

# Flow Divider

Durability. Reliability. Efficiency. Performance



## **MIA - FD** series

MANIFOLD

INSTANTANEOUS

AUTO-COMPENSATING

FLOW

DIVIDER



ENGLISH



## SUMMARY

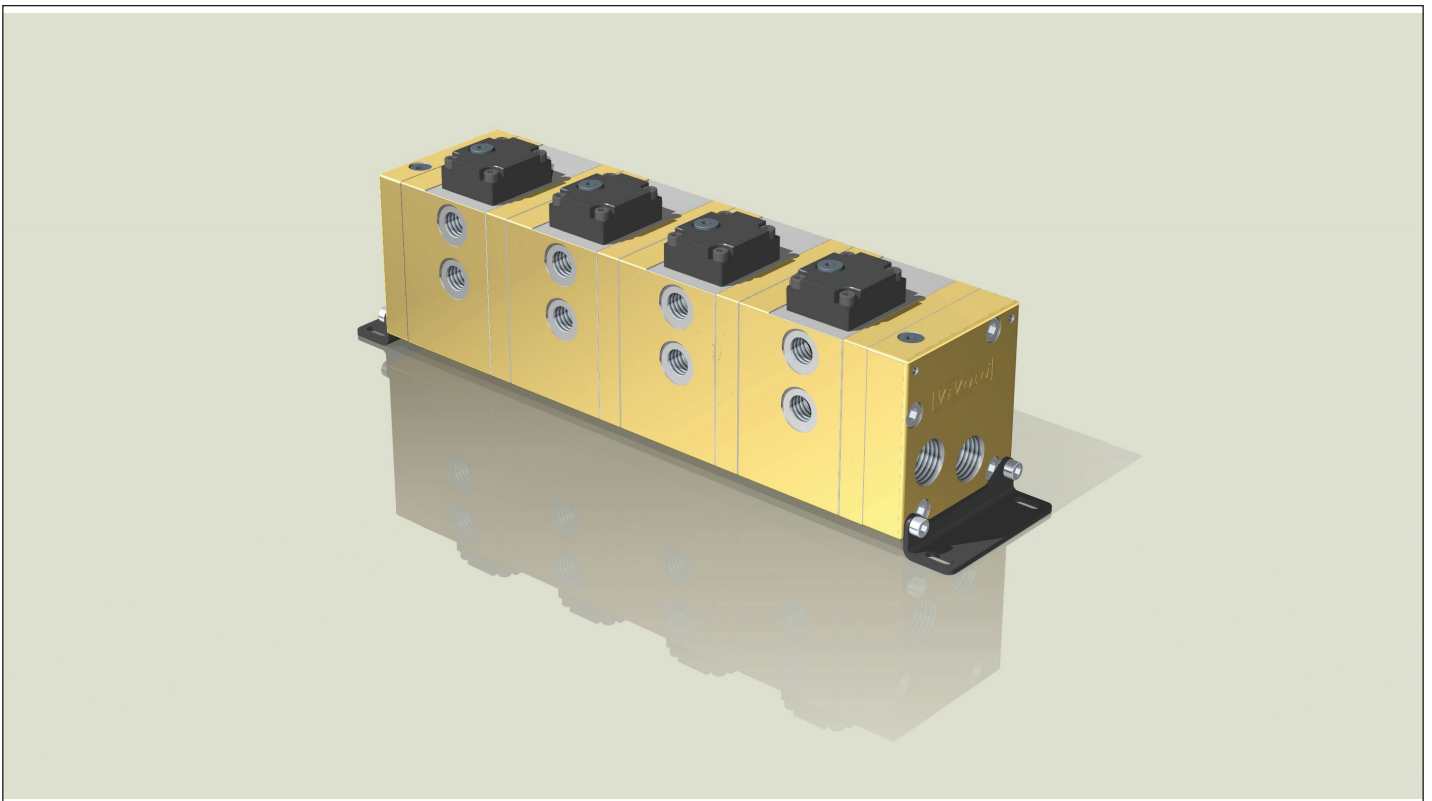
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## GENERAL DESCRIPTION

**MIA-FD** is the acronym for Manifold Instantaneous Auto-compensating Flow Divider. The VIVOIL MIA-FD flow divider is the answer to the market request for continuous improvement of:

- **Precision:** All components has been re-engineered to allow for a tolerance constructive reduction and to reach a higher uniformity between elements. In addition we have included an internal auto-compensating system that removes the dependency from the pressure diffence between elements.
- **Modular:** each element is a single independent unit
- **Configurable:** each element can have added valves and other modular elements with CETOP NG6 , ISO 4401-03-02-0-05.
- **Expandable:** the system can be improved by adding new divider elements on to an existing flow divider.
- **Simple:** the completed flow divider is a real compact manifold system and is easy to install.

**The MIA-FD FLOW DIVIDER** is not only a simple flow divider and combiner, but it is a system to distribute and feed with constant and independent flow rates for the various circuit branches. The open architecture of the MIA-FD has been developed to be integrated into different functionality that will follow the customers requirements.



## TECHNICAL INFORMATION

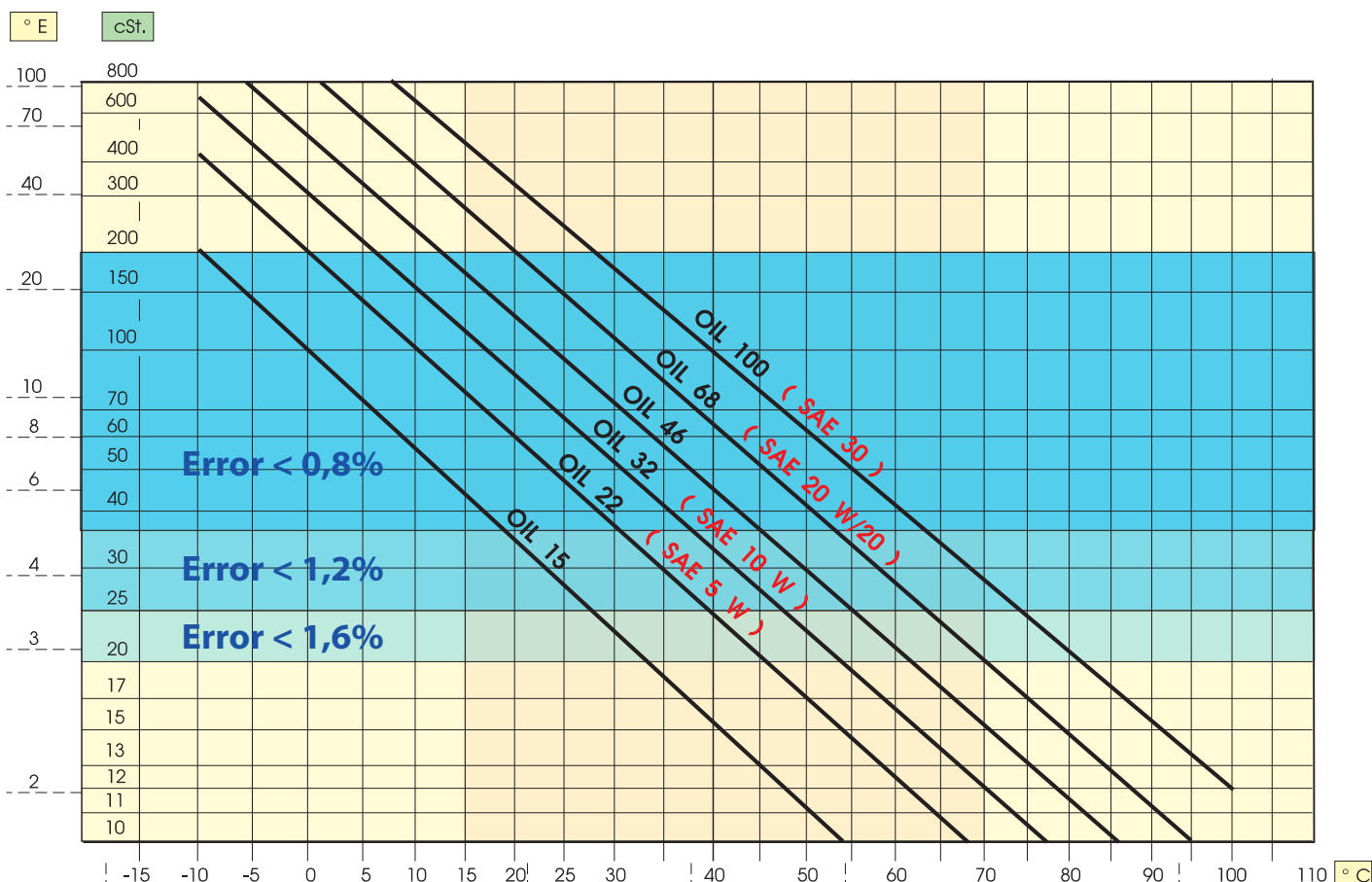
### Attention:

Please carefully read the following instructions before installing the MIA-FD flow divider. All installation activities must be executed by specialized and qualified persons.

HYDRAULIC FLUID	MINERAL OIL HL, HLP DIN 51524
FLUID CONTAMINATION (filter: $\beta_5 \geq 75$ )	ISO 4406:1999 CLASS 19/17/14 (NAS 1638 class 8)
SUGGESTED VISCOSITY	20 ÷ 200 cSt
ALLOWED VISCOSITY	12 ÷ 500 cSt
ROOM TEMPERATURE	-20° C ÷ 80° C
NBR SEALS FLUID TEMPERATURE ALLOWED	-15° C ÷ 75° C

## PRECISION GRADE

**FLOW DIVISION ERROR < 1,6%**  
**PRESSURE DIFFERENCE CONSIDERED 170 BAR**  
 (oli VG 46 c fluid and flow divider temperature < 60°)



\* Values in the blue area have been calculated by interpolation, starting with many experimental tests.  
 For additional information, please contact our technical service.

### DEPENDENCE OF THE ERROR TREND FROM TEMPERATURE/VISCOSITY

The below graph shows the typical trend of the error captured during experimental tests:

The green line represents the maximum real error measured during the tests.

With oil temperatures up to 45 °C the absolute error between elements is < 0.8 % (with a pressure difference from 0 to 180 bar)

**Note:** All products were tested after assembly and an initial run time to adapt the parts to each other. The complete adjustment requires several hours.

Test details:

MIA-FD 6 l/min x 3 elements

Max pressure difference between elements 170 bar

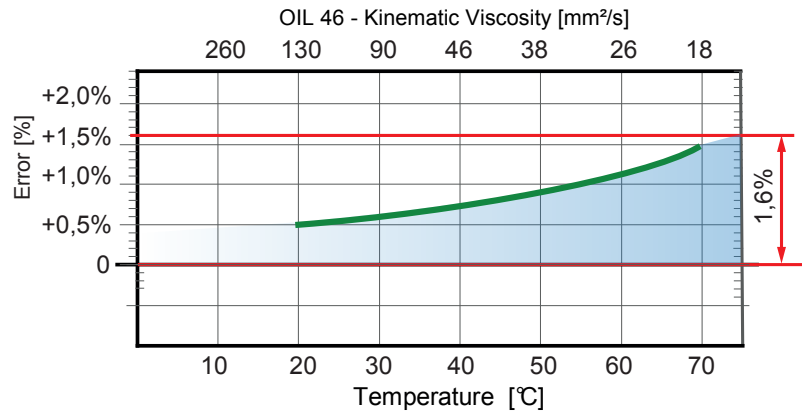
Oil Schell Tellus T 46

Oil temperature from 15°C to 75°C

Inlet flow rate 18 l/min

Flexible pipes EN 853/2SN 3/8 GAS L=2000 mm

Cylinder bore ø100 mm - Cylinder rod ø50 mm - 1000 mm stroke.



### FLOW DIVISION PRECISION DEFINITION:

We define the flow division error as the difference between the maximum and the minimum volume of flow on the outlet of the flow divider (expressed in a percentage).

**Example:** One 4 element flow divider feeds 4 equal cylinders with a 1000 mm stroke.

When the first cylinder C1 reaches the end of the stroke at 1000 mm, the other cylinders will have different strokes, because of the error flow division.

The difference between the maximum stroke on C1 and minimum stroke on C3 is:

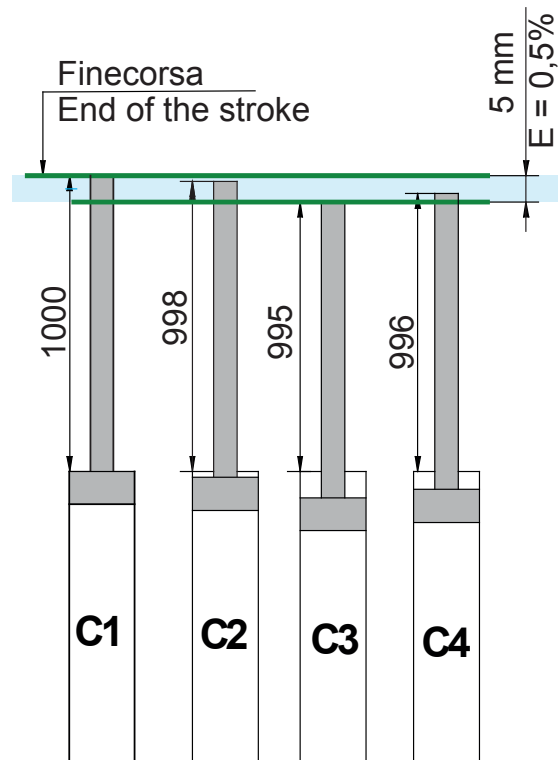
$$1000 - 995 = 5 \text{ mm}$$

Therefore the absolute flow division error is:

$$(5/1000) * 100 = 0,5\%$$

**Attention!** In order to express the error as a percentage, you must calculate the maximum misalignment between all stroke positions.

Please remember that the final error rate is made of the flow divider error, the oil compressibility, the pipes, seals and cylinders elasticity, in addition to the volumetric efficiency of the final uses (such as motors).

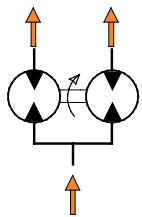


## HOW IT WORKS GENERAL INFORMATION

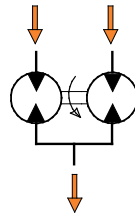
The flow divider is made up of two or more elements (sections). Inside each element there are a couple of gears that determine the quantity of oil that goes from the inlet to the outlet. The gear couples are connected mechanically so that all of them has a synchronized rotation.

For this reason, the flow rate that passes through each element has a constant ratio determined by the displacement of each element.

Gears can rotate in both directions, making the flow divider reversible.



• Flow division



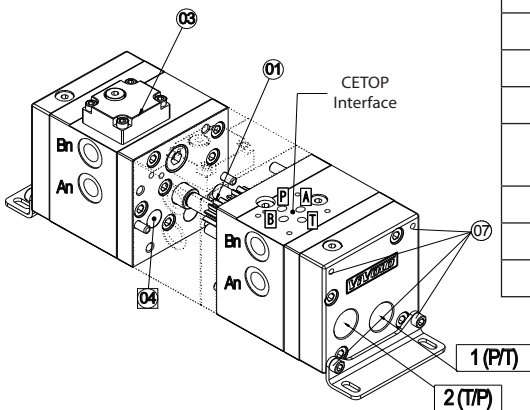
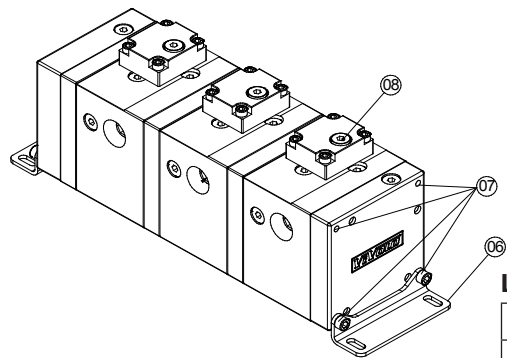
• Flow combiner

### MIA-FD FLOW DIVIDER

An auto-compensating system has been added inside of the MIA-FD making the flow division does not depends on the pressure applied on each of the elements. **This system does not require any adjustments.**

With this type of flow divider there is no pressure amplifier effect, and therefore there is no risk of making the safety valve, that is positioned before the flow divider ineffective.

Due to the higher precision of this solution, no relief valve is necessary in the main part of the applications. Relief valves can be installed at any time and only in the elements that need them. This is accomplished by using a CETOP connection on top of each element.



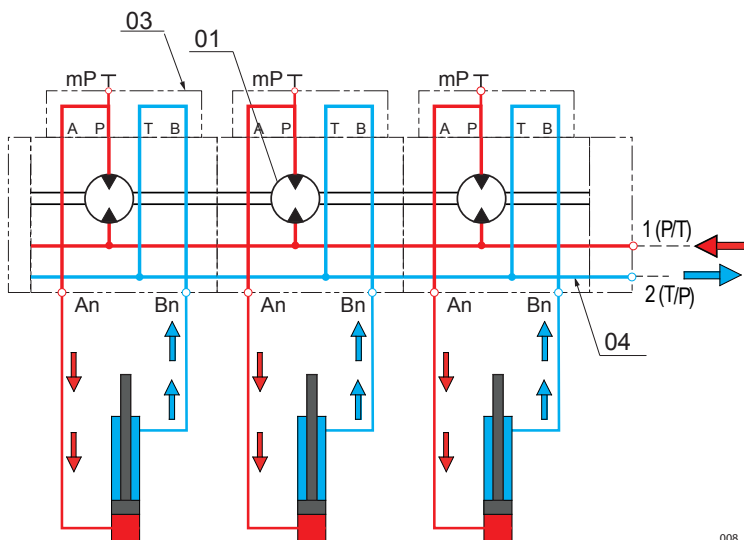
#### Legend:

1(P/T)	2(T/P)	CONNECTION PORTS		
01		GEARS		
03		CETOP CLOSING PLATE		
04		INTERNAL FLOW PIPE (COLLECTOR)		
An	Bn	IN and OUT CONNECTIONS		
P	T	A	B	CETOP CONNECTING INTERFACE ON EACH ELEMENT (CONNECTING PORTS)
06		FIXING L-SHAPE		
07		M6 FIXING HOLES		
08		PLUG GAUGE G1/8 (P connection)		

**FLOW DIVISION MODALITY**

**Inlet from 1 (P/T) to An:** The flow is sent to the gear element (01) that divides it into independent flow rates. The fluid goes through the compensation system and feeds the P from the CETOP connection on each element. The CETOP closing plate (03) connects P with A which is communicating with An.

The Bn connection is communicating with the B port on the CETOP interface on each element. The CETOP closing plate (03) connects B with T and consequently is communicating with the common line (04) and connection 2 (T/P). The Bn connection can be used for the backline from the actuators.



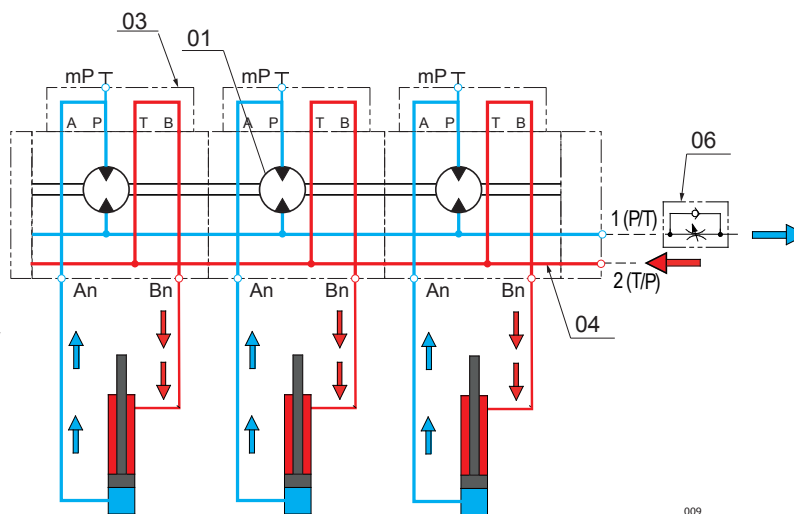
**Scheme 1**  
How it works as a flow divider

**FLOW COMBINER MODALITY**

**Inlet form An to 1(P/T):** the different flow rate gets in from the An connections that are all communicating with the A port in the CETOP interface of each element. The CETOP closing plate (03) connects A with P, then feeds the gears (01)

With this working method it is recommended that you insert an adjustable flow regulator (06) and assemble it (as per the scheme 2) on the flow divider outlet in order to increase the precision. This will slow down the descending phase and consequently give to the gears a counterpressure.

Bn connections, can be used to send oil to the actuators, because they are directly communicating through the common line (04) to the 2 connection (T/P).



**Scheme 2**  
How it works as a flow combiner

**CETOP CONNECTION INTERFACE USE ON THE FLOW DIVIDER STAGES:**

From the above schemes :

- When the oil works as in *Scheme 1* the **P** connection on the CETOP interface is the outlet and **T** is the back line.
- When the oil works as in *Scheme 2*, the **P** connection on the CETOP interface is the back line and **T** is the outlet.

**This is really important when you are considering the use of CETOP components on top of each element.**





## GENERAL INSTRUCTION

### FLOW RATE DEFINITION

The table shows the operating range of the individual elements of the flow divider.

Higher flow rates with the same gear displacement, improve the precision, but cause a higher pressure loss and higher noise levels. For this reason we suggest, whenever it is possible, the use of a flow rate close to the optimal value defined in the table.

It's important to check the flow rate for each element, even for the combining phase.

Working pressures indicated must be considered maximum continuous values.

Pressure peaks of approximately 10 percent are allowed.

Displac. cm <sup>3</sup> /rev	P.max bar	WORKING RANGE Flow Rate per element [l/min]		
		Min.	Optimal	Max
0,9	250	1	2	6
1,2	250	1,5	3	7
1,7	250	2	4	9,5
2,2	250	2,5	5	13
2,6	250	3	6	16
3,2	250	3,5	7	19
3,8	250	4,5	8	22,5
4,3	250	5	9	26
4,9	250	5,5	11	29
5,9	220	6,5	13	30
6,5	220	7,5	14	33
7,8	210	8,5	17	38
9,8	200	11	22	38

### INLET NUMBER DEFINITION

With inlet flow rates of over 80÷90 l/min, we suggest you to contact our technical service to evaluate additional inlet port addition.

#### Legend

Total inlet flow rate [l/min]	Min. inlet number suggested
< 50	1
< 90	
> 90	2

Limit for MVE version (Flow divider with relief valve, flow rate adjustment valve and cetop connection for command valve.)	
< 50 lt/min	

Displac. cm <sup>3</sup> /rev	P.max bar	Optimal flow rate for an element [l/min]	TOTAL INLET FLOW RATE [l/min]									
			ELEMENT NUMBER:									
			2	3	4	5	6	7	8	9	10	
0,9	250	2	4	6	8	10	12	14	16	18	20	
1,2	250	3	6	9	12	15	18	21	24	27	30	
1,7	250	4	8	12	16	20	24	28	32	36	40	
2,2	250	5	10	15	20	25	30	35	40	45	50	
2,6	250	6	12	18	24	30	36	42	48	54	60	
3,2	250	7	14	21	28	35	42	49	56	63	70	
3,8	250	8	16	24	32	40	48	56	64	72	80	
4,3	250	9	18	27	36	45	54	63	72	81	90	
4,9	250	11	22	33	44	55	66	77	88	99	110	
5,9	220	13	26	39	52	65	78	91	104	117	130	
6,5	220	14	28	42	56	70	84	98	112	126	140	
7,8	210	17	34	51	68	85	102	119	136	153	170	
9,8	200	22	44	66	88	110	132	154	176	198	220	

### INSTALLATION

**Installation, initial tests, commissioning and ordinary maintenance for the flow divider must be done only by qualified and experienced staff, who are properly equipped with the right tools and individual safety protection.**

Check that the flow divider has not been damaged during the transport.

Pay close attention so you do not damage parts during the movement and assembling phases.

- Secure the flow divider on clean, flat surface.
- Secure the flow divider by using the mounting brackets supplied or the threaded holes on the products sides. Securing the flow divider incorrectly can compromise the proper functionality of the system.
- To prevent additional noise caused by acoustic resonance, you should consider the use of anti-vibration mounts.
- Only remove the plugs immediately before you connect the pipes.
- Pay careful attention so you do not introduce dirt into the ports or the CETOP connections

- Use only cylindrical fittings BSPP suitable to the working pressure. **The use of conical fitting is absolutely not allowed.**
- Flexible or rigid pipes must conform to the maximum nominal pressures, respect minimal radii of curvature and be positioned so as not to transfer mechanical stress to the flow divider.

### **COMMISSIONING**

- Execute all of the proper connections
- Check that all of the valves that can influence the pressure are adjusted to the minimal values during the first start up.
- Check that no valves, taps, plugs, flow restrictors or other elements, that can obstruct or restrict the oil flow or improve the pressure, are present after the flow divider.
- Check the proper connection tightening and the proper circuit positioning
- **Always respect the recommendations and instructions from the machine builder, where the flow divider is installed, concerning safety and how to install pipes, valves, electrical connections, etc.**
- Start the flow divider for a short period with no load on the uses
- Immediately stop the use if any strange noise, leakages, strange movements, etc. cause you to doubt or suspect there are issue with the proper functionality.
- Purge the air from the circuit. In order for the flow divider to work properly, no air should be present in the circuit (no foam in the tank).
- Perform many cycles without load on the uses.
- With all the actioning deactivated and no pressure on all the pipes, check that no leakage occurs and that all pipes, fittings and connections have been properly tightened
- Adjust the valves and perform some empty cycles.
- After all the steps before have been successfully passed, start by gradually adding the load on the uses on step at a time.

### **USE**

- The flow divider must be used within the limits provided by this catalogue.
- Use the type of oil suggested in this catalogue.
- Take care of the oil filtration because contamination can irreparably damage the flow dividers precision and cause a lifetime reduction.
- Do not exceed the temperature indicated in this catalogue
- Check that no air is in the circuit (no foam in the tank).
- If CETOP valves are applied on the flow divider, respect the user instructions from the manufacturer.
- **Always respect the recommendations and instructions from the machine builder where the flow divider is installed concerning safety.**

### **MAINTENANCE**

The user must periodically check:

- No leakage should be present between the elements.
- Fittings and fixing screws should be properly tightened.
- Valves and plugs should be properly tightened.
- Never exceed the tightening torque values indicated in the catalogue and from the components manufacturers.

**Note** When leakage is found and the tightening is correct, do not tighten more, instead replace the seals. **This operation has to be done by qualified and experienced staff.**

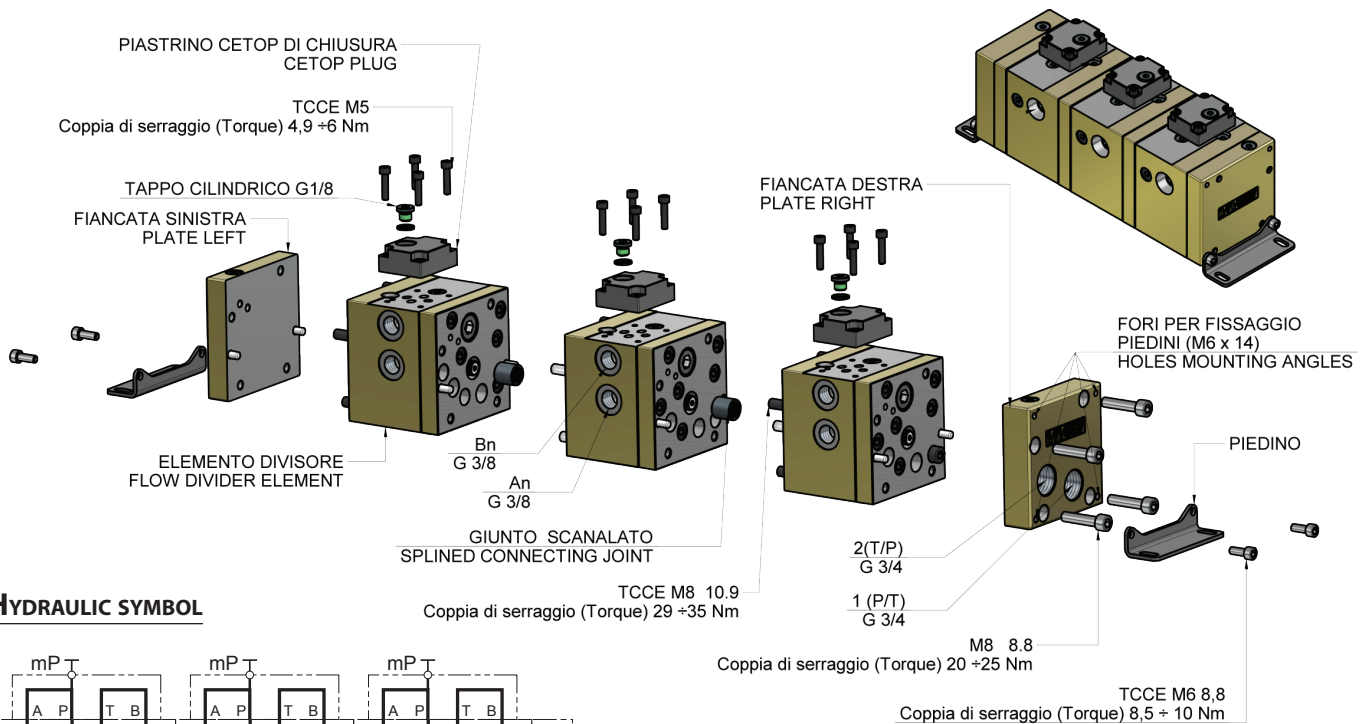


**DIMENSIONS OF AN ASSEMBLED FLOW DIVIDER (FROM 2 TO 8 ELEMENTS)**

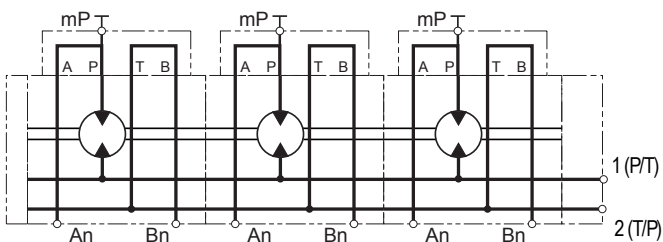
Displacement cm <sup>3</sup> /rotation	Optimal single element flow rate	ELEMENT NUMBER																							
		2			3			4			5			6			7			8					
		Ld	Li	kg	Ld	Li	kg	Ld	Li	kg	Ld	Li	kg	Ld	Li	kg	Ld	Li	kg	Ld	Li	kg			
0,9	2 l/min	194	230	5,9	268,5	304,5	8,2	343	379	10,4	417,5	453,5	12,7	492	528	14,9	566,5	602,5	17,2	641	677	19,4			
1,2	3 l/min	196	232	6,0	271,5	307,5	8,2	347	383	10,5	422,5	458,5	12,8	498	534	15,1	573,5	609,5	17,3	649	685	19,6			
1,7	4 l/min	199	235	6,0	276	312	8,4	353	389	10,7	430	466	13,0	507	543	15,3	584	620	17,6	661	697	20,0			
2,2	5 l/min	203	239	6,2	282	318	8,5	361	397	10,9	440	476	13,3	519	555	15,7	598	634	18,0	677	713	20,4			
2,6	6 l/min	207	243	6,3	288	324	8,7	369	405	11,1	450	486	13,6	531	567	16,0	612	648	18,4	693	729	20,8			
3,2	7 l/min	211	247	6,4	294	330	8,9	377	413	11,3	460	496	13,8	543	579	16,3	626	662	18,8	709	745	21,3			
3,8	8 l/min	215	251	6,5	300	336	9,0	385	421	11,6	470	506	14,1	555	591	16,7	640	676	19,2	725	761	21,7			
4,3	9 l/min	219	255	6,6	306	342	9,2	393	429	11,8	480	516	14,4	567	603	17,0	654	690	19,6	741	777	22,2			
4,9	11 l/min	225	261	6,8	315	351	9,4	405	441	12,1	495	531	14,8	585	621	17,5	675	711	20,2	765	801	22,8			
5,9	13 l/min	232	268	7,0	325,5	361,5	9,7	419	455	12,5	512,5	548,5	15,3	606	642	18,1	699,5	735,5	20,8	793	829	23,6			
6,5	14 l/min	237	273	7,1	333	369	9,9	429	465	12,8	525	561	15,6	621	657	18,5	717	753	21,3	813	849	24,2			
7,8	17 l/min	245	281	7,3	345	381	10,3	445	481	13,2	545	581	16,2	645	681	19,1	745	781	22,1	845	881	25,1			
9,8	22 l/min	263	299	7,8	372	408	11,0	481	517	14,2	590	626	17,4	699	735	20,6	808	844	23,8	917	953	27,1			

- Note:**
- For flow dividers with more than 8 elements and/or global inlets of more than 90 l/min, we suggest you contact our technical department to evaluate if an additional inlet or more than one is required.

**EXPLODED VIEW WITH COUPLING TORQUE VALUES**

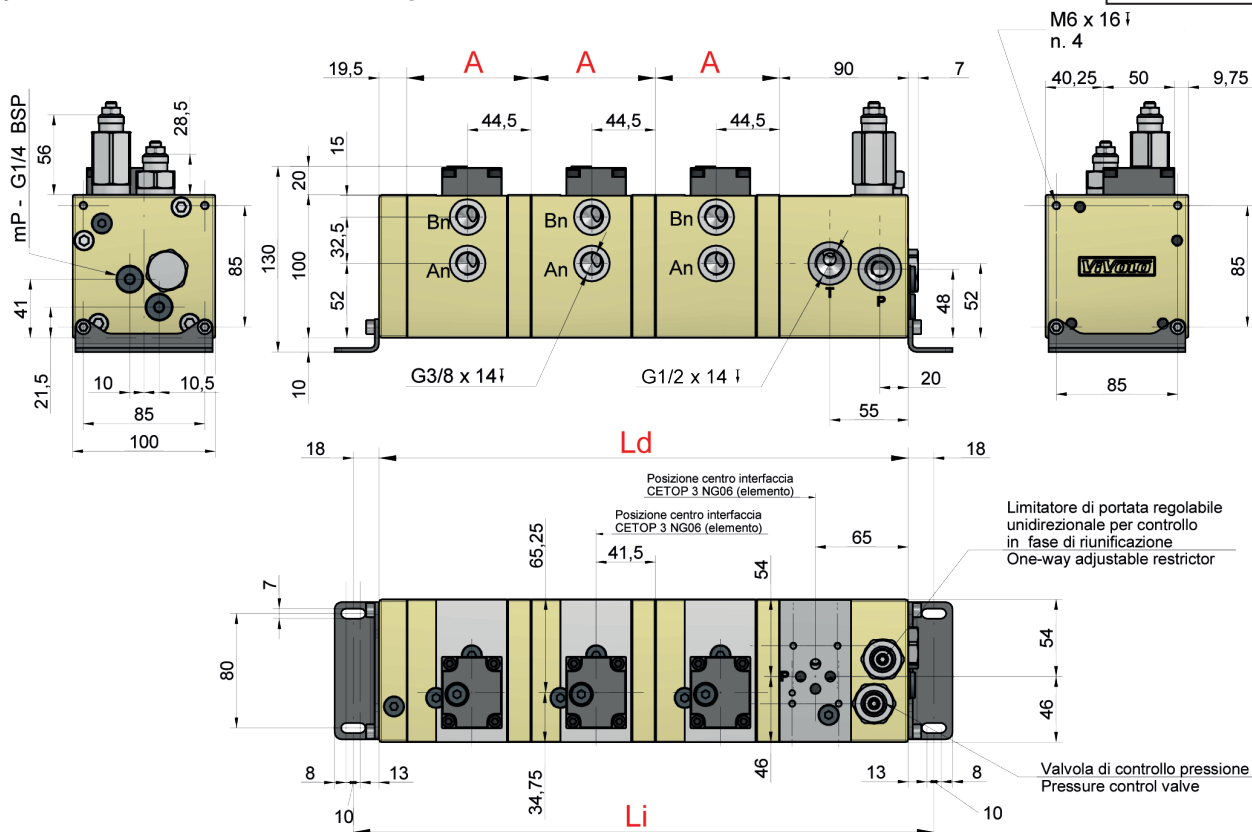
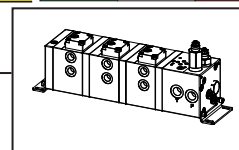


**HYDRAULIC SYMBOL**



### MVE - FLOW DIVIDER WITH COMMAND CONNECTION (UP TO 50L/MIN)

Flow divider with command CETOP connection, relief valve, flow rate valve and unidirectional flow rate adjustment to lead the reunification phase.



016

#### ORDERING CODE

FLOW DIVIDER WITH EQUAL DISPLACEMENTS:



TOTAL ELEMENT NUMBER

	Setting range of the valve
A	10 ÷ 105 bar
B	70 ÷ 210 bar
C	140 ÷ 350 bar

FLOW DIVIDER WITH DIFFERENT DISPLACEMENT ELEMENTS (MAX. 7\*):



TOTAL ELEMENT NUMBER

Right Cover Weight = 2,9 kg  
Left Cover Weight = 0,6 kg

Displ. cm <sup>3</sup> /rev.	Code CC	A	P.max bar	Flow Rate per element [l/min]			Element weight kg
				Min.	Optimal	Max	
0,9	16	74,5	250	1	2	6	2,3
1,2	17	75,5	250	1,5	3	7	2,3
1,7	18	77	250	2	4	9,5	2,3
2,2	20	79	250	2,5	5	13	2,4
2,6	21	81	250	3	6	16	2,4
3,2	23	83	250	3,5	7	19	2,5
3,8	25	85	250	4,5	8	22,5	2,5
4,3	27	87	250	5	9	26	2,6
4,9	29	90	250	5,5	11	29	2,7
5,9	31	93,5	220	6,5	13	30	2,8
6,5	32	96	220	7,5	14	33	2,8
7,8	34	100	210	8,5	17	38	3,0
9,8	36	109	200	11	22	38	3,2

#### Example:

4 Element flow divider 3,8+4,9+4,9+6,5 with relief valve 70÷210 bar

cod. **MVE 04 B 25 29 29 32**

\* **Note:** To define the code for different displacement version with more than 7 element please contact sales.

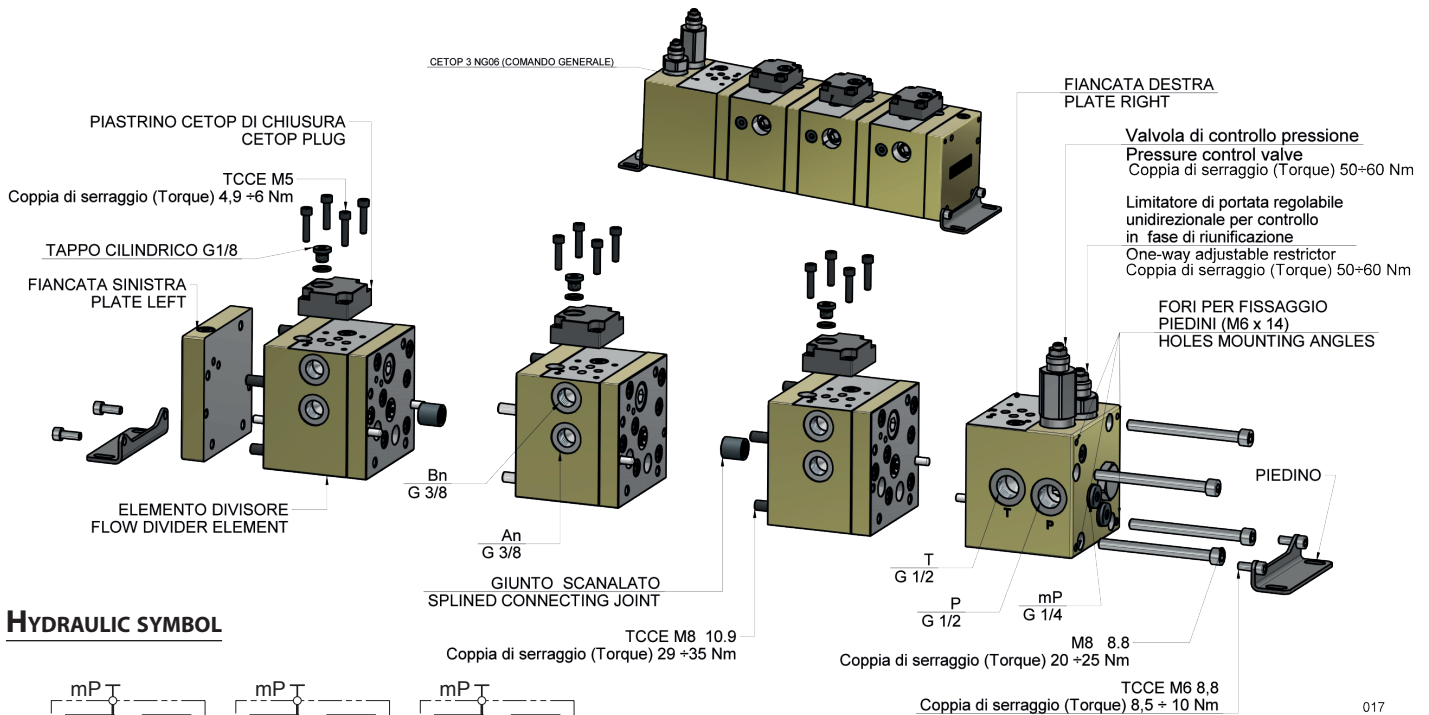


**DIMENSIONS OF AN ASSEMBLED FLOW DIVIDER (FROM 2 TO 8 ELEMENTS)**

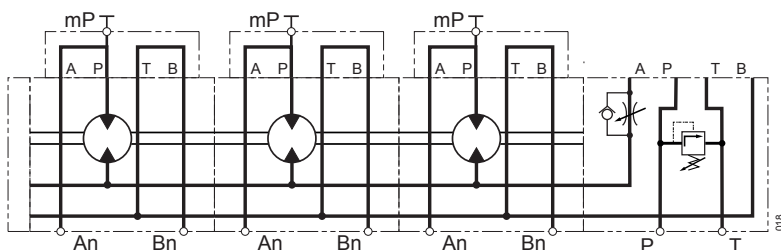
Displacement cm <sup>3</sup> /rotation	Optimal single element flow rate	ELEMENT NUMBER																							
		2			3			4			5			6			7			8					
		Ld	Li	kg	Ld	Li	kg	Ld	Li	kg	Ld	Li	kg	Ld	Li	kg	Ld	Li	kg	Ld	Li	kg	Ld	Li	kg
0,9	2 l/min	258,5	294,5	8,0	333	369	10,3	407,5	443,5	12,5	482	518	14,8	556,5	592,5	17,0	631	667	19,3	705,5	741,5	21,5			
1,2	3 l/min	260,5	296,5	8,1	336	372	10,4	411,5	447,5	12,7	487	523	14,9	562,5	598,5	17,2	638	674	19,5	713,5	749,5	21,8			
1,7	4 l/min	263,5	299,5	8,2	340,5	376,5	10,5	417,5	453,5	12,8	494,5	530,5	15,1	571,5	607,5	17,5	648,5	684,5	19,8	725,5	761,5	22,1			
2,2	5 l/min	267,5	303,5	8,3	346,5	382,5	10,7	425,5	461,5	13,0	504,5	540,5	15,4	583,5	619,5	17,8	662,5	698,5	20,2	741,5	777,5	22,5			
2,6	6 l/min	271,5	307,5	8,4	352,5	388,5	10,8	433,5	469,5	13,3	514,5	550,5	15,7	595,5	631,5	18,1	676,5	712,5	20,6	757,5	793,5	23,0			
3,2	7 l/min	275,5	311,5	8,5	358,5	394,5	11,0	441,5	477,5	13,5	524,5	560,5	16,0	607,5	643,5	18,5	690,5	726,5	20,9	773,5	809,5	23,4			
3,8	8 l/min	279,5	315,5	8,6	364,5	400,5	11,2	449,5	485,5	13,7	534,5	570,5	16,3	619,5	655,5	18,8	704,5	740,5	21,3	789,5	825,5	23,9			
4,3	9 l/min	283,5	319,5	8,7	370,5	406,5	11,3	457,5	493,5	13,9	544,5	580,5	16,5	631,5	667,5	19,1	718,5	754,5	21,7	805,5	841,5	24,3			
4,9	11 l/min	289,5	325,5	8,9	379,5	415,5	11,6	469,5	505,5	14,3	559,5	595,5	16,9	649,5	685,5	19,6	739,5	775,5	22,3	829,5	865,5	25,0			
5,9	13 l/min	296,5	332,5	9,1	390	426	11,9	483,5	519,5	14,7	577	613	17,4	670,5	706,5	20,2	764	800	23,0	857,5	893,5	25,8			
6,5	14 l/min	301,5	337,5	9,2	397,5	433,5	12,1	493,5	529,5	14,9	589,5	625,5	17,8	685,5	721,5	20,6	781,5	817,5	23,5	877,5	913,5	26,3			
7,8	17 l/min	309,5	345,5	9,5	409,5	445,5	12,4	509,5	545,5	15,4	609,5	645,5	18,3	709,5	745,5	21,3	809,5	845,5	24,2	909,5	945,5	27,2			
9,8	22 l/min	327,5	363,5	10,0	436,5	472,5	13,2	545,5	581,5	16,4	654,5	690,5	19,6	763,5	799,5	22,8	872,5	908,5	26,0	981,5	1017,5	29,2			

- Note:**
- For flow dividers with more than 8 elements and/or global inlets of more than 90 l/min, we suggest you contact our technical department to evaluate if an additional inlet or more than one is required.

**EXPLODED VIEW WITH COUPLING TORQUE VALUES**

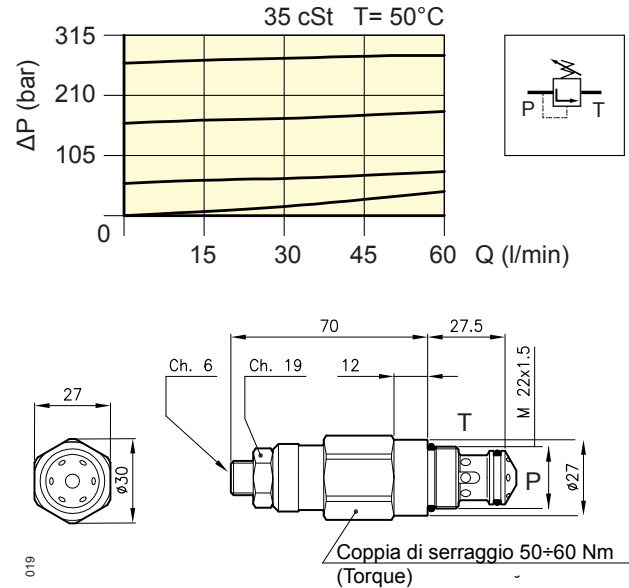


**HYDRAULIC SYMBOL**



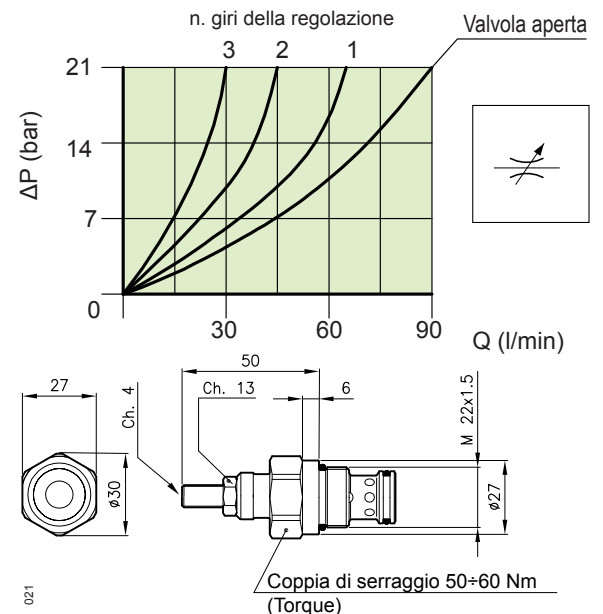
**VALVES CHARACTERISTICS**
**RELIEF VALVE (50 L/MIN)**

Max flow rate	50 l/min
Max pressure in P	350 bar
Max pressure in T	210 bar
Spring range 01	10 ÷ 105 bar
Spring range 02	70 ÷ 210 bar
Spring range 03	140 ÷ 350 bar
Filtering required	19/15 ISO 4466 (25 µm absolute)
Oil viscosity range allowed	2.8 ÷ 350 cSt
Temperature range	-20 +80 °C
Standard seals material	Poliuretano Buna N
Weight	0,270 kg
Percentage of the set value to open	95% (defined with 1 i/min)
Percentage of the set value to close	75% (defined with 1 i/min)
Hydraulic oil	Mineral oil HM e HV ISO 6074


**FLOW RATE ADJUSTMENT VALVE (50 L/MIN)**

Max flow rate adjustable (Δp 7 bar)	0 ÷ 50 l/min
Max flow rate adjustable (Δp 14 bar)	0 ÷ 70 l/min
Max pressure	350 bar
Filtering required	19/15 ISO 4466 (25 µm absolute)
Oil viscosity range allowed	2.8 ÷ 350 cSt
Temperature range	-20 +80 °C
Standard seals material	Poliuretano Buna N
Weight	0,170 kg
Hydraulic oil	Mineral oil HM e HV ISO 6074

**Note**  
Total valve regulation is done by 4 spin.

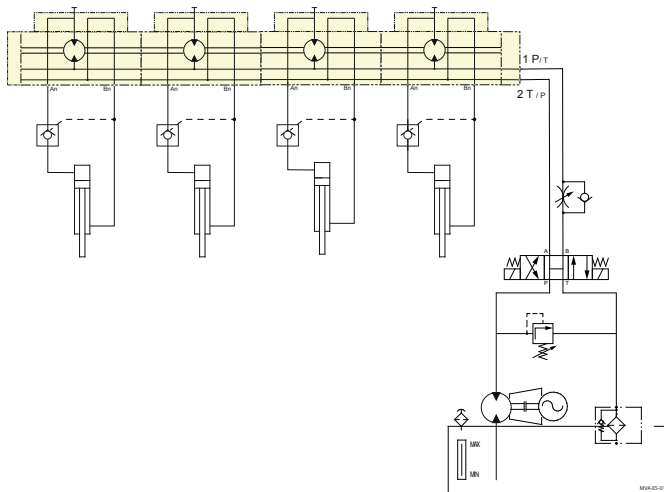




**EXAMPLES**

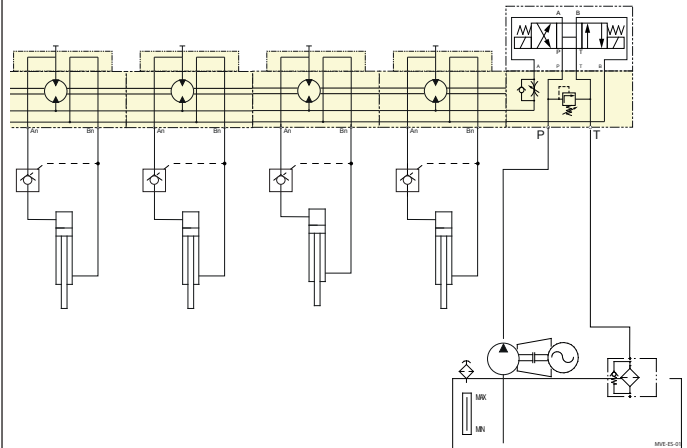
Standard 4 elements flow divider

**MVA**



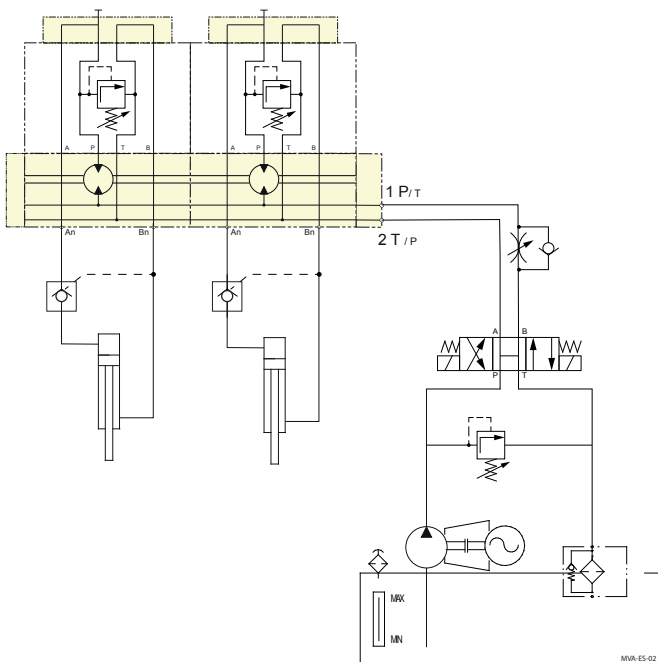
**MVE**

4 elements flow divider with integrated relief valve and flow rate regulator. On the CETOP a command valve installed.



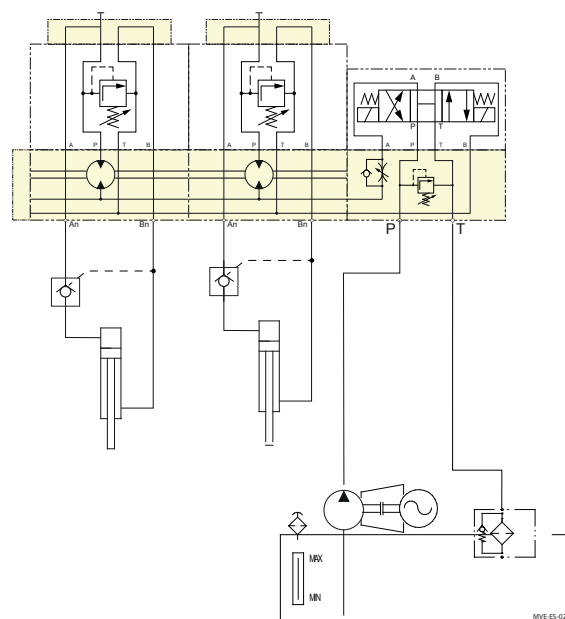
2 Elements Flow Divider  
Relief valves installed on the elements CETOP to realign the actuators at the end of the stroke.

**MVA**



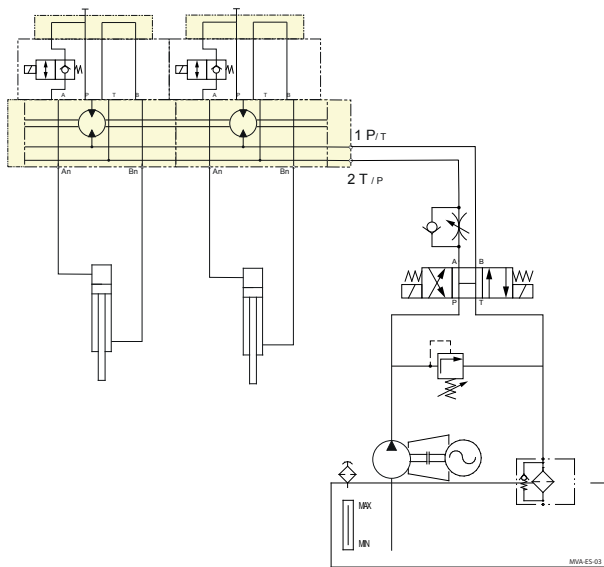
**MVE**

2 Elements flow divider with integrated relief valve and flow rate regulator. On the CETOP a command valve installed. Relief valves installed on the elements CETOP to realign the actuators at the end of the stroke.



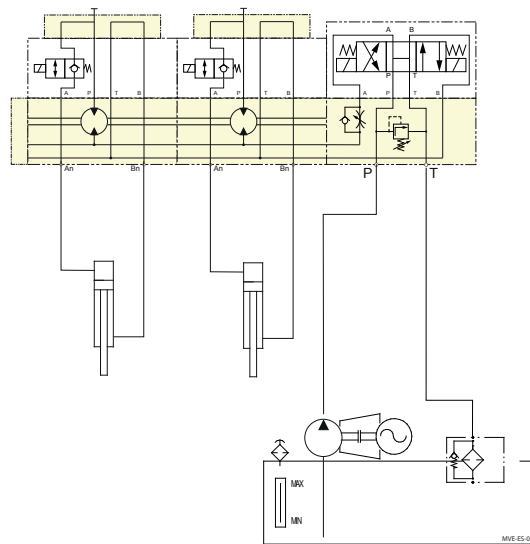
2 Elements Flow Divider with electrical check valves on each element CETOP interface

**MVA**

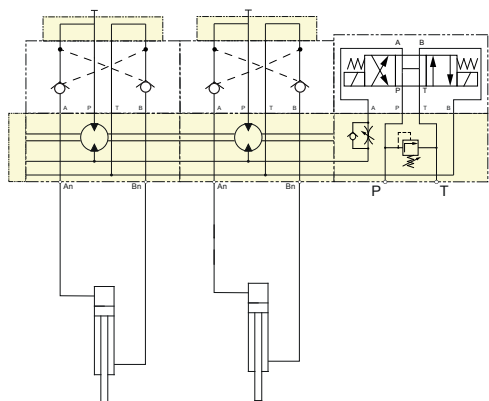


**MVE**

2 Elements flow divider with integrated relief valve and flow rate regulator. On the CETOP a command valve installed. Relief valves installed on the elements CETOP to realign the actuators at the end of the stroke. Electrical check valves on each element CETOP interface.



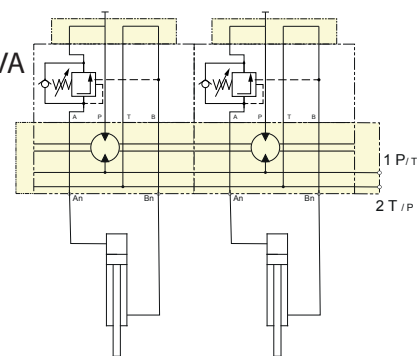
**MVE**



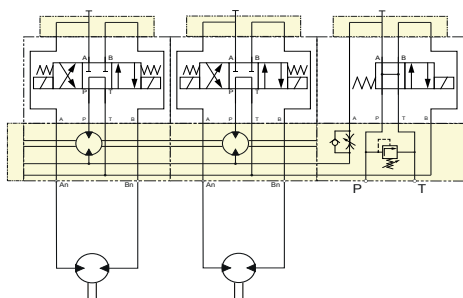
2 Elements flow divider with integrated relief valve and flow rate regulator. On the CETOP a command valve installed. Relief valves installed on the elements CETOP to realign the actuators at the end of the stroke. On the single elements CETOP, piloted nonreturn valves.

Flow divider with overcenter valves on each CETOP.

**MVA**



**MVE**



2 Elements flow divider with integrated relief valve and flow rate regulator. On the CETOP a command valve installed. Relief valves installed on the elements CETOP to realign the actuators at the end of the stroke. On the single element CETOP, independent 3 position controls.

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Vivoil Oleodinamica Vivolo s.r.l  
Via Leone Ginzburg 2-4 40054 Budrio (Bo) Italy  
Tel +39 051 803689 - Fax+39 051 800061  
site : [www.vivoil.com](http://www.vivoil.com)

