This is an introduction to the real-world of pneumatic control and power transmission.

Learn the full scope of compressed air production, preparation and distribution. Learn to apply simple gas laws and to read appropriate symbols to understand component technologies.

Improve your ability to install, maintain and troubleshoot pneumatic automation systems.

**CLASS FORMAT:**
Lab + classroom
The participant is able to “learn-by-doing” in the course; this knowledge can be transferred to the workplace.

**STANDARD CLASS SIZE:**
NTT recommends a class of no more than 12 participants for the best results

**NTT PROVIDES:**
- 3-days (24 contact hours) of on-site instruction
- Textbooks and lab manuals
- Classroom consumables
- Completion certificates
- Shipping and instructor travel logistics

**CLIENT PROVIDES:**
- Classroom, with easy access, of 750 square feet or greater
- Projection screen, white board and/or flip charts
- A dock facility or a forklift to unload the training equipment
- A pallet jack to move the crates around after they have been unloaded may also be needed
- Please place this equipment in the training room for the NTT instructor to test and setup prior to the start of class

**SHIPPING**
2 crates at 2,000 pounds
- 2 crates at 49” x 35” x 76”
- 2 sets of equipment
- 4 trainers

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**PNEUMATIC PRINCIPLES**
- Pneumatic power systems
- Force, weight and mass
- Pressure
- Standard air and free air
- Work and energy
- Diffusion and dispersion
- Separation of gases and liquids
- Pneumatic Laws: Pascal’s Law, Boyle’s Law, Charles’ Law
- Transmission of pneumatic fluid power
- Pneumatic leverage
- Flow measurements
- Air flow in pipes
- Air viscosity
- Bernoulli’s Principle
- Pneumatic Power System
- Air versus Electricity
- Air versus Hydraulics

**AIR COMPRESSORS**
- Reciprocating piston compressors
- Compressor construction
- Horsepower cooling
- Compressor lubrication
- Non-lubricated compressors
- Compressor control
- Rotary compressors
- Compressor classification
- Vane compressors
- Rotary screw compressors
- Liquid ring compressor
- Low-pressure, high-volume compressors
- Dynamic compressors
- Compressor selection
PNEUMATIC SYSTEMS AND PRINCIPLES

COURSE AGENDA, continued

AIR COMPRESSORS, CONTINUED
• Total air requirements
• Compressor load
• Initial installed cost
• Power cost
• Reliability
• Capacity control
• Driver

AFTER COOLERS AND AIR DRYERS
• After cooler: over compression and refrigeration
• Absorption
• Absorption dryers
• Flow capacity
• Installation and maintenance
• Water content in compressed air systems

PNEUMATIC PIPING SYSTEMS
• Functions of different piping systems
• Dead end or grid
• Pipe size
• Unit or decentralized
• Loop
  - Pneumatic piping systems
  - Equivalent pipe lengths of valves and bends

PNEUMATIC ACTUATORS
• Pneumatic, linear and rotary actuators
• Air motors
• Single acting cylinder
• Directional control valves
• Cylinder mounting methods
• Fixed centerline mountings
• Fixed non-centerline mountings
• Pivoted centerline mountings

ACTING CYLINDER: 4-WAY VALVE
• Double acting cylinder
• Force
• 4-way, 5-ported directional control valve

PILOT OPERATED INDIRECT CONTROL
• Remote control by pilot operation
• Air pilot operated 3-way valve, spring return

MEMORY CONTROLS
• Double air pilot, 4-way valve

AUTOMATIC CYLINDER RETURN VALVE: LOGIC “OR” GATE

TWO PRESSURE VALVE: LOGIC “AND” GATE
• “AND” Function—directional valves in series

FLOW CONTROL
• Flow control valves
• Elbow type flow regulators
• Speed control

QUICK EXHAUST

COMPRESSED-AIR-DRIVEN VACUUM PUMPS
• Venturi principle
• Compressed-air-driven vacuum pumps
• Evaluating vacuum pump performance
  - Vacuum level
  - Air removal rate
  - Fluid power horsepower
  - Drive power requirements
  - Drive speeds
  - Effects of temperature rise

• Vacuum pump selection
  - Vacuum level factors
  - Maximum vacuum rating
  - System control factors
  - Temperature factors
  - Other selection factors

• Factors
  - Open capacity rating
  - Pump-down rate
  - Other vacuum pump sizing factors
  - Drive power selection
  - Motor-mounted pumps
  - Separate-drive mechanical vacuum pumps

TIME DELAY
• Pneumatic time delay
• Pneumatic timer

PRESSURE REGULATORS

SEQUENCE VALVE

PNEUMATICS LAB EXERCISES
• 3-way directional control valve
  manually operated
• Operating principle of a manually operated 4-way valve, 5-ported spring return
• Air pilot operated 4-way valve, 5-ported, spring return
• Operating principle of a double air pilot 4-way valve
• Limit switches
• Shuttle valves
• “AND” function with 3-way valve
• Meter-in speed control/meter-out speed control
• Quick exhaust valves
• Alternately for “off-delay”
• Application and function
• Pressure sensing/sequence pressure sensing circuit