



ANNUGAS PRODUCTION ENHANCER® OPERATIONS AND MAINTENANCE MANUAL

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ANNUGAS PRODUCTION ENHANCER® OPERATIONS AND MAINTENANCE MANUAL

The Annugas Production Enhancer® is an engineered Walking Beam Compressor for mounting to the pumping unit of an oil well. As such, only Annugas Compression Consulting Ltd. Service Technicians are trained and qualified to service this equipment.

Modifying parts, not using the proper bolts, nuts, and washers, and unauthorized service will void your warranty and may cause equipment damage and/or personal injury.

Maximum working pressures are:

- AG600 series: 400 psi
- AG800 series: 225 psi
- AG1000 series: 135 psi
- Fuel Gas Scrubber: 600 psi

The working pressures for the AG600, AG800, and AG1000 series compressors are determined so that the forces generated by the piston rod of the compressor are limited. Excessive piston rod loads can cause damage to the pumping unit, including but not limited to the walking beam, bearings and gear box.

If the compressor is not required in the field, it should be removed and examined by an Annugas Compression Consulting Ltd. Service Technician. Afterwards, it should be stored in a dry location.

Recommended Components

- Pressure Regulator; a pressure regulator can be used to prevent the casing from going into a vacuum or to prevent excessive rod load which can cause damage to the pumping unit, compressor, or both,
- Fuel Gas Scrubber; a fuel gas scrubber can be used to separate fluids from the gas and prevent fluids from getting into the compressor,
- High Level Shutdown; a high level shutdown sensor is installed on the fuel gas scrubber and used to shut down the pumping unit and compressor before fluids can enter the compressor.

What Not To Do

- Do not leave the suction valve open when the pumping unit is shut down. Well pressure can build up and flow gas and liquids through the compressor,
- Do not lengthen the stroke of the pumping unit, increase pressure relief valve settings, or modify the installation without calling Annugas Compression Consulting Ltd.,
- Do not oil or grease any bearings or the piston rod,
- Do not heat trace or insulate the compressor cylinder,
- Do not remove the compressor by taking the cross pins out of the top or bottom bearing or clevis.



Operation of Annugas Production Enhancer®

Normal Operations

For normal operations, the gas flow and valve positions on a typical installation with a regulator are shown in Figure 1. The gas will flow through the fuel gas scrubber to the compressor and then to the production flow line as below:

1. From the casing through the suction line,
2. Into the fuel gas scrubber manifold piping,
3. Into the fuel gas scrubber,
4. Out of the fuel gas scrubber to the suction of the compressor,
5. Out of the compressor discharge to the fuel gas scrubber manifold,
6. Out of the fuel gas scrubber manifold to the discharge line,
7. From the discharge line into the production flow line.
8. The first valve coming off the fuel gas scrubber on the drain line is to remain open to allow fluids to flow back to the wellhead.

Pressure Regulated Bypass

When the compressor flow rate is larger than the gas production of the well, the compressor will draw the casing into a vacuum. In this case, the pressure regulator will open and allow gas from the discharge lines to enter the suction lines of the compressor to make up for any gas shortage. This will keep the compressor from drawing the casing into a vacuum.

To verify that the pressure regulator is functioning as required, close the valve from the suction line to the casing. With the compressor operating normally, the pressure gauge on the suction line at the wellhead will show the pressure drop and hold at the set point of the regulator. The set point for the pressure regulator is set on installation based on well parameters and could vary from well to well.

Manually Bypass the Compressor

In order to manually bypass the compressor, refer to Figure 2 to show the valve position for the bypass valve. If the compressor is to be left running, leave the automatic drain line and the drain connection to wellhead valves open so that fluids will continue to drain.

It is important to remember that with the compressor in manual bypass; well gas, well oil, chemicals, and other well fluids can still get into the compressor. For chemical injections, circulating the well, and other interventions, the compressor must be isolated.

Isolating Compressor

In order to isolate the compressor from the wellhead refer to Figure 3 and follow the steps below:

1. Open the manual bypass valve on the fuel gas scrubber manifold piping,
2. Close the valve that connects the suction line to the casing and the valve connecting the discharge line to the production flow line.
3. Close the drain connection to wellhead valve to isolate the fuel gas scrubber.



4. The compressor can be left operating with the pumping unit running or the pumping unit can be shut down.

Without a Pressure Regulator

If there is no pressure regulator on the piping system for the Annugas Production Enhancer®, the typical normal operation of the valves is illustrated in Figure 4. To isolate the compressor with this system, follow the same procedures as outlined above in the *Manual Bypass* section.

Shutting the Pumping Unit Down

If the pumping unit is to be shut down for any reason, the following procedure is to be followed:

1. The pumping unit must be shut down so that the piston rod and piston are at bottom on the compressor. To clarify, the piston rod will have the least amount of rod showing above the packing. For example, on a conventional pumpjack with the compressor installed between the center (saddle or pivot) bearing and the equalizer (tail) bearing the pumpjack will be stopped so that the horses head is at the highest point. This is the point when the crank arm and the pitman arm are inline and not necessarily when the weights are at the lowest point.
2. Isolate the compressor using the procedure above for *Isolating Compressor*. Ensure that the drain connection to wellhead valve is closed.
3. With the manual bypass valve open and the drain connection to wellhead valve closed, slowly open the manual drain valve to bleed down the pressure and drain any fluids that might have accumulated and prevent any fluids from accumulating above or below the piston of the compressor.
4. If the compressor is to be shut down for long periods, it is strongly recommended that an Annugas Service Technician take down the compressor and prepare it for storage. This will limit the amount of corrosion from occurring.

This shut down position is critical when the ambient temperatures are below 5°C (40°F) as any fluids in the compressor could freeze. Failure to shut down the pumping unit in the recommended position could result in equipment damage and/or personal injury.

Starting up the Pumping Unit

When starting up the pumping unit after the unit has been shut down, the following procedure should be used:

1. Bump (quickly turn pumping unit motor on and off) pumping unit motor switch for the first couple turns of the crank arm. Use these cycles to watch the compressor to ensure that the compressor moves freely and is not binding.
2. Slowly open the suction line valve to allow the casing gas to fill the compressor, scrubber and all lines.
3. Slowly open the discharge line valve.
4. Open the drain connection to wellhead valve.
5. Turn on the pumping unit for normal operations.
6. Close the bypass valve and make sure that the compressor is working.
7. Once proper operation is confirmed, the valves on the scrubber manifold should be returned to normal operations as shown in Figure 1.



If the compressor appears to bind or jam or if there is unusual noises being generated by the compressor, the pumping unit should be shut down and Annugas should be called and an Annugas Service Technician should inspect the compressor and service the compressor if required.

Operations in Temperatures Below 5°C (40°F)

It is recommended that the piping manifolds on both the compressor and fuel gas scrubber be insulated and heat traced. Additional insulation and heat trace are recommended for the fuel gas scrubber, all hoses and/or piping between the compressor, fuel gas scrubber, and wellhead, and the drain line from the fuel gas scrubber to the wellhead. The compressor cylinder shall not be insulated so that additional heat generated by the compression of the gas is dissipated.

Methanol injection may also be required depending on temperature and well conditions. Generally all installations will have a methanol pot installation at the connection of the suction line to the wellhead and beside the pressure safety valve (PSV) on the fuel gas scrubber. The methanol pot is a series of swaged fitting and valves that will allow the operator to safely inject methanol into the system without being exposed to wellhead pressure or fluids.

Maintenance of Annugas Production Enhancer®

The Annugas Production Enhancer® is virtually maintenance free. Servicing by Annugas Compression Consulting Ltd. Service Technicians is strongly recommend at periods not exceeding twelve (12) month intervals. Please contact Annugas to arrange a service.

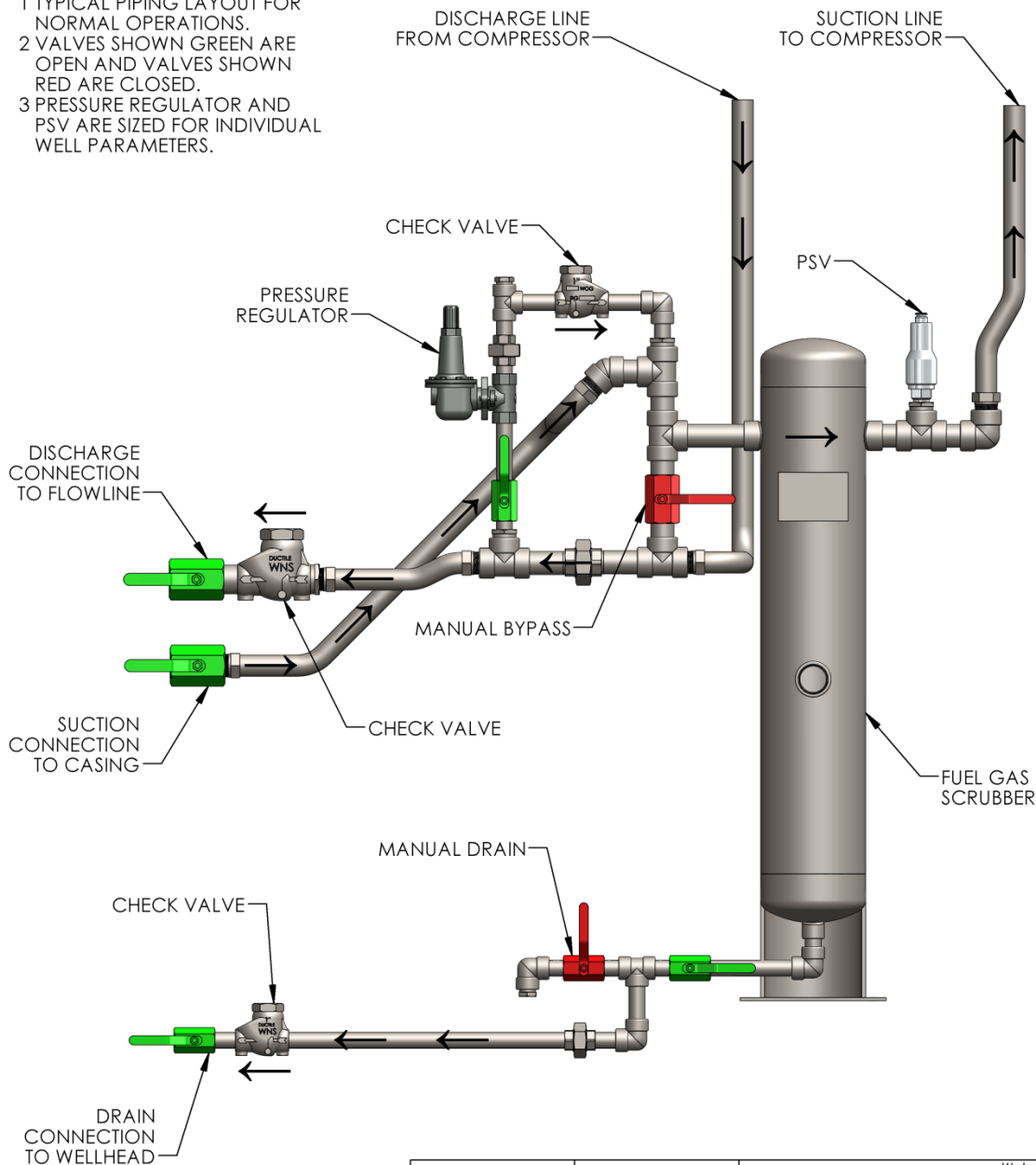
Items that should be checked by the well operators are:

- The pressure gauges at the wellhead for the suction and discharge pressures should be checked daily or at an interval not exceeding one (1) week. The suction pressure should be less than the discharge pressure if the compressor is still operating efficiently. The pressures will vary from well to well however the suction pressure should remain constant as long as the well characteristics has not changed.
- The manual drain valve should be checked daily to ensure that there is not buildup of fluids in the fuel gas scrubber. It is the responsibility of the well operator to ensure that this is performed in a safe and responsible manner.



NOTES:

- 1 TYPICAL PIPING LAYOUT FOR NORMAL OPERATIONS.
- 2 VALVES SHOWN GREEN ARE OPEN AND VALVES SHOWN RED ARE CLOSED.
- 3 PRESSURE REGULATOR AND PSV ARE SIZED FOR INDIVIDUAL WELL PARAMETERS.



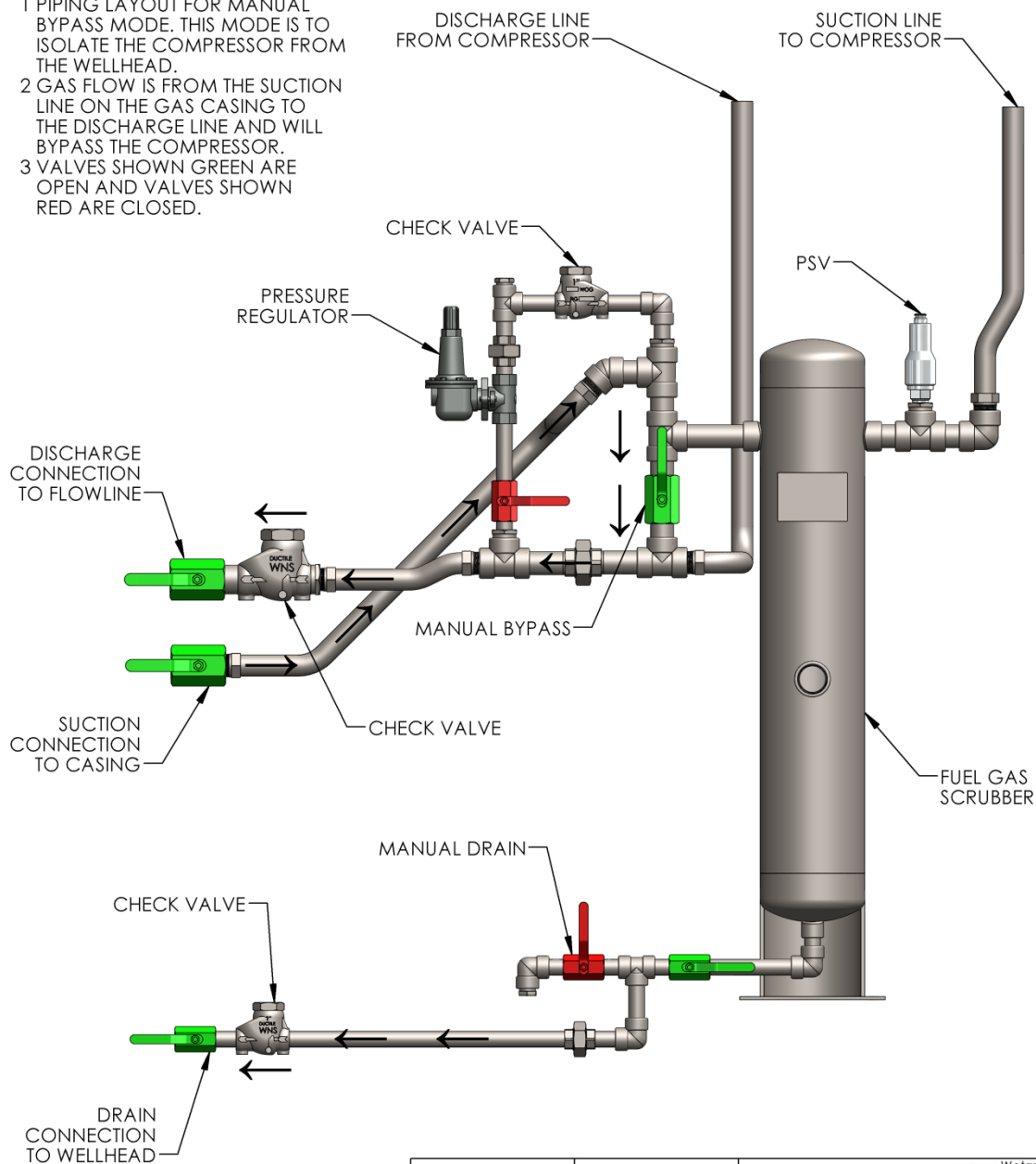
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Figure 1: Valve Positions in Typical Normal Operations



NOTES:

- 1 PIPING LAYOUT FOR MANUAL BYPASS MODE. THIS MODE IS TO ISOLATE THE COMPRESSOR FROM THE WELLHEAD.
- 2 GAS FLOW IS FROM THE SUCTION LINE ON THE GAS CASING TO THE DISCHARGE LINE AND WILL BYPASS THE COMPRESSOR.
- 3 VALVES SHOWN GREEN ARE OPEN AND VALVES SHOWN RED ARE CLOSED.




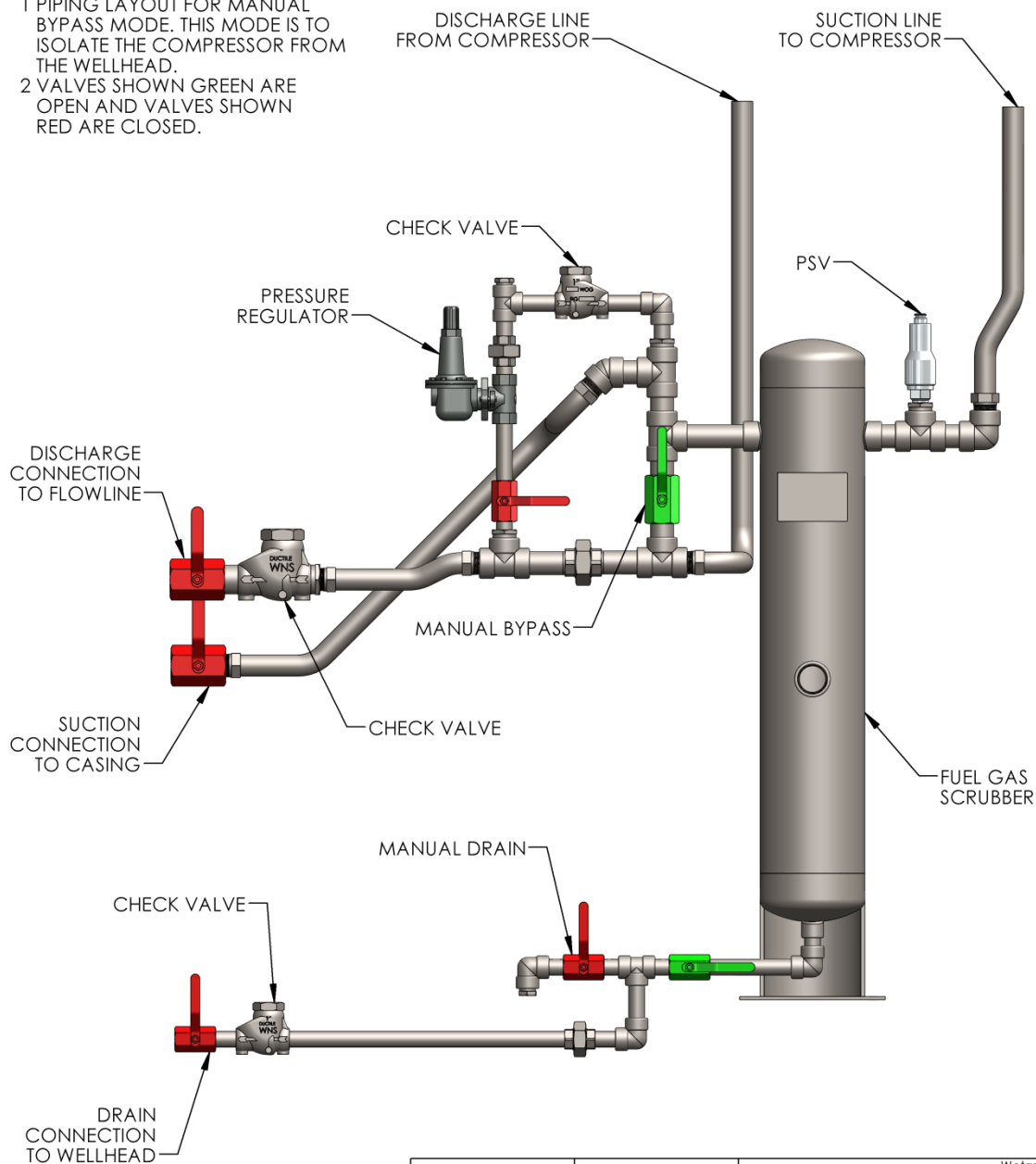
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Figure 2: Valve Positions in Manual Bypass Mode



NOTES:

- 1 PIPING LAYOUT FOR MANUAL BYPASS MODE. THIS MODE IS TO ISOLATE THE COMPRESSOR FROM THE WELLHEAD.
- 2 VALVES SHOWN GREEN ARE OPEN AND VALVES SHOWN RED ARE CLOSED.




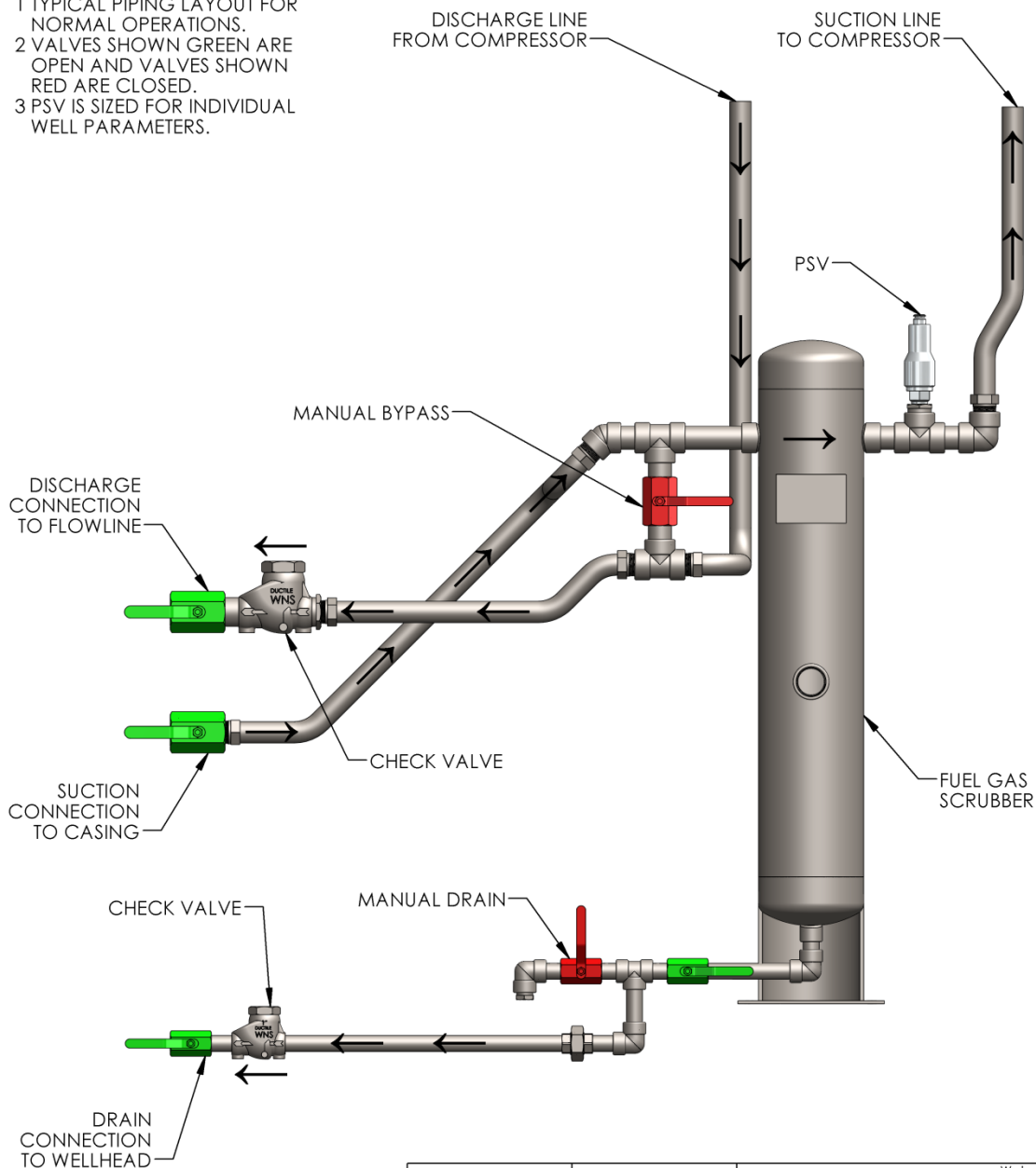
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Figure 3: Valve Positions to Isolate the Compressor



NOTES:

- 1 TYPICAL PIPING LAYOUT FOR NORMAL OPERATIONS.
- 2 VALVES SHOWN GREEN ARE OPEN AND VALVES SHOWN RED ARE CLOSED.
- 3 PSV IS SIZED FOR INDIVIDUAL WELL PARAMETERS.




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Figure 4: Valve Positions in Normal Operations without Pressure Regulator