

Beavertronics 5970 presents **Pneumatics**



Hello!

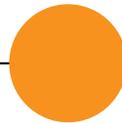


My name is Paige

My role on the team is Build Lead and I go to Mountainside High School.



Over the last 3 years on the team, I have been learning about pneumatics and how to use them from someone who is now graduated. Last year I set up the competition robot's pneumatic system, which worked with little to no issues. While I may not have been formerly trained, this is a pretty complete list of what I know.





What will be covered

What are pneumatics? Why do we use them?

- ◇ Why we use pneumatics
- ◇ Prototyping
- ◇ PSI
- ◇ Basic Safety

Important Components

- ◇ Compressor
- ◇ Emergency Bleeds/
pressure release valves
- ◇ Pistons 101
- ◇ Tanks
- ◇ Pressure Dials
- ◇ Solenoids
- ◇ Tubing + Fittings

How to assemble pneumatics

- ◇ The 4 Rules
- ◇ Where to plug stuff in
solenoids
- ◇ Finding Leaks



**Please ask questions
along the way!**

Let's get started



1

What are pneumatics?

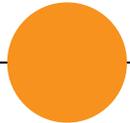
And why do we use them?



Pneumatics is a type of system that is run using pressurized air. Think of pneumatics like a circuit board, but instead of electricity, we're using air.



Pneumatics are a really easy way to get linear motion





Things we use pneumatics for

- ◇ Shifting gearboxes
- ◇ Manipulators
- ◇ Prototyping

We have had pneumatics on our robots for the last 3 years!





What is PSI?

Stands for Pounds of force per Square Inch

So the more PSI in a system, the more force the system will spit out.

Important to know what PSI to use when!





Safety

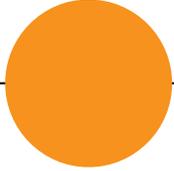
Dos

- ◇ Safety Glasses
- ◇ Emergency Bleed Valves
- ◇ Properly fastening components to robot
- ◇ Double checking connections before enabling robot
- ◇ Face away from robot when bleeding air

Don'ts

- ◇ Unplugging something while there is still pressure (I've done this)
- ◇ Kinking a tube
- ◇ Mishandling components
- ◇ Yanking tubing out of a component
- ◇ More than 125 PSI
- ◇ Touching the compressor after it's been turned on (I've done this as well)





Pneumatics are a GREAT way to prototype

To do this effectively, we set up a small, broken down version of a pneumatics system. This allows us to basically plug and play components and has let us make some really cool prototypes. We call it the “bomb box.”

PLEASE DO NOT USE THE BOX UNLESS YOU KNOW WHAT YOU ARE DOING. We can help you with it!



2

Important Components





Important Components

Compressor

The thing that compresses the air. Makes a very loud buzzing sound when turned on. Gets hot quickly



Pressure Tanks

Where the air is stored after it is compressed. Easiest thing to break, be very gentle with fittings!



Dials

Where you see the PSI in the system. There should always be 2 dials, 1 reading around 80 - 120 PSI, and 1 at 60 PSI





Important Components

Pressure Release Valve

Manual valve to let go of all the pressure when the robot is turned off. You need to know where this is!



Solenoid (electric)

Electronically switches back and forth so we can control pistons. Also comes in a brick.



Solenoid (manual)

Basically like an electronic switch. Almost always used for prototyping





Important Components

Emergency Bleeds

If the pressure ever gets over 120 PSI, the emergency bleed will let out air. Needs to be manually set



Flow control Valves

Controls how fast the air flows through, but keeps the same PSI



Pressure Regulator

Only lets a certain amount of PSI through. Needs to be manually set.





Important Components

Pressure Switch

Turns off the compressor when it reaches the right PSI



Fittings

The things that connect the components to the tubing OR tubing to tubing. Has quick release



Tubing

Basically a wire in the pneumatics world. Moves air from one component to the next





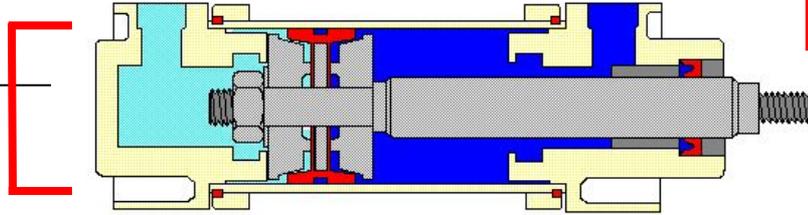
Important components

Pistons

The only thing that should be moving when you turn on pneumatics. Every time the piston is actuated a little bit of air is lost.



Diameter =
the "bore"



Distance
moved =
the "stroke"

Pistons

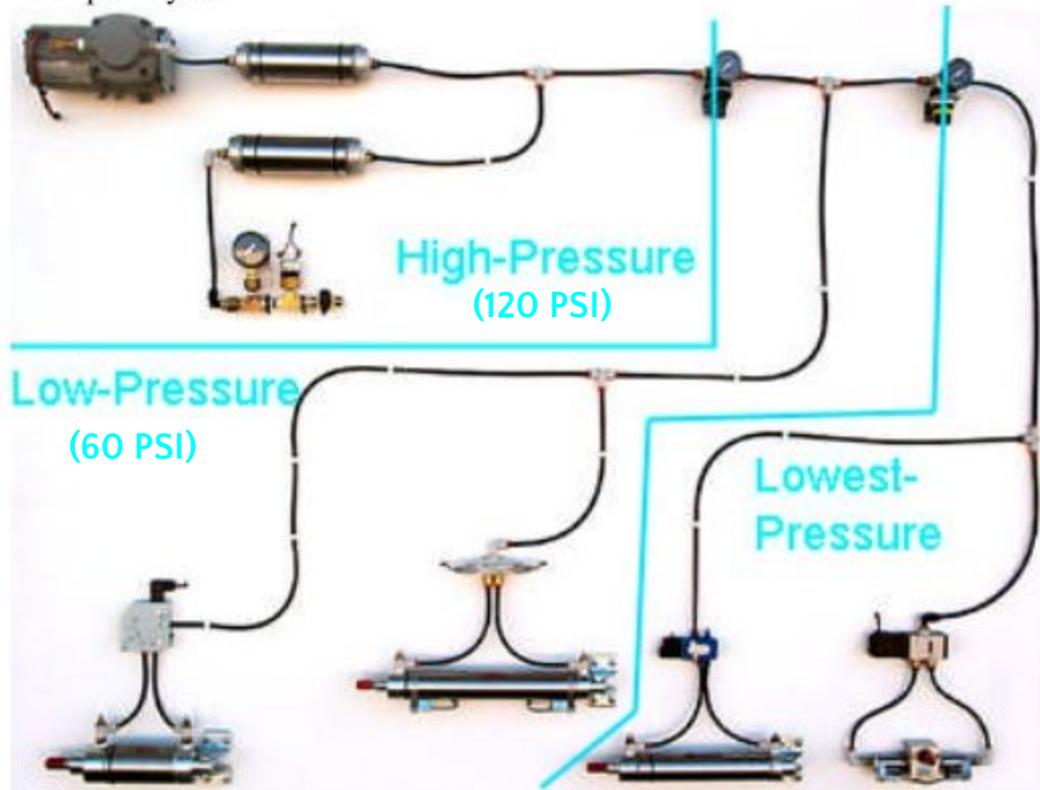
Used for linear motions (usually)



3

Assembling Pneumatics







Follow the rules and you'll do great!

RULE 1

**Always cut
tubing
correctly (and
not with
scissors)**

RULE 2

**Never EVER
yank a tube
out**

RULE 3

**Always
hand
tighten
fittings**

RULE 4

**Never use
duct tape
to secure
anything**





RULE 1 - cutting tubing

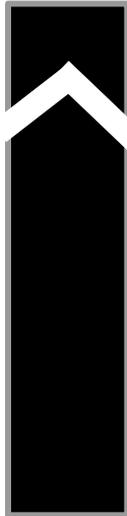
BAD



BAD



BAD



GOOD



If it's
not
square
it
leaks!!





RULE 2 - NEVER yank a tube

You WILL break something if you yank on anything



Kind of boring
to listen to
entire thing.
Skip to 1:20,
end at 2:00

Video is
technically not on
pneumatics but
whatever it still
teaches what you
need to know





RULE 3 - hand tighten fittings



First you gotta add this stuff

It's called teflon tape

Wrap 1 layer on threads
COUNTERCLOCKWISE





RULE 3 - hand tighten fittings



Has a specific spot where it can be tightened with a wrench

If you tighten it to much, it makes it really difficult to remove later. If you tighten it too little, it will leak air.





RULE 4 - No duct tape

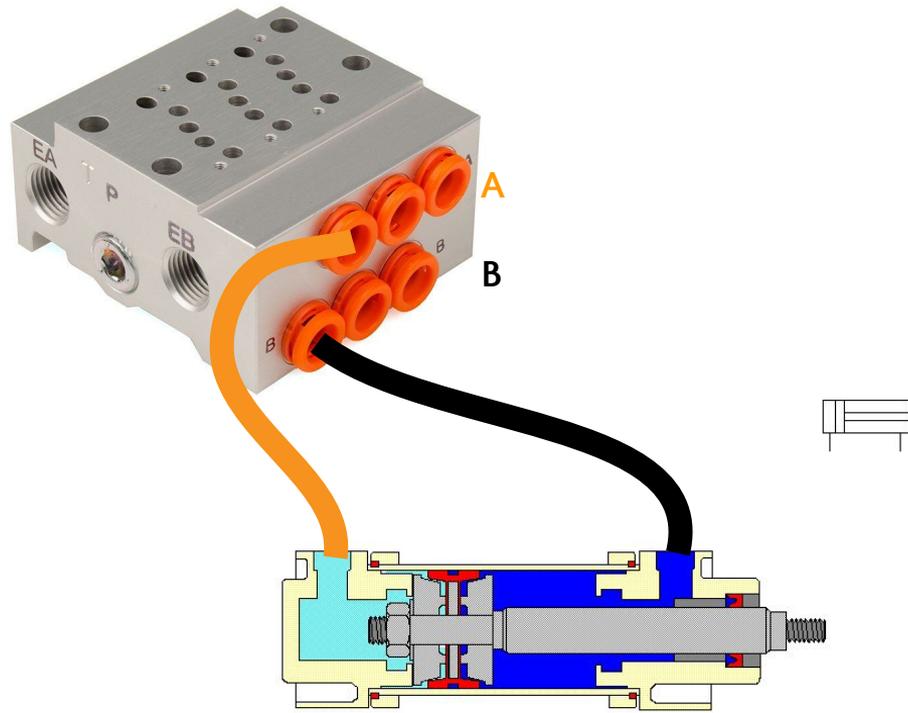


Against FRC regulations to use duct tape on any pneumatic system, so we use (a lot of) zip ties and bolts to hold things down.



Not to scale :)

Side note -
the orange
tubing is
more flexible
than the black
tubing



If you do not fill
your entire
solenoid block,
plug the rest of
the openings
with one of
these things



PLUGGING INTO A SOLENOID





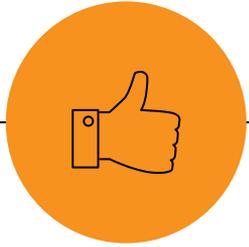
Inevitably, stuff will leak

If the pressure dials are dropping in PSI even though nothing is being actuated, you have a leak.

However, we can fix this!

If the leak is not immediately obvious, **get a little bit of soapy water and lightly coat fittings and connections points.** You'll know where the leak is once you start seeing bubbles. Most likely you just need to tighten a fitting more or trim the end of a tube.





**That's all
folks!**

Any questions ?

