

HDF(*) STACKABLE VALVES SYSTEM

1) Generalities

HDF(*) system is designed to create very compact hydraulic control groups, by the use of stackable solenoid valves (and modules), that don't need the use of a base plate.

All connections A and B to "users" are 1/4" BSPP and they are located directly on the solenoid valves bodies or on the pilot operated check valves.

The HDF(*) system is optimized to control flows up to 20 l/min with max pressure of 25 MPa.

Ideal use of HDF(*) system is on various type of minipowerpacks.

- 1.1) The basic system uses HDF-ES-*** solenoid valves, packed in a very compact overall dimensions, where the 4-way solenoid valve share common P and T lines (in parallel or in series connection) and A and B ports are located on the top of each 4-way valve.
- 1.2) The more sophisticated systems uses HDF2-ES-*** solenoid valves, where connections to A and B lines are internal and therefore it is possible to stack modules that control flow or pressure on individual A and/or B ports : typically the use of p.o. check valve is current.
- 1.3) Elements from HDF and HDF2 systems can be mixed and can be stacked together, then giving an optimum of flexibility
- 1.4) Installation normally is made by fastening, by 3 tie rods, the stack of HDF(*) valves on a plate or manifold or block where a surface presents suitably located P and T connections.
This principle permits the best installation of HDF(*) stacks on minipowerpacks, on control blocks or, as a piggy back, on banks of larger 4-way control valves.
- 1.5) In current application of HDF system, a "closing" plate is needed to seal the P and T lines that are passing through the stack of valves.
In case of repetitive or large scale application, the use of "blind" final elements could be of great help:
 - solenoid valves type HDFC-ES-*** (P and T ports on face with seals)
 - solenoid valves type HDFB-ES-*** (P and T ports on face without seals)
 - p.o. check valves type AMFC-CP-AB
 These eliminate the need of a "closing" plate and permit shorter tie rods

2) Components for the HDF system

2.1) 4-way solenoid valve (see table HD220/1)

- 2.1.1) Valves type **HDF-ES-*****, see table HD220/1. Those are the basic elements with A and B ports (1/4" BSP) on top of valve; P and T passing through.
- 2.1.2) Valves type **HDF2-ES-*****, see table HD220/1. Those valves have P and T passing through and internal connection for A and B line.
Normally the A and B 1/4" BSP ports must be plugged and a suitable control module is associated to the valve.
- 2.1.3) In the basic versions the spool can be manually shifted by acting on the emergency pins. This manual override can be replaced by lockable override nut device type G01-E

2.2) Control modules

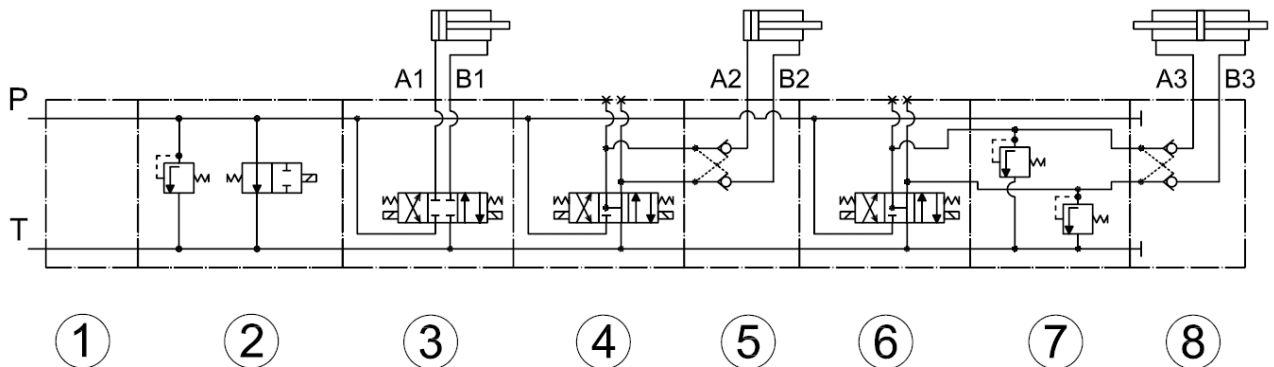
- 2.2.1) Pilot operated check valve type **AMF-CP-AB** (see table AM-F50)
Associated to HDF2-ES-*** solenoid valve, operates on A and B lines and presents A and B ports connections 1/4" BSP on sides.
- 2.2.2) Relief valves
- 2.2.2.1) **AMF-MOP/*-CC ; AMF-MOP/*-P1 ; AMF-MOP/*-T1** (see table AM-F60)

Relief valve acting on main (common) P line (passing) with discharge on (common) T line (passing). Version P1 presents an auxiliary 1/4" BSP port P on one side. In the same way Version T1 presents an auxiliary 1/4" BSP port T on one side.

- 2.2.2.2) Relief combined with variable flow control valve type **AMF-MOP/*-CF** (see table AM-F60)
This valve presents, in parallel with the relief valve, a regulated bleeding flow from P line to T line. Version with graduated knob for the throttle valve is available (**AMF-MOP/*-CV**).
- 2.2.2.3) Relief combined with pressure compensated flow control valve type **AMF-MOP/*-Q*** (see table AM-F60)
This valve presents, in parallel with the relief valve, a pressure compensated bleeding flow from P line to T line. Bleeding flow rate can be fixed (**AMF-MOP/*-Q(*)**) or adjustable (**AMF-MOP/*-QV**).
- 2.2.2.4) Relief combined with electric by-pass valve type **AMF-MOP/*-EV2*** (see table AM-F61)
This valve presents in parallel with pressure relief valve a directional valve that allows connection of P and T lines with electric command. Normally open (**AMF-MOP/*-EV2O**) and normally closed (**AMF-MOP/*-EV2C**) versions are available.
- 2.2.2.5) A and B pressure relief valve type **AMF-MO-BA** (see table AM-F65)
Relief valve acting on A and B line with discharge on (common) T line. P line is passing.
- 2.2.3) **Pressure reducing valves**
This valve type **AMF-RO-P/*** is a 3-way direct operated pressure reducing valve (see table AM-F70), that permits to obtain a lower pressure line.
- 2.2.4) **Plates**
- 2.2.4.1) Inlet/outlet modules type **AMF-SE-*** (see table AM-FSE)
This is a plate with standard HDF-ES interface (inlet) on one face and additional P and T ports (1/4" BSP) on one side. This plate is equipped with a NC 2/2 solenoid valve that discharge P line on T line (**AMF-SE-CO**);. This function is typical for simple acting cylinders.
In series with the NC 2/2 solenoid valve is possible to use a flow control valve that can be : throttle adjustable (**AMF-SE-CV**); fixed flow, pressure compensated (**AMF-SE-Q(*)**); adjustable flow pressure compensated (**AMF-SE-QV**)
- 2.2.4.2) Inlet/outlet module type **PD1-PT** (see table HD220/1).
This plate presents HDF-ES interface (inlet) on one face and P and T ports (1/4" BSP) on one side.
- 2.2.4.3) Inlet/outlet module type **PD1-03/32-5** (see table HD220/1).
This plate presents HDF-ES interface (outlet) on one face and P and T ports (3/8" BSP) on the other face.
- 2.2.4.4) Intermediate plate type **AMF-PM-TP** (see table HD220/1).
This modules permits change of circuit from "parallel" to "series" (T1→P2).
- 2.2.4.5) Steel closing plate type **PD1-03/32-0** (see table HD220/1).
- 2.2.4.6) Aluminium closing plate type **PD1-AL-0** (see table HD220/1).
Closing plate is not necessary when HDF-ES-*** or AMFC-ES-*** are used.
- 2.2.5) **In line valves and accessories**
- 2.2.5.1) In line throttle and check valve type **HFC-14** (see table AM-F14).
This valve can be screwed directly on the A and B exit ports of the HDF-ES-*** valves, obtaining free direct flow and restricted reverse flow (adjustable).
The presence of a "turning connector" allows the contemporary mounting of two valves on both ports of the solenoid valve.
- 2.2.5.2) If a fixed throttle on P or T lines is needed is possible to use the "section reducers" type **3S-***, that can be installed on the interested port under the seal.
- 2.2.5.3) To install the stack a mounting angle kit, type **MAF-KIT-2**, is available (see table HD220/1).

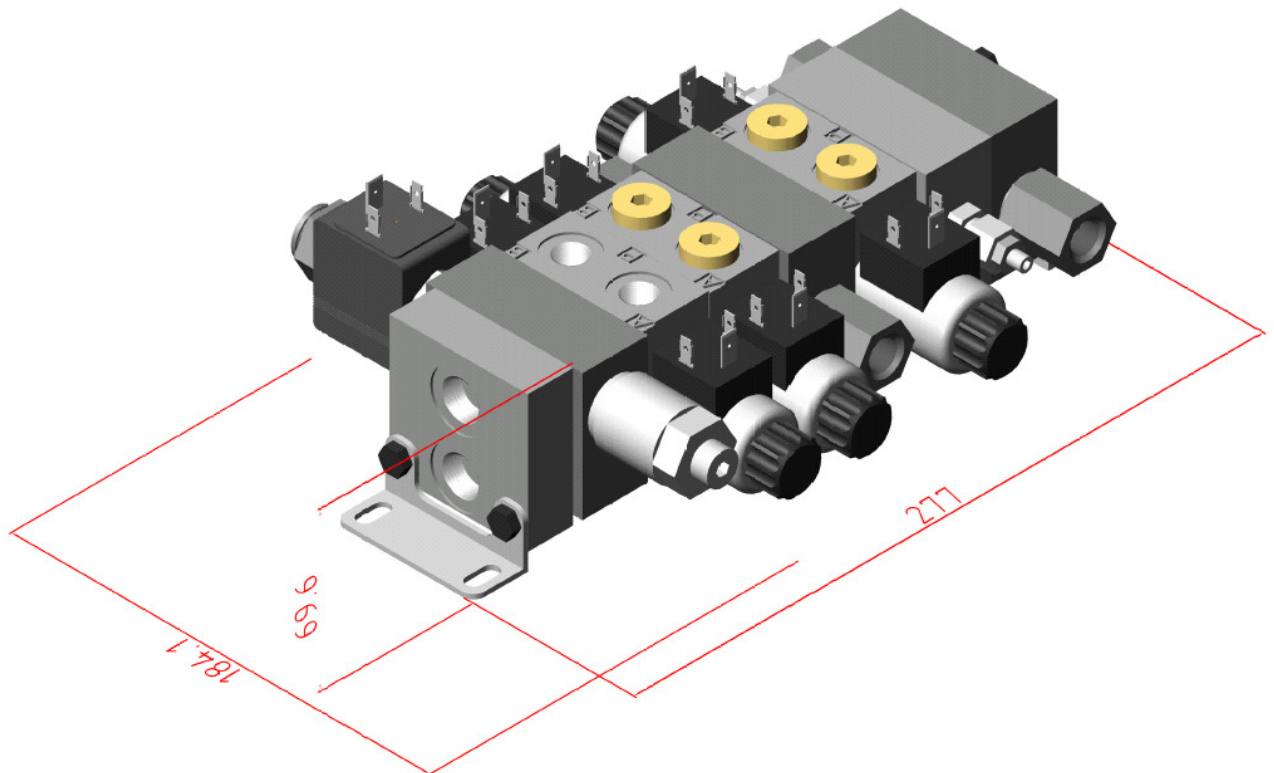
3) **Circuit examples**

The use of HDF system permits to obtain hydraulic circuits in very low dimensions. The following scheme can be taken as an example :



With HDF(*) stackable system is possible to realize this circuit using seven elements :

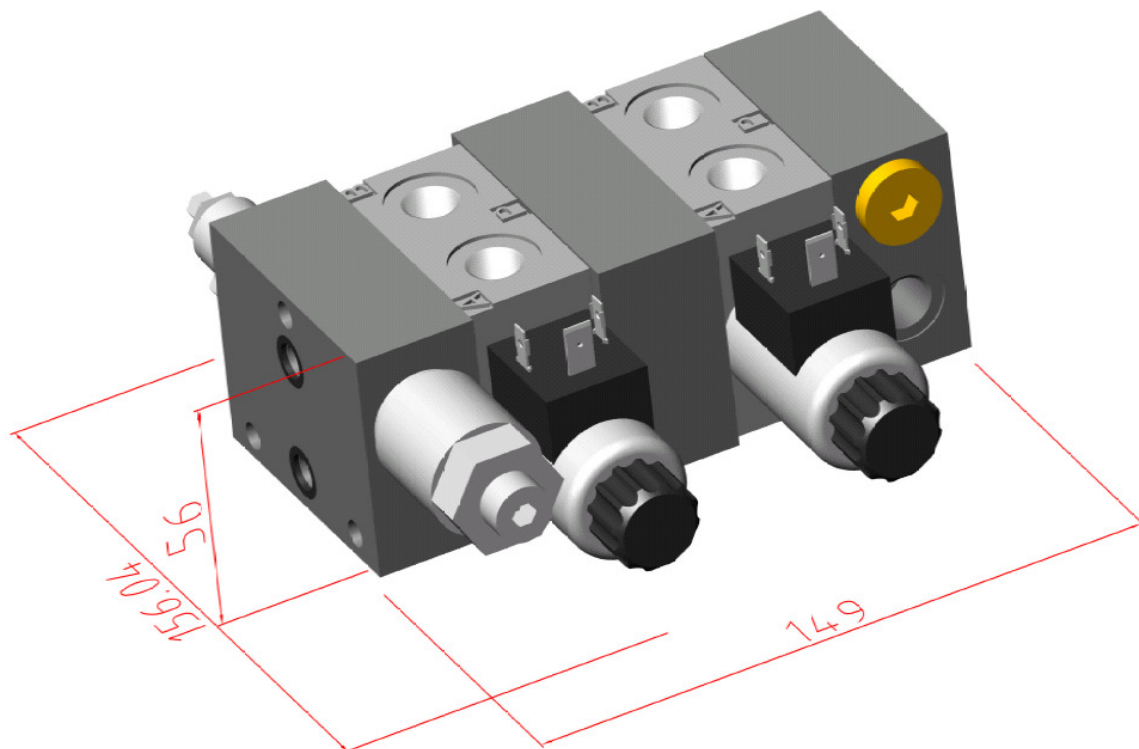
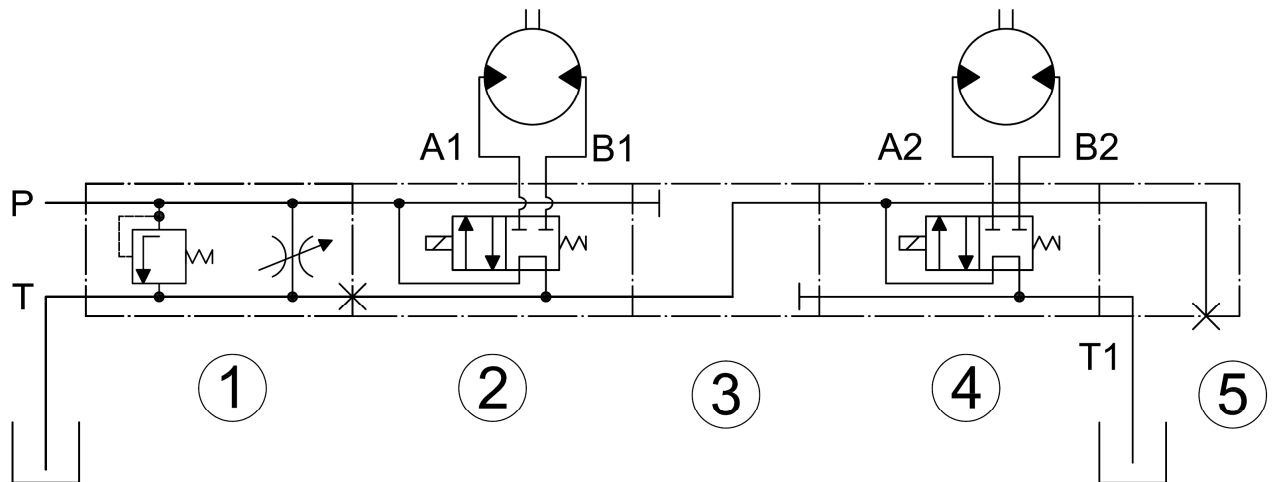
1. Inlet plate PD1-03/32-5 with P and T G 3/8 ports
2. By-pass valve in parallel with a pressure relief (AMF-MOP/*-EV20)
3. 4-way solenoid operated valve (HDF-ES-1C-****)
4. 4-way solenoid operated valve with internal A and B ports (HDF2-ES-3C-****)
5. Double p.o. check valve (AMF-CP-AB)
6. 4-way solenoid operated valve with internal A and B ports (HDF2-ES-3C-****)
7. Relief valve operating on A and B lines separately (AMF-MO-BA)
8. Double p.o. check valve, blind version(AMFC-CP-AB)
9. Mounting angle kit MAF-KIT-2



Tandem circuit example

The use of AMF-PM-TP module permits to realize, shifting the flow from P to T line, a tandem circuit in very simple way. This leads to a small size of the block. This solution implies the need for an additional T port, which is available, for example in the closing element PD1-PT.

An example of a circuit with series connection of two hydraulic motors is shown in the following figures :



1. Pressure relief valve in parallel with a variable bleeding flow (AMF-MOP/*-CF)
2. 4- way solenoid operated valve (HDF-ES-4ML-****)
3. Intermediate plate for tandem circuit (AMF-PM-TP)
4. 4-way solenoid operated valve (HDF-ES-4ML-****)
5. Closing plate with additional G1/4 P(plugged) and T port (PD1-PT)
6. Stop on T line (between 1 and 2) type 3S-00