A GUIDE TO UNDERSTANDING ISO SYMBOLS AND SCHEMATICS

Schematics

Troubleshooting made easier with schematics
SCHEMATICS

The mystery of them all

Being able to troubleshoot any system without actually being on site can only happen if you understand how to read a schematic. Many resist picking up the schematic because of their lack of understanding the language of the symbols.

By understanding the symbols and following the flow path of the schematic, success in determining a problem with your system becomes quicker and more rewarding. The ability to determine a point of entry for removal of components or installation of gauges and or flow meters becomes quicker.

By reading a schematic and following its flow path, there is a less likely chance of components being removed pre-maturely thus saving time and component costs.
Symbols are critical for technical communication. They are not dependent on any specific language, being international in scope and character. Hydraulic graphic symbols emphasize the function and methods of operation of the components. These symbols can be rather simple to draw, if the logic and elementary forms used in symbol design are understood.

The elementary forms of symbols are:

- Circles
- Squares
- Triangles
- Arcs
- Arrow
- Dots
- Crosses
READING A SCHEMATIC

Not for the faint of heart

A schematic is a compilation of interconnected graphic symbols, showing a sequence of operational flow. In short, they explain how a circuit functions. Correct schematic reading is the most important element of hydraulic troubleshooting. Although initially most circuits may appear complicated, recognizing standard symbols and systematic flow tracings simplifies the process.
READING A SCHEMATIC

This circuit uses two sequence valves. They are normally closed valves that open at a predetermined setting. By tracing the flow in the circuit, one should be able to determine how the circuit is designed to operate. This process is called reading a schematic.

Tracing the flow in this circuit reveals that it is designed to keep retracting and extending automatically when the prime mover is engaged. Once the circuit is understood, proper function of the system will depend on the proper setting and function of the sequence valves and the proper function of the hydraulically piloted directional control valve.
PROPER SCHEMATIC DESIGN

Building a schematic is important for all who are to read it and be able to troubleshoot with it. Here we will examine wrong and right ways of schematic usage. Too often in industrial manufacturing proper schematics are not supplied to the owners of the equipment. This makes it very difficult to understand how the system is to properly operate.

Excluding the hand written notes and numbers that we added, this is a customers schematic who manufactured a proto-type miniature F16 planes for the Air Force Recruiters. This schematic was handed me and asked me to troubleshoot the system.

What would you see as being the first problem with this?

There is no way of knowing what the pathways were for the valves. The flow paths are missing in the components.
PROPER SCHEMATIC DESIGN

This customer wanted this system troubleshoot as to why they broke off the back cover plate on the steering pump. Looking at this schematic, even the novice troubleshooter can determine that this is not a good format.

What is wrong with this picture?

In this particular system the customer just replaced all the hoses in the system and this is the factory supplied page which informs the customer where the hoses are to be installed. Though this is a good parts page, it is also the page in the book the helps the mechanic or operator determine where the components are located and how they interact with each other.

The inserting of the number bubbles confuses the one wishing to troubleshoot.
Below is the re-drawn schematic that the customer can now use for troubleshooting. The flow path can be followed and understanding of what the components do help assist in determining what caused the failure. By following the flow from the double fixed displacement pump we found that after re-installing the new hoses, they crossed the auxiliary line with the fixed steering line and when they turned the steering wheel the flow dead headed the second pump.
TROUBLESHOOTING

It would be a virtually impossible to try to document the cause and remedy of every possible fault that could occur on even the simplest hydraulic system. For this reason it is necessary to adopt a logical approach to troubleshooting, in order to locate a fault as quickly and accurately as possible.

Troubleshooting can be either frustrating or rewarding.

The outcome depends on how you approach the task at hand. As in any job to be done, the best tools available will help make the job go faster; establishing a starting point to search out the trouble requires knowledge of several different orientations.

As we have seen a proper schematic helps to visualize what components are involved in the system and how they are configured. The flow of the components settings of the pressure controls should all be listed on the schematic. Attempting to visualize the hydraulic system, of any but the simplest machine and how it functions by looking at the machine first, can be self defeating.

Many of the major hydraulic components are not visible from a single vantage point and time can be lost simply in becoming familiar with the hydraulic system. This time is better spent reviewing the circuit diagram and relating the trouble symptoms to components which could be at fault.
1. Know the Fundamentals of Hydraulics
2. Know the basic Components used
3. Understand the operation of the system
4. Listen to what is being said about the problem and write them down.
5. Examine the system schematic and isolate components that relate to symptoms described.
6. Check pressures settings after the repair or replacement of components, before the start up.
7. Replace filters and oil before start up
8. Isolate what may have caused the problem and what can be done to prevent from causing a pre-mature re-occurrence.
9. Make a record of what was done and components replaced for future information.
10. Plan another examination shortly after repairs for follow up.

“Success is not final, failure is not fatal: it is the courage to continue that counts.”

Winston Churchill
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