Pneumatic Control Schematics

• **Applications shown in the document are:** Lift axle circuits, suspension dump circuits and tailgate control circuits for single acting air cylinders. (Air to open spring to close) Single acting air cylinders require what is known as a 3 way valve function. Because Velvac valves are multi-purpose we can also control double acting air cylinders (air to open air to close) if required using the same valve but as a 4 way function.

• **Solenoid or “Electric Over Air” Valves:** Many of the circuits shown here use solenoid operated valves as well as air pilot operated valves and a few manual valve control circuits.

• **Remote Manual Operation (on the trailer):** The circuits shown here all are drawn with the ability to control the valve from inside the cab with an electrical “flip switch” or the operator can also control the axle, suspension or tailgate from outside the cab with a manual valve. The manual valve can be either a separate Push-Pull style valve or, can also be a 3 way function manual valve mounted right to the power valve we have both options.

• **The “12” Flow Condition:** All valves shown in this document are known as “12” flow condition valves. This means that when the valve is used as a single pressure supply valve and the solenoid is not energized and air will flow from port #1 to port #2 and air will exhaust from port #4 to port #5. When the solenoid is energized the valve shifts and supply air flows from port #1 to port #4 and exhausts from port #2 to port #3.
Pneumatic Control Schematics

- **Dual Pressure Applications - Lift Axle Control**: All 5 ported valves offered by Velvac Inc, and shown in this document are capable of being used as dual pressure valves for lift axle control applications.

- **Dual Pressure Function**: Air is supplied to ports #3 and port #5 and port #1 becomes a common exhaust port. When the solenoid is not energized air will flow from port #5 to port #4 and air will exhaust from port #2 to port #1. When the solenoid is energized the valve shifts and supply air flows from port #3 to port #2 and exhausts from port #4 to port #1.

- **Three Basic Plumbing Layouts For Dual Pressure Lift Axle Control:**
  - **1. Dual Pressure supply with a Leveling Valve (or Height Control Valve - HCV)** supplying the reduced pressure for down bags. The valve is plumbed as a dual pressure supply valve. Reduced air pressure is supplied to port #3 from the Leveling Valve (LV) or HCV and port #5 is supplied with full line pressure port #1 becomes a common exhaust port. When the solenoid is not energized high pressure air will flow from port #5 to port #4 and fill the lift bags and air will exhaust from port #2 to port #1. When the solenoid is energized the valve shifts and supply reduced air pressure from the Leveling Valve flows from port #3 to the down bags at port #2 and exhausts from port #4 to port #1. (See Slide #4 & #5)
  - **2. Dual Pressure with Regulator supplying the reduced pressure** for down bags. The valve is plumbed as a dual pressure supply valve. Reduced air pressure is supplied to port #3 from a pressure regulator and port #5 is supplied with full line pressure port #1 becomes a common exhaust port. When the solenoid is not energized high pressure air will flow from port #5 to port #4 and fill the lift bags and air will exhaust from port #2 to port #1. When the solenoid is energized the valve shifts and supply reduced air pressure from the regulator flows from port #3 to the down bags at port #2 and exhausts from port #4 to port #1. (See Slide #6 & #7)
3. Single full line pressure supplied to the valve at port #1 down bag pressure reduced “after” the valve. Full line pressure is supplied to the “up or lift bags” straight through the valve. Reduced pressure is supplied to the “down bags” by placing a pressure regulator (pressure reducing valve) in the air lines connected to the “down bags” after the lift axle control valve (also known as power valve). The regulator must have what is known as “full flow in reverse capability” or it can cause sluggish or inconsistent operation. (See Slide #10 & #11)

There are many additional ways to plumb control circuits for lift axle control but the three methods listed above are the most commonly used.

You Must Always Externally Pilot All Dual Pressure Supplied Valves: All solenoid valves that are used in the dual pressure supply mode must be supplied with at least 75 PSI to the 1/8” external pilot port located on the bottom of the solenoid operator. This is usually done by using a Tee fitting tied into a high pressure supply line from an air tank.

You have the option of externally piloting any solenoid valve from Velvac but it is only required if the internal pilot supply is not a high enough pressure for proper operation (65-75 PSIG) or an internal pilot supply cannot be communicated to the solenoid operator because the #1 port is not being used as the supply port; this is the case when valves are used as dual pressure supply valves.
Axle Lift - Dual Pressure w/ leveling valve

#320148
Brass adapter allows full line pressure to shift valve manually (install finger tight & seal w/ Loc-Tite #222 or 242)

#320129
3 Way push-pull valve provides full line pressure from air tank to brass adapter to shift valve.

#320185
4-Way solenoid spring return valve with 1/8” external pilot dual pressure application shown in the de-energized condition. When energized the valve will shift it’s flow paths and lower the axle.

Air Tank

HVC or Leveling valve (LV)
The same reduced pressure supplied to lift axle down bags & the primary suspension

Port #1
Common exhaust

Port #2
Normally closed flow connected to “down bags” Deflated

Port #4
Normally open flow connected to “up bags” Inflated

Port #5 & 1/8” external pilot port
Full line pressure from air tanks to up bags

Port #3
Reduced pressure supply from regulator to down bags
#320189
4-Way solenoid spring return air operated manual override dual pressure application **shown in the de-energized condition.**
When energized the valve will shift it’s flow paths and lower the axle.

Manual override knob detented air pressure shifts the valve (electric on = axle down)

**Axle Lift - Dual pressure w/ leveling valve**
Axle Lift - Dual pressure w/ regulator

#320148
Brass adapter allows full line pressure to shift valve manually (install finger tight & seal w/ Loc-Tite #222 or 242)

#320129
3 Way push-pull valve provides full line pressure from air tank to brass adapter to shift valve

#320185
4-way solenoid spring return with 1/8” external pilot in a dual pressure application shown in the de-energized condition. When energized the valve will shift it’s flow paths and lower the axle.

Port #2
Normally closed flow connected to “down bags” - Deflated

Port #4
Normally open flow connected to “up bags” - Inflated

Port #3
Reduced pressure supply from regulator to down Bags

Port #1
Common exhaust

Port #5 & /8”
External pilot port
Full Line pressure from air tanks to up bags

Air Tank

Air regulator with gauge

#320149
Axle Lift - Dual pressure w/ regulator

#320189
4-Way solenoid spring return air operated manual override dual pressure application shown in the de-energized condition. When energized the valve will shift it’s flow paths and lower the axle. Dual Pressure Axle Lift - HCV

Manual override knob detented air pressure shifts the valve (electric on = axle down)

Air Tank
#320149 Air regulator with Gauge

Port #1 Common exhaust
Port #3 Reduced pressure supply from regulator to down bags
Port #4 Normally open flow connected to “up bags” - Inflated
Port #5 & 1/8” external pilot port - Full line pressure from air tanks to up bags
Axle Lift - Internally piloted w/ regulator after power valve (electric on = axle down)

Port #1
Full line pressure supply

Port #2
Normally open flow connected to “up bags” - Inflated

Port #3 & #5
Exhaust ports from air bags

Port #4
Reduced pressure supply through regulator to axle down bags

Port #4
Normally closed flow connected to “down bags” - Deflated

#320186
4-Way solenoid spring return air operated manual internal override dual pressure application shown in the de-energized condition. When energized the valve will shift its flow paths and lower the axle.

Manual override knob detented air pressure shifts the valve (electric on = axle down)

Air Tank

#320149
Air regulator with gauge

VELVAC #320186

#320149
Internal Pilot 1/8”
Axle Lift - Internally piloted w/ regulator after power valve (electric on = axle down)

Port #2
Normally open flow connected to “up Bags”- Inflated

Port #4
Reduced pressure supply through regulator to axle down bags

#320148
Brass adapter allows full line pressure to shift valve manually (install finger tight & seal w/ LocTite #222 or 242)

Port #1
Full line pressure supply

Port #3 & #5
Exhaust ports from air bags

#320129
3 Way push-pull valve provides full line pressure from air tank to brass adapter to shift valve

#320149
Air regulator with gauge

Port #4
Normally closed flow connected to “down bags” Deflated

#320181
4-Way solenoid spring return air operated manual internal override dual pressure application shown in the de-energized condition. When energized the valve will shift it’s flow paths and lower the axle.

VELVAC #320181
Axle Lift – Dual pressure internally piloted
(electric on = axle down)

Port #1
Inactive port can be plugged.

Port #2
3 Way normally open flow pattern connected to “primary suspension bags” - Inflated.

Port #4
Plugged with 3/8” pipe plug

Port #3
Exhaust port

Port #5
Full line pressure from air tanks to suspension bags

#320148
Brass adapter allows full line pressure to shift valve manually (install finger tight & seal w/ LocTite #222 or 242

#320129
3 Way push-pull valve provides full line pressure from air tank to brass adapter to shift valve

#320181
4-Way solenoid spring return air operated manual internal override dual pressure application shown in the de-energized condition. When energized the valve will shift it’s flow paths and lower the axle.

Air Tank

Full line pressure from air tanks to suspension bags
Axle Lift – Air piloted operated w/ leveling valve

- **Port #1**: Full line pressure from air tanks to up bags
- **Port #2**: Normally closed flow connected to “down bags” - Deflated
- **Port #3**: Reduced pressure supply from regulator to down bags
- **Port #4**: Normally open flow connected to “up bags” - Inflated
- **Port #5**: Common Exhaust

**#320129**
- 3 Way push-pull valve provides full line pressure from air tank to pilot to shift valve

**#320183**
- Dual pressure application shown in the de-energized condition.
  - When energized the valve will shift its flow paths and lower the axle.

**HVC or Leveling valve**
- The same reduced pressure supplied to lift axle down bags & the primary suspension

**VELVAC #320183**

When energized the valve will shift its flow paths and lower the axle.
Axle Lift - Air pilot operated w/ regulator (air on = Axle down)

#320129
3 Way push-pull valve provides full line pressure from air tank to pilot to shift valve.

#320183
Dual pressure application shown in the de-energized condition. When energized the valve will shift it’s flow paths and lower the axle.

#320149
Air regulator with gauge

Port #1
Common exhaust

Port #2
Normally closed flow connected to “down bags” Deflated

Port #3
Reduced pressure supply from regulator to down bags

Port #4
Normally open flow connected to “up bags”- Inflated

Port #5
Full line pressure from air tanks to up bags

VELVAC #320183

Air Tank

Port #2
Common exhaust

Port #3
Reduced pressure supply from regulator to down bags

Port #4
Normally open flow connected to “up bags”- Inflated

Port #5
Full line pressure from air tanks to up bags

Axle Lift - Air pilot operated w/ regulator (air on = Axle down)
Axle Lift - Air pilot operated w/ regulator after power valve (air on = axle down)
Port #1
Full line pressure supply

Port #2
Normally open flow connected to “up bags”- Inflated

Port #3 & #5
Exhaust ports from air bags

Port #4
Reduced Pressure supply through regulator to axle down bags

#320129
3 Way push-pull valve provides full line pressure from air tank to brass adapter to shift valve

Dual pressure application shown in the de-energized condition. When energized the valve will shift it’s flow paths and lower the axle.

#320182
3 Way push-pull valve

#320149
Air regulator with gauge

Axle Lift - Air pilot operated w/ regulator after power valve (air on = axle down)

Velvac #320182

Port #1
Full line pressure supply

Port #4
Normally closed flow connected to “down Bags” Deflated

Air Tank
Axle Lift - Air pilot operated

Port #1
- Common
- Exhaust

Port #2
- Normally closed flow
- Connected to “down bags” - Deflated

Port #3
- Reduced pressure supply from regulator to down bags

Port #4
- Normally open flow
- Connected to “up bags” - Inflated

Port #5
- Full line pressure
- From air tanks to up bags

HVC or Leveling valve (LV)
- The same reduced Pressure supplied to lift axle down bags
- & the primary suspension

#320129
- 3 Way push-pull valve provides full line pressure
- From air tank to brass adapter to shift valve

#320134
- 4 Way solenoid valve provides full line pressure from air tanks
- To pilot port shifts valve.
- Electric On = Axle Up

#320182
- Dual pressure application shown in the deenergized condition.
- When energized the valve will shift it’s flow paths and lower the axle.

#320134
- 4 Way solenoid valve provides full line pressure from air tanks
- To pilot port shifts valve.
- Electric On = Axle Up

#320182
- Dual pressure application shown in the deenergized condition.
- When energized the valve will shift it’s flow paths and lower the axle.

Air Tank

Port #2 & #3 plugged

2 Way check valve

Port #1
- Common exhaust

Port #3
- Reduced pressure supply from regulator to down bags

Port #4 & #5
- Full line pressure from air tanks to up bags

Electric On = Axle Up

Dual pressure application shown in the deenergized condition. When energized the valve will shift it’s flow paths and lower the axle.

In

Out

2 Way check valve

2 Way check valve

In

Out

In

LV

In

OUT

LV

In

Out

In

Out

In

Out

In

Out

In

Out

In

Out

In

Out

In

Out

In

Out

In

Out

In

Out

In

Out

In

Out

In

Out

In

Out

In

Out

In

Out
Axle Lift - Air pilot operated
(air on = axle down)

#320129
3 Way push-pull valve provides full line pressure from air tank to check valve to shift valve.

#320134
4 Way Solenoid valve provides full line pressure from air tanks to pilot port shifts valve. Electric On = Axle Up

#320149
Air regulator with gauge

Port #2
Normally closed flow connected to “down bags” Deflated

Port #4
Normally open flow connected to “up bags” Inflated

#320182
Dual pressure application shown in the de-energized condition. When energized the valve will shift its flow paths and lower the axle.

Port #1
Common exhaust

Port #3
Reduced pressure supply from regulator to down bags

Port #5
Full line pressure from air tanks to up bags
Port #3
Exhaust port from air bags

Port #2
3 Way flow pattern connected to “primary suspension bags” inflated.

Port #1
Full line pressure from air tanks to suspension bags

#320184
Remote operation manual valve
2 way push-pull valve provides leveling valve pressure from air tanks to suspension.
(Shown w/ Knob Pushed In)
Pull to Exhaust – Push to Inflate

VELVAC #320184

HVC or Leveling valve (LV)
The same reduced pressure supplied to the primary suspension

Air Tank

Primary Suspension Dump

IN OUT
LV

1/4” NPT pilot reset port not used

Port #3
Exhaust port from air bags

17
Port #2
3 Way flow pattern connected to “primary suspension bags” inflated.

#320184
Remote operation manual valve 2 way push-pull valve provides leveling valve pressure from air tanks to suspension.
(Shown w/ Knob Pushed In)
Pull to Inflate – Push to Exhaust

Air Tank

Primary Suspension Dump

HVC or Leveling valve (LV)
The same reduced pressure supplied to the primary suspension

1/4” NPT pilot reset port
(Shown w/ Knob Pulled Out)

Port #3
Full line pressure from air tanks to suspension bags

Port #1
Exhaust port from air bags
Port #1
Full line pressure from air tanks to suspension bags

Port #2
3 Way normally open flow pattern connected to “primary suspension bags” inflated.

Port #3
Exhaust port from air bags.

Port #4
Plugged with 3/8” pipe plug

Port #5
Inactive port can be plugged.

Air Tank

#320182
4 Way normally open application shown in the deenergized condition. When energized the valve will exhaust air from the bags.

#320129
3 Way push-pull valve provides full line pressure from air tank to brass adapter to shift valve.

Air Piloted Primary Suspension Dump
Air Piloted Primary Suspension Dump

**Port #2**
3 Way normally open flow pattern connected to “primary suspension bags” Inflated.

**Port #4**
Plugged with 3/8” pipe plug

**Port #5**
Inactive port can be plugged.

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**#320129**
3 Way push-pull valve provides full line pressure from air tank to pilot to shift valve

**#320183**
3 Way normally open application shown in the deenergized condition. When energized the valve will exhaust air from the bags.

Air Tank

**Port #3**
Exhaust port from air bags

**Port #1**
Full line pressure from air tanks to suspension bags

**VELVAC #320183**
Port #1
Full line pressure from air tanks to suspension bags

Port #2
3 Way normally open flow pattern connected to “primary suspension bags” Inflated.

Port #3
Plugged with 3/8” pipe plug

Port #4

Port #5
Inactive port can be plugged

#320134
4 Way solenoid valve provides full line pressure from air tanks to pilot port shifts valve.

Electric On = Axle Up

#320182
4 Way normally open application shown in the de-energized condition. When energized the valve will exhaust air from the bags.

VELVAC #320182

Port #1
Full line pressure from air tanks to suspension bags

Port #3
Exhaust port from air bags

Port #5
Inactive port can be plugged

Air Tank

Air Piloted Primary Suspension Dump
Port #3
Exhaust Port from air bags

Port #2
3 Way normally open flow pattern connected to “primary suspension bags” Inflated.

Port #4
Plugged with 3/8” pipe plug

Port #5 - Inactive Port can be plugged.

Port #1 - Full Line Pressure from air tanks to suspension bags

Air Tank

Air Piloted Primary Suspension Dump

#320134
4 Way solenoid valve provides full line pressure from air tanks to pilot port shifts valve.
Electric On = Axle Up

#320182
4 Way normally open application shown in the deenergized condition. When energized the valve will exhaust air from the bags.

VELVAC #320182
Air tailgate cylinder
Internally piloted
Single acting cylinder

Port #1
Full line pressure from air tanks to air cylinder

Port #3
Inactive Port can be plugged.

Internal Pilot 1/8"

Port #4
Plugged with 3/8” pipe plug

Port #5
Exhausts air from air cylinder port

Port #4
3 Way normally closed flow pattern connected to air cylinder retracted = gate closed.

#320148
Brass adapter allows full line pressure to shift valve manually (install finger tight & seal w/ LocTite #222 or 242

#320129
3 Way push-pull valve provides full line pressure from air tank to brass adapter to shift valve

#320181
4-Way solenoid spring return air operated manual internal override dual pressure application shown in the de-energized condition. When energized the valve will supply air to the cylinder & open or unlatch the tailgate.

Air Tank
Air tailgate cylinder
Single acting cylinder

Port #1
Full line pressure from air tanks to air cylinder

Port #3
Exhausts air from air cylinder port

#32184
2 Way push pull air piloted reset valve

Air Tank

VELVAC #320184
**Air tailgate cylinder**

**Internally piloted**

**Double acting cylinder**

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#320148
Brass adapter allows full line pressure to shift valve manually (install finger tight & seal w/ LocTite #222 or 242)

#320129
3 Way push-pull valve provides full line pressure from air tank to brass adapter to shift valve

#320181
4-Way solenoid spring return air operated manual internal override dual pressure application **shown in the de-energized condition**. When energized the valve will supply air to the cylinder & open or unlatch the tailgate.

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**Port #1**
Full line pressure from air tanks to air cylinder

**Port #2**
Flowing air

**Port #3**
Inactive port can be plugged.

**Port #4**
3 Way normally closed flow pattern connected to “tailgate cylinder” retracted = gate closed.

**Port #5**
Exhausts air from air cylinder port

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VELVAC #320181