inlet pressure and 40 L/min flow (10 L/min, Low Flow blender)
Maximum Flow	≥120 L/min High/Low Flow Blender (≥30 L/min, Low Flow Blender) at 60% setting & 50 PSI (345 kPa) inlet pressures
Reverse Gas Flow	From either gas inlet to the other is zero (complies with clause 6 of ISO 11195)
Dimensions	127mm H × 121.5 mm W × 113.5 mm D
Weight	2.75 lbs (1.25 kg)