Chris Braissant

TDI Compressor operator

Ban’s Diving Resort

Introduction

Introduction

Intro, Paperwork, Schedule

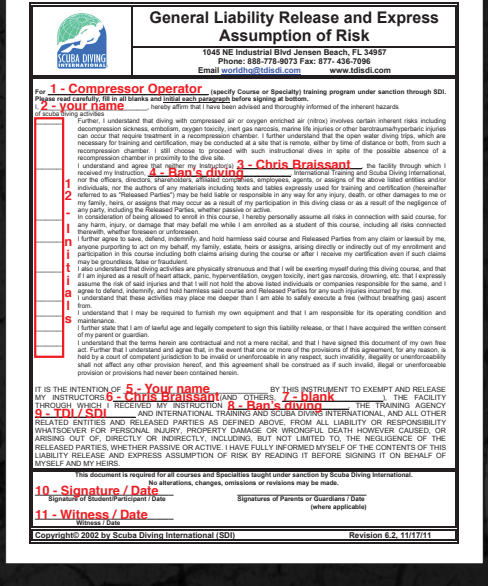
Course overview

Entry-level course
Operating principle
Routine maintenance
Proper handling
Filter changing
Practical part in the workshop

Paperwork

Liability Release and Express Assumption of Risk
Medical Statement

Liability Release



General Liability Release and Express Assumption of Risk

1045 NE Industrial Blvd Jensen Beach, FL 34957
Phone: 888-778-9073 Fax: 877- 436-7096
Email worldhq@tdisdi.com www.tdisdi.com

For 1 - Compressor Operator (specify Course or Specialty) training program under sanction through SDI. Please read carefully, fill in all blanks and initial each paragraph before signing at bottom.

I, 2 - your name, hereby affirm that I have been advised and thoroughly informed of the inherent hazards of scuba diving activities

12 - Initials

Further, I understand that diving with compressed air or oxygen enriched air (nitrox) involves certain inherent risks including decompression sickness, embolism, oxygen toxicity, inert gas narcosis, marine life injuries or other barotrauma/hyperbaric injuries can occur that require treatment in a recompression chamber. I further understand that the open water diving trips, which are necessary for training and certification, may be conducted at a site that is remote, either by time of distance or both, from such a recompression chamber. I still choose to proceed with such instructional dives in spite of the possible absence of a recompression chamber in proximity to the dive site.

I understand and agree that neither my instructor(s) 3 - Chris Braissant, the facility through which I received my instruction, 4 - Ban's diving, International Training and Scuba Diving International, nor the officers, directors, shareholders, affiliated companies, employee(s), agents, or assigns of the above listed entities and/or individuals, nor the authors of any materials including texts and tables expressly used for training and certification (hereinafter referred to as "Released Parties") may be held liable or responsible in any way for any injury, death, or other damages to me or my family, heirs, or assigns that may occur as a result of my participation in this diving class or as a result of the negligence of any party, including the Released Parties, whether passive or active.

In consideration of being allowed to enroll in this course, I hereby personally assume all risks in connection with said course, for any harm, injury, or damage that may befall me while I am enrolled as a student of this course, including all risks connected therewith, whether foreseen or unforeseen.

I further agree to save, defend, indemnify, and hold harmless said course and Released Parties from any claim or lawsuit by me, anyone purporting to act on my behalf, my family, estate, heirs or assigns, arising directly or indirectly out of my enrollment and participation in this course including both claims arising during the course or after I receive my certification even if such claims may be groundless, false or fraudulent.

I also understand that diving activities are physically strenuous and that I will be exerting myself during this diving course, and that if I am injured as a result of heart attack, panic, hyperventilation, oxygen toxicity, inert gas narcosis, drowning, etc. that I expressly assume the risk of said injuries and that I will not hold the above listed individuals or companies responsible for the same, and I agree to defend, indemnify, and hold harmless said course and Released Parties for any such injuries incurred by me.

I understand that these activities may place me deeper than I am able to safely execute a free (without breathing gas) ascent from.

I understand that I may be required to furnish my own equipment and that I am responsible for its operating condition and maintenance.

I further state that I am of lawful age and legally competent to sign this liability release, or that I have acquired the written consent of my parent or guardian.

I understand that the terms herein are contractual and not a mere recital, and that I have signed this document of my own free act. Further that I understand and agree that, in the event that one or more of the provisions of this agreement, for any reason, is held by a court of competent jurisdiction to be invalid or unenforceable in any respect, such invalidity, illegality or unenforceability shall not affect any other provision hereof, and this agreement shall be construed as if such invalid, illegal or unenforceable provision or provisions had never been contained herein.

IT IS THE INTENTION OF 5 - Your name BY THIS INSTRUMENT TO EXEMPT AND RELEASE MY INSTRUCTORS 6 - Chris Braissant (AND OTHERS: 7 - blank) THE FACILITY THROUGH WHICH I RECEIVED MY INSTRUCTION 8 - Ban's diving THE TRAINING AGENCY 9 - TDI / SDI AND INTERNATIONAL TRAINING AND SCUBA DIVING INTERNATIONAL, AND ALL OTHER RELATED ENTITIES AND RELEASED PARTIES AS DEFINED ABOVE, FROM ALL LIABILITY OR RESPONSIBILITY WHATSOEVER FOR PERSONAL INJURY, PROPERTY DAMAGE OR WRONGFUL DEATH HOWEVER CAUSED, OR ARISING OUT OF, DIRECTLY OR INDIRECTLY, INCLUDING, BUT NOT LIMITED TO, THE NEGLIGENCE OF THE RELEASED PARTIES, WHETHER PASSIVE OR ACTIVE. I HAVE FULLY INFORMED MYSELF OF THE CONTENTS OF THIS LIABILITY RELEASE AND EXPRESS ASSUMPTION OF RISK BY READING IT BEFORE SIGNING IT ON BEHALF OF MYSELF AND MY HEIRS.

This document is required for all courses and Specialties taught under sanction by Scuba Diving International.
No alterations, changes, omissions or revisions may be made.

10 - Signature / Date
Signature of Student/Participant / Date

Signatures of Parents or Guardians / Date (where applicable)

11 - Witness / Date
Witness / Date

 Revision 6.2, 11/17/11

1. Compressor Operator
2. Your name
3. Instr.: Chris Braissant
4. Facility: Ban's diving
5. Your name
6. Instr.: Chris Braissant
7. Facility: Ban's Diving
8. - blank -
9. Training agency: TDI/SDI
10. Signature and date
11. Witness signature and date
12. Your initials

Theory

Theory
Heat exchange

Polytropic process

A process which occurs with an INTERCHANGE OF BOTH HEAT AND WORK between the system and its surroundings.

$$\boxed{PV^n = constant} \qquad (n = polytropic\ index)$$

Isothermal process

A process which occurs at CONSTANT TEMPERATURE. (Boyle-Mariotte's Law)

$$\boxed{PV = constant} \qquad (n = 1)$$

Adiabatic process

A process in which heat does not enter or leave the system concerned (all heat is contained).

$$\boxed{PV^{\gamma} = constant} \qquad (\gamma = adiabatic\ index)$$

Monoatomic gas (inert gas)

- helium, argon, neon, xenon,...
  $\gamma = {}^{5}/_{3}$

Diatomic gas

- oxygen, nitrogen, hydrogen, air...
  $\gamma = {}^{7}/_{5}$

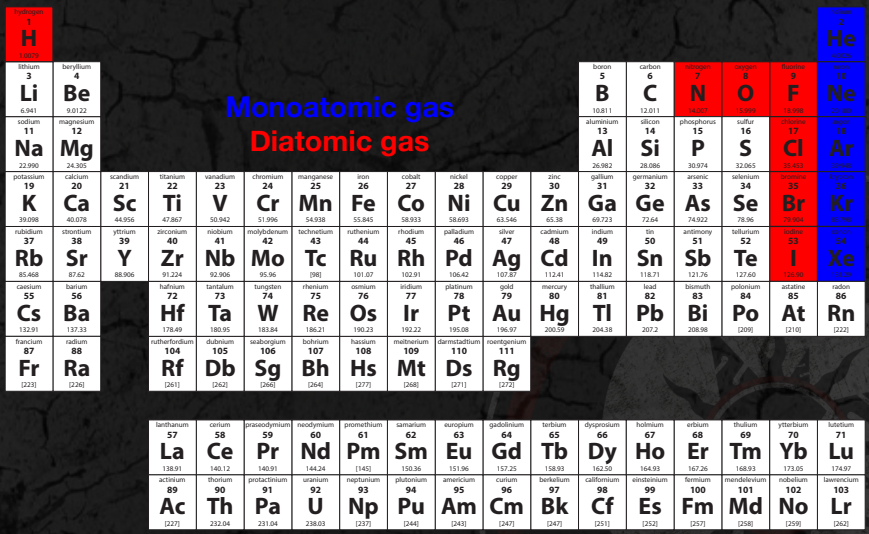
Adiabatic compression

Without going to much into details, the formula to find the temperature after compression in a adiabatic process is:

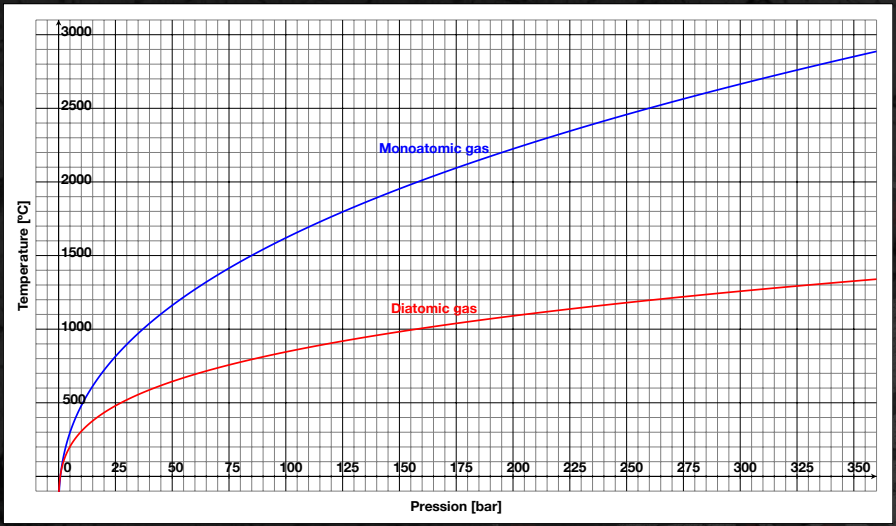
$$T_2 = T_1 \left(\frac{P_2}{P_1} \right)^{\frac{\gamma - 1}{\gamma}}$$

The temperature after compression is independant of the volume (or size) of a compressor.
Only the pressures and the ambiant temperature could change the final temperature.

Adiabatic compression



Adiabatic compression

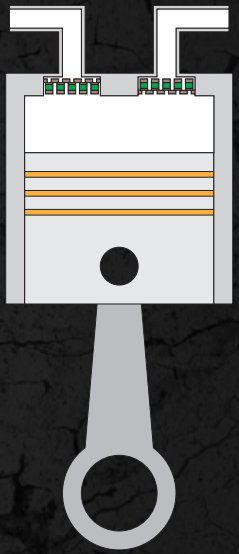


Compressor design

Compressor design

Single stage

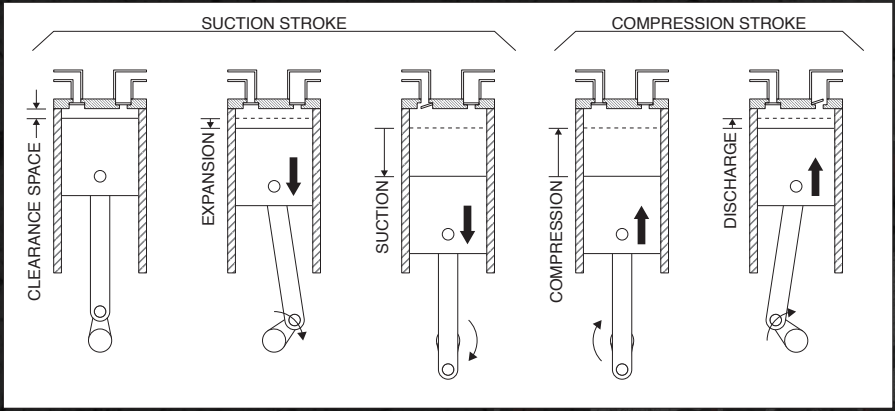
Single stage's design



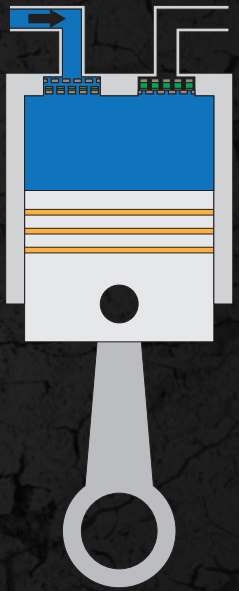
A compressor's stage is composed of:

- Inlet and outlet pipe
- Inlet and outlet valve
- Cylinder
- Piston - compressing the air in the chamber
- Piston rings - making a seal between the piston and the cylinder
- Rod - connecting the crankshaft to the piston
- Crankshaft - moving the piston up and down (not on the drawing)

Single stage's design



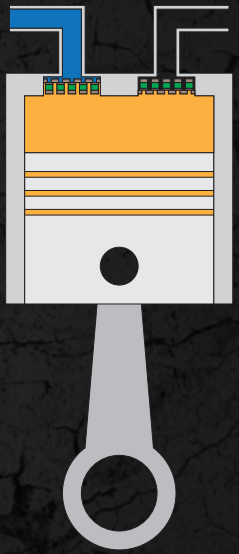
Compressor phases



First phase:

- Inlet valve is open
- Outlet valve is closed
- The chamber is filled with low pressure air

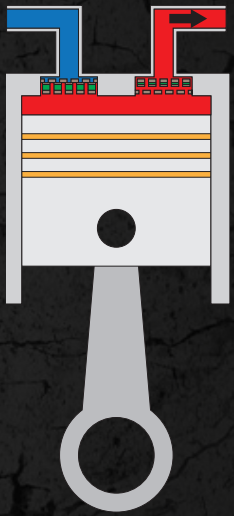
Compressor phases



Second phase:

- Piston starts to go upward
- Pressure increase in the piston
- Inlet valve is closed
- Pressure not sufficient enough to open the outlet valve

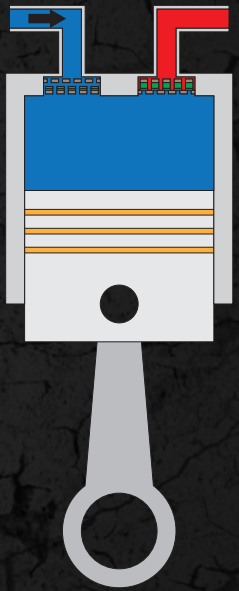
Compressor phases



Thrid phase:

- Piston reaches the maximum stroke
- Pressure open the outlet valve
- High pressure air leave the chamber

Compressor phases



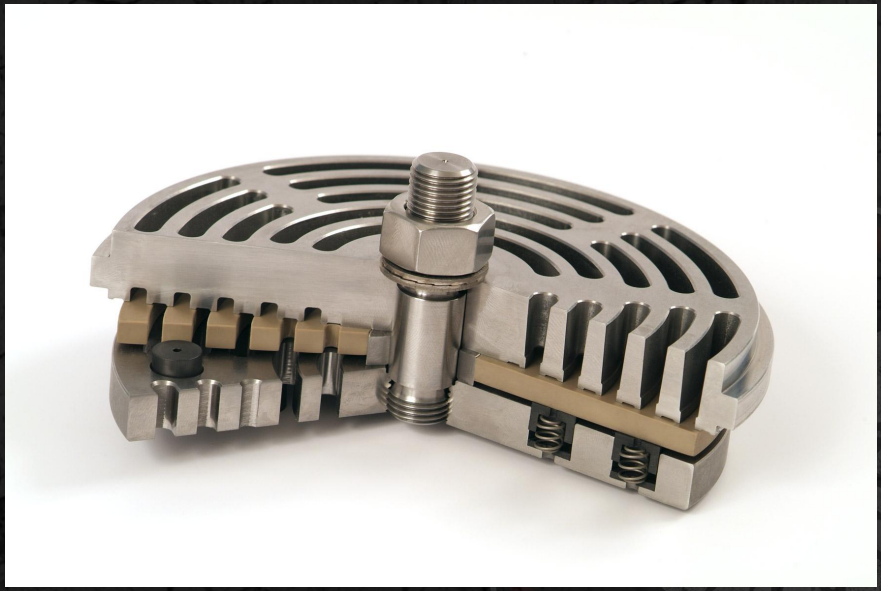
Fourth phase:

- Piston goes downward
- Pressure drops in the piston
- Inlet valve is open
- Outlet valve is closed
- The chamber is filled with low pressure air

Compressor valves

- Same principle as a dump valve
- Pressure push intermediate plate
- Spring are compressed
- Air can flow through the gap

Compressor valves



Temperature

The temperature of the gas after compression can be determined using the formulas seen before:

$$T_2 = T_1 \left(\frac{P_2}{P_1} \right)^{\frac{\gamma-1}{\gamma}}$$

which give us a temperature of $1257[^\circ C]$!!!

Temp. before compression:	$T_1 = 27[^\circ C] = 300[K]$
Pressure before compression:	$P_1 = 1bar$
Pressure after compression:	$P_2 = 300bar$
Adiabatic index:	$\gamma = 7/5 \Rightarrow \frac{\gamma-1}{\gamma} = 2/7$

Temperature

The temperature of the gas after compression can be determined using the formulas seen before:

$$T_2 = T_1 \left(\frac{P_2}{P_1}\right)^{\frac{\gamma-1}{\gamma}} = 300 \left(\frac{300}{1}\right)^{\frac{2}{7}} = 1530[K] = 1257[^\circ C]$$

Filtration

Filtration

Air Quality

Air Quality

	EN12021	BS4275	O_2 Clean Air	PADI 5 stars
Oxygen	$21 \pm 1\%$			
CO_2	$< 500ppm$			
CO	$< 15ppm$	$< 5ppm$	$< 5ppm$	$< 10ppm$
Oil	$< 0.5ppm$	$< 0.5ppm$	$< 0.3ppm$	$< 5ppm$
Water	$< 25mg/m^2$			Not specified
Odor / taste	None			

Starting and running

Starting and running
Compressor

Compressor pre-startup checks

- Oil level
- Input filter
- Output filter
- Fan belt
- Hoses
- Filter towers
- Log book

Compressor startup sequence

- Condensate drains
- Drain valves opened
- All Gauges at zero
- Start compressor
- Clacking noise from 3rd stage
- Close drain valves
- Pressure maintaining valve (PMV)
- Safety valves goes off

Compressor shut sown sequence

- Open drain valves
- Gauges going down
- Turn off engine / motor

Compressor runinng tests

- RPM - Motor speed
- Vibration
- Condensate every x minutes
- Filter

Starting and running

Petrol engine

Petrol engine pre-startup checks

- Oil level
- Input filter
- Spark plug
- Petrol level

Petrol engine startup sequence

- Turn fuel ON
- Turn ignition ON
- Place choke on COLD START position
- Set throttle to 1/3 full speed
- Slowly pull starter cord to remove slack
- Sharply pull starter cord
- Set throttle to full speed
- Place choke on WARM/RUN position

Petrol engine switch off sequence

- Slowwly set throttle to minimum speed
- Turn fuel OFF until motor stop
- Turn ignition OFF

Sources

Sources

- url