HI-LO Pump

P. HI-LO
PUMPS
HI = HIGHT PRESSURE - LOW FLOW
LO = LOW PRESSURE - HIGHT FLOW

VIVOIL OLEODINAMICA VIVOLO

ITALIANO

SUMMARY

GENERAL DESCRIPTION

The HI-LOW pump is useful when an operating cycle is required to run at different speeds, especially when a considerable part of the cycle is carried out with zero or far less than the actual working effort.

Typical applications for this type of pump are: forming machine tools, waste compactors, deep-drawing presses, log splitters, etc.

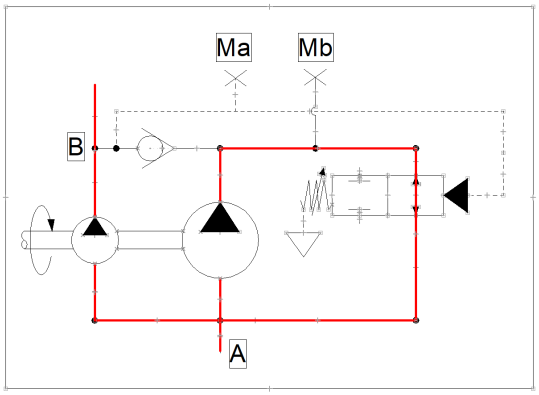
The HI-LOW VIVOIL pump is essentially a double pump in which the drive pump is the pump dedicated to providing the high pressure; the final pump provides the low pressure flow (added to the front pump) for fast movements. The necessary valves have been integrated into the intermediate plate and cover:
- 3-way directional valve with external piloting
- 2-way directional check valve (guide poppet type)

Below a given pressure (decoupling pressure, set by adjusting the set screw of the valve), the flow rate delivered by the pump is the sum of the flow rate of the front and rear stages.
Above the decoupling pressure, the rear stage is put into recirculation and delivers no flow; under these conditions, only the front stage operates, whose flow rate is only given by its displacement, being able to reach the maximum pressure required by the application.
The function of the diverter valve is carried out by the directional valve in the pump cover, which automatically switches the flow direction depending on the piloting: when a certain pressure is exceeded, the valve switches and opens the recirculation channel of the pump. The non-return valve closes the connection between the two stages so that only the front stage reaches maximum pressure.

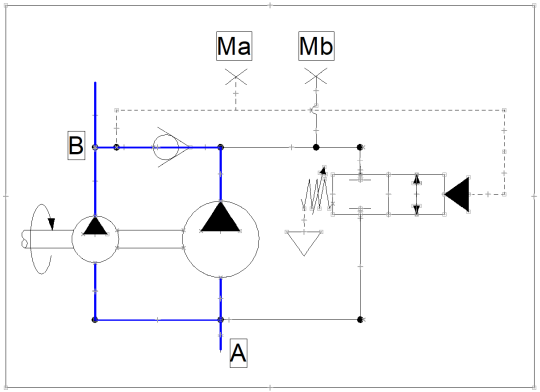
FEATURES

- **N.1 INLET**
- **N.1 OUTLET**
- **DIRECTIONAL SPOOL-TYPE VALVE**
- **DIRECTIONAL CONTROL TWO WAY CHECK VALVE**
- **N.2 PRESSURE GAUGE SOCKETS: Mb, Ma**

SCHEME HI-LOW



HIGH PRESSURE



HIGH FLOW

DIMENSIONING

The main purpose of the HI-LOW pump is to optimise power absorption during the operating cycle by in-creasing the operating speed during low-pressure operation.

DATA:

V_{LO}	[cc/rev]	= final pump displacement (low-pressure element)
V_{HI}	[cc/rev]	= pump drive displacement (high-pressure element)
p_{LO}	[bar]	= maximum pressure with high flow and low pressure operation
p_{HI}	[bar]	= maximum pressure with high pressure and low flow operation
n	[rpm]	= engine rpm
10	[bar]	= final stage recirculation pressure (average value, depends on operating flow rates)
Q_{LO}	[l/min]	= flow rate of the final pump (low-pressure element)
Q_{HI}	[l/min]	= flow rate of the drive pump (high-pressure element)
η_v	0.9÷0.95	= volumetric efficiency
η_m	0.8÷0.9	= mechanical efficiency

CALCULATIONS:

T_{LO} [Nm] = $p_{LO} \times (v_{LO} + v_{HI}) \ / \ 20 \times \pi \times \eta_m$ = total torque absorbed in LOW PRESSURE phase

T_{HI} [Nm] = $(p_{HI} \times v_{HI} + 10 \times v_{LO}) / 20 \times \pi \times \eta_m$ = total torque absorbed in HIGH PRESSURE phase

T_{INT} [Nm] = $(p_{LO} \times v_{LO}) / 20 \times \pi \times \eta_m$ = totale torque absorbed in final pump (low-pressure element)

POWER ABSORBED:

Pm_{LO} [kW] = $(v_{LO} + v_{HI}) \times p_{LO} \times n \ / \ 600000 \times \eta_m$ = power absorbed in LOW PRESSURE phase

Pm_{HI} [kW] = $[(v_{HI} \times p_{HI}) + (v_{LO} \times 10)] \times n / 600000 \times \eta_m$ = power absorbed in HIGH PRESSURE phase

TOTAL FLOW:

Q_{LO} [l/min] = $v_{LO} \times n \times \eta_v$ = flow rate delivered by the final pump (low-pressure element)

Q_{HI} [l/min] = $v_{HI} \times n \times \eta_v$ = flow rate delivered by the driving pump (high-pressure element)

Q_{TOT} [l/min] = $Q_{LO +} Q_{HI}$ = total pump flow rate with $p < p_{LO}$

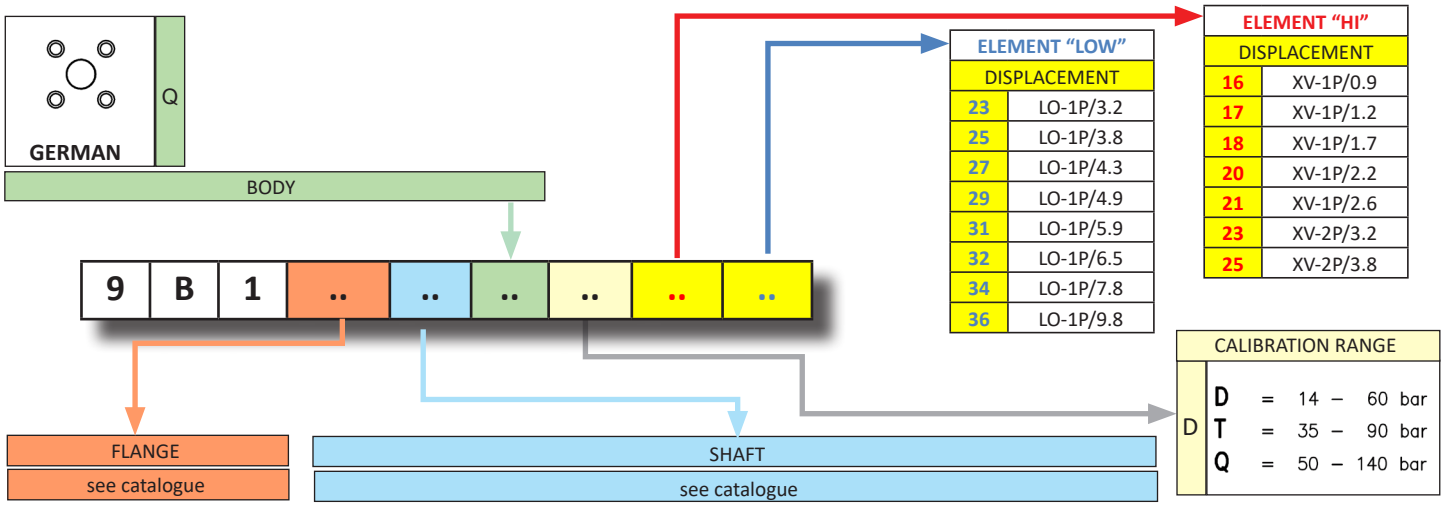
LIMIT VALUE:

$Q_{LO} < 60$ [l/min] (gr. 2)
$Q_{LO} < 20$ [l/min] (gr. 1)
p_{HI} = see pressure value P1-P3 on pump catalogue
p_{LO} = see valve calibration range
Maximum coupling torque gr.2 = 86.2 [N/m]
Maximum coupling torque gr.1 = 42.8 [N/m]

It is recommended to ALWAYS check:

- torque absorbed by the primary shaft and intermediate coupling;
  - $T_{LO} < T.2$ max. permissible see table permissible torques for shafts
  - $T_{HI} < T.2$ max. permissible see table permissible torques for shafts
- T_{INT} < Maximum coupling torque
- flow rate final pump (Q_{LO})
  - $Q_{LO} < 60$ [l/min] (gruppo 2)

CONFIGURATION TABLE - GR.1 - GERMAN PORTS

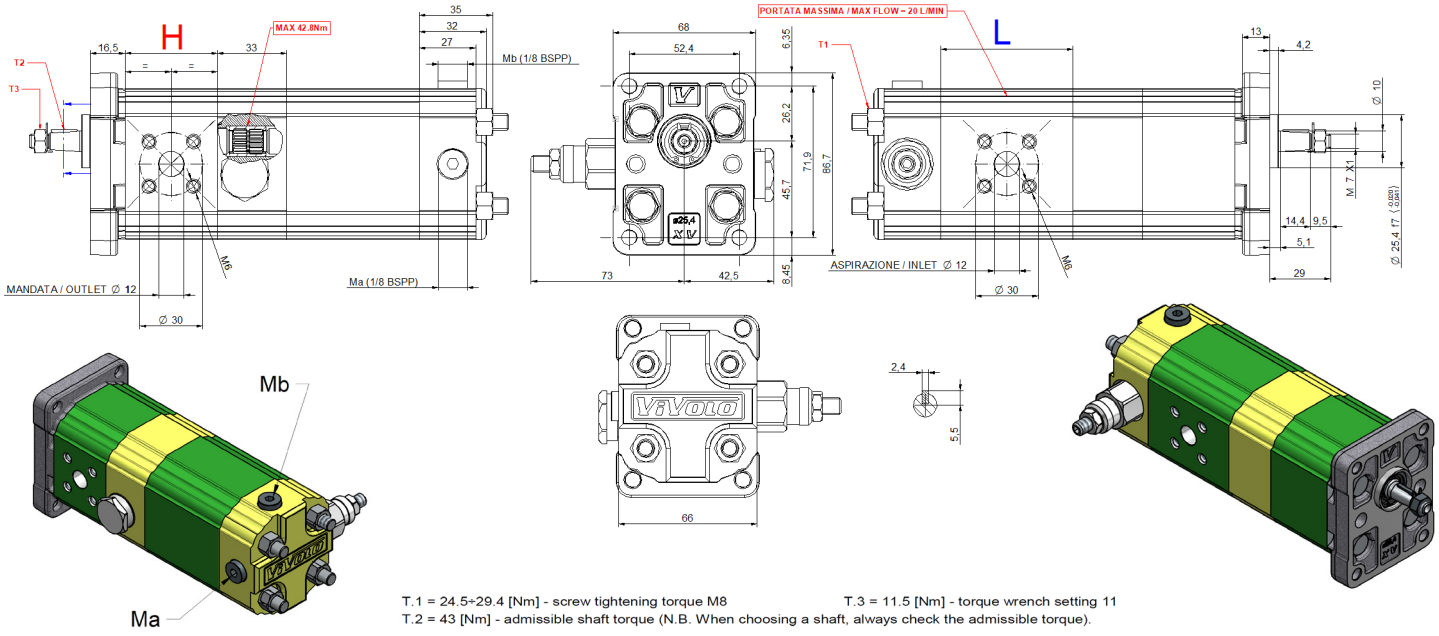


ELEMENT "LOW"	
DISPLACEMENT	
23	LO-1P/3.2
25	LO-1P/3.8
27	LO-1P/4.3
29	LO-1P/4.9
31	LO-1P/5.9
32	LO-1P/6.5
34	LO-1P/7.8
36	LO-1P/9.8

ELEMENT "HI"	
DISPLACEMENT	
16	XV-1P/0.9
17	XV-1P/1.2
18	XV-1P/1.7
20	XV-1P/2.2
21	XV-1P/2.6
23	XV-2P/3.2
25	XV-2P/3.8

CALIBRATION RANGE					
D	D	=	14 –	60	bar
	T	=	35 –	90	bar
	Q	=	50 –	140	bar

DIMENSION GR.1 - FLANGE Ø25.4 - CO001- CLOCKWISE - GERMAN PORTS



T.1 = 24.5÷29.4 [Nm] - screw tightening torque M8
T.2 = 43 [Nm] - admissible shaft torque (N.B. When choosing a shaft, always check the admissible torque).
T.3 = 11.5 [Nm] - torque wrench setting 11

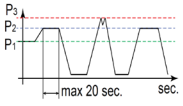
HI						
TYPE	Displacement	H	Max. Pressure		Min speed	Max speed
	cm³/rev		P1 (bar)	P3 (bar)	rpm	rpm
HI-1P/0.9	0.91	41.5	240	290	700	6000
HI-1P/1.2	1.17	42.5	250	300		
HI-1P/1.7	1.56	44				
HI-1P/2.2	2.08	46				
HI-1P/2.6	2.60	48				
HI-1P/3.2	3.12	50				
HI-1P/3.8	3.64	52				

LOW					
TYPE	Displacement	L	Disjunction pressure	Min speed	Max speed
	cm³/rev		Pmax (bar)	rpm	rpm
LO-1P/3.2	3.12	50	60/90/140*	700	6000
LO-1P/3.8	3.64	52		700	5400
LO-1P/4.3	4.16	54		700	4700
LO-1P/4.9	4.94	57		700	4000
LO-1P/5.9	5.85	60.5		700	3400
LO-1P/6.5	6.50	63		700	3000
LO-1P/7.8	7.54	67		700	2600
LO-1P/9.8	9.88	76		700	2000

* see calibration range valve

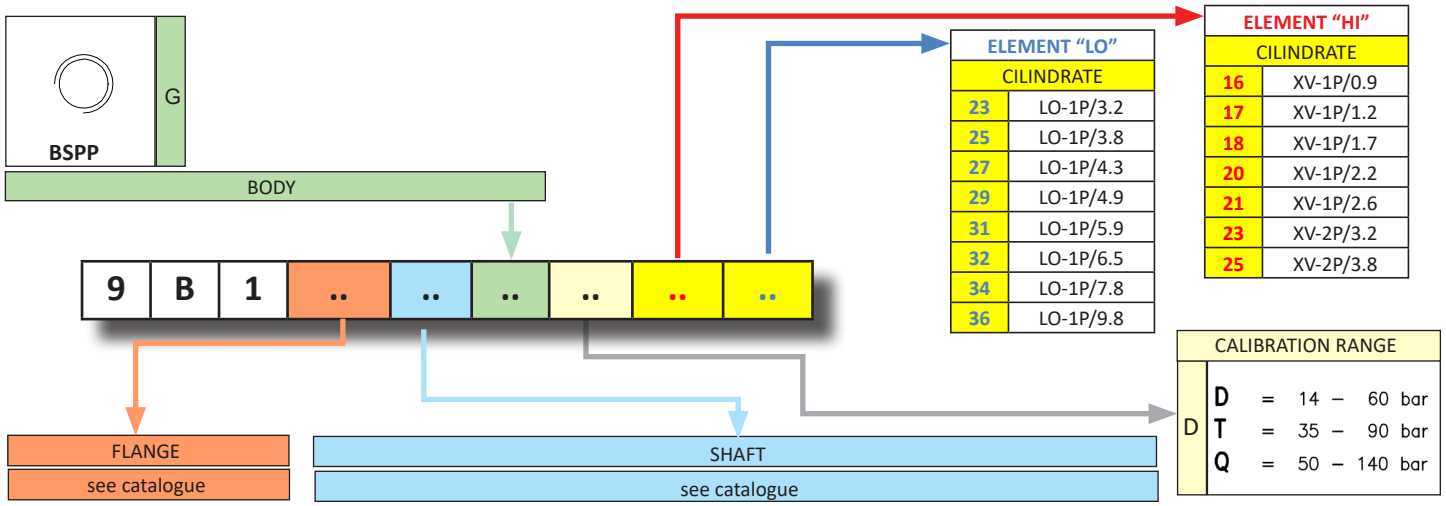
CODE:

9	B	1	02	F	Q	..	..	..



P3 = pressione massima di picco — peak max. pressure
P2 = pressione massima intermittente — intermittent max. pressure
P1 = pressione massima continua — continuous max. pressure

CONFIGURATION TABLE - GR.1 - BSPP PORTS

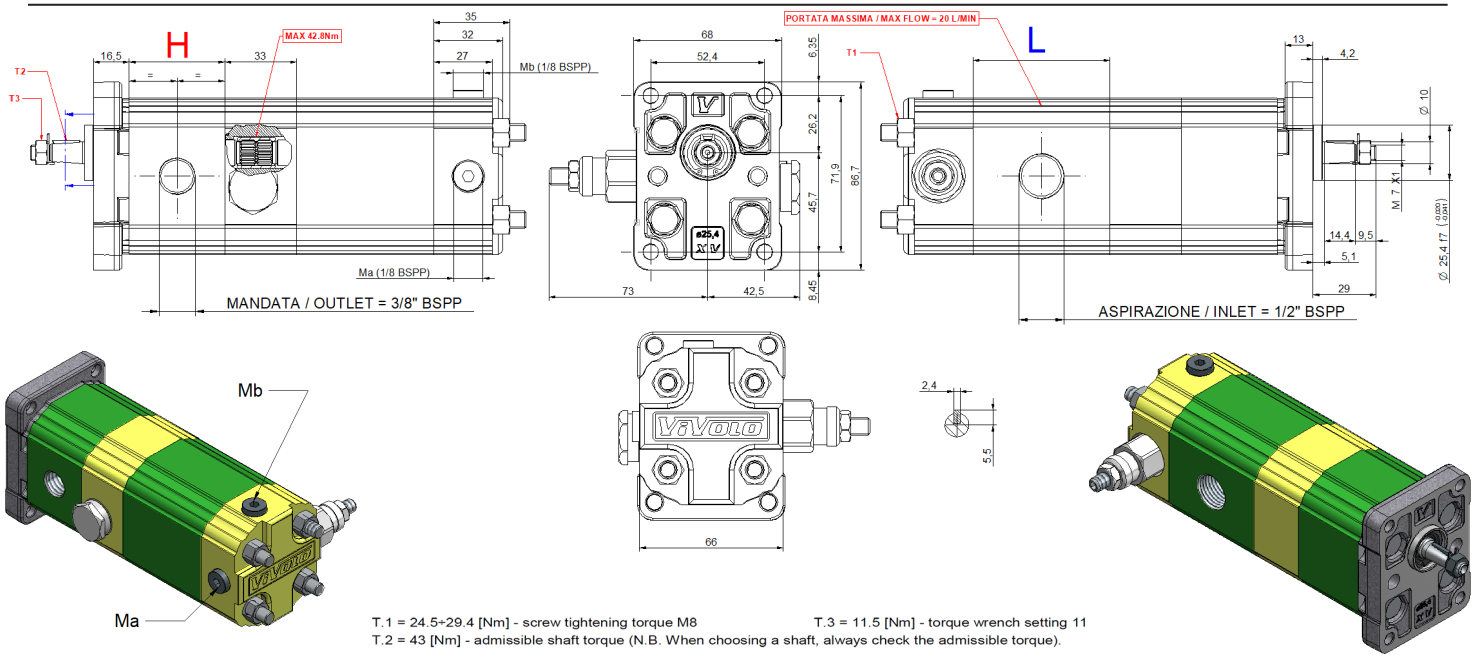


ELEMENT "LO"	
CILINDRATE	
23	LO-1P/3.2
25	LO-1P/3.8
27	LO-1P/4.3
29	LO-1P/4.9
31	LO-1P/5.9
32	LO-1P/6.5
34	LO-1P/7.8
36	LO-1P/9.8

ELEMENT "HI"	
CILINDRATE	
16	XV-1P/0.9
17	XV-1P/1.2
18	XV-1P/1.7
20	XV-1P/2.2
21	XV-1P/2.6
23	XV-2P/3.2
25	XV-2P/3.8

CALIBRATION RANGE					
D	D	=	14 –	60	bar
	T	=	35 –	90	bar
	Q	=	50 –	140	bar

DIMENSION GR.1 - FLANGE Ø25.4 - CO001- CLOCKWISE - BSPP PORTS



T.1 = 24.5÷29.4 [Nm] - screw tightening torque M8 T.3 = 11.5 [Nm] - torque wrench setting 11
T.2 = 43 [Nm] - admissible shaft torque (N.B. When choosing a shaft, always check the admissible torque).

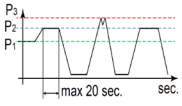
HI						
TYPE	Displacement	H	Max. Pressure		Min speed	Max speed
	cm³/rev		P1 (bar)	P3 (bar)	rpm	rpm
HI-1P/0.9	0.91	41.5	240	290	700	6000
HI-1P/1.2	1.17	42.5	250	300		
HI-1P/1.7	1.56	44				
HI-1P/2.2	2.08	46				
HI-1P/2.6	2.60	48				
HI-1P/3.2	3.12	50				
HI-1P/3.8	3.64	52				

LOW					
TYPE	Displacement	L	Disjunction pressure	Min speed	Max speed
	cm³/rev		Pmax (bar)	rpm	rpm
LO-1P/3.2	3.12	50	60/90/140*	700	6000
LO-1P/3.8	3.64	52		700	5400
LO-1P/4.3	4.16	54		700	4700
LO-1P/4.9	4.94	57		700	4000
LO-1P/5.9	5.85	60.5		700	3400
LO-1P/6.5	6.50	63		700	3000
LO-1P/7.8	7.54	67		700	2600
LO-1P/9.8	9.88	76		700	2000

* see calibration range valve

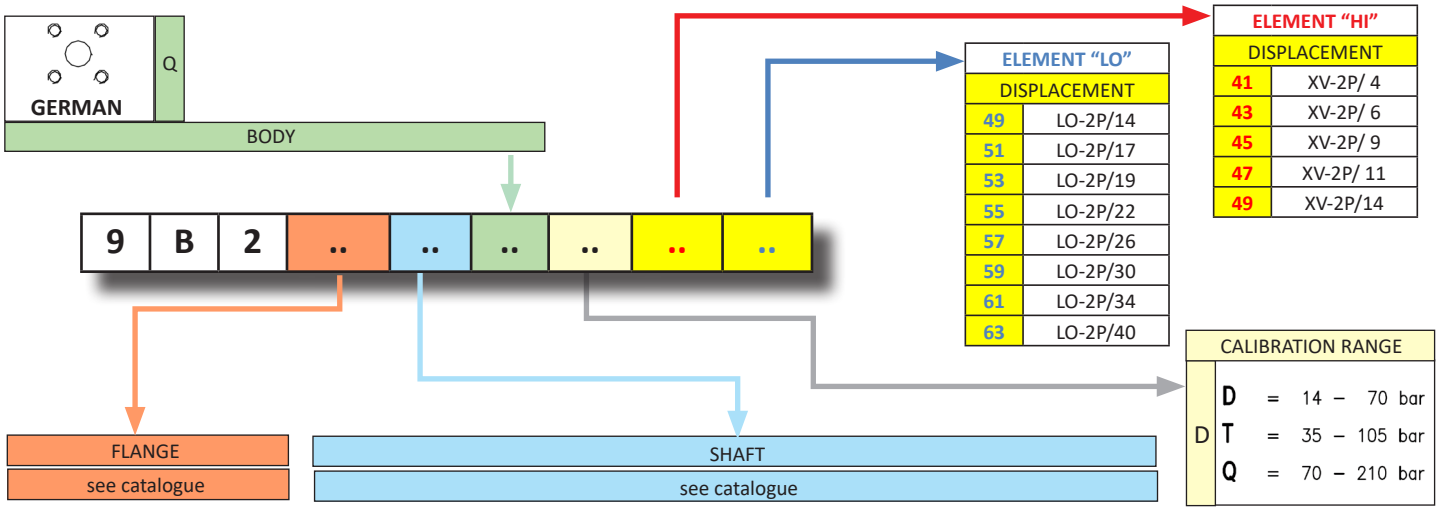
CODE:

9	B	1	02	F	G	..	..	..



P_3 = pressione massima di picco — peak max. pressure
P_2 = pressione massima intermittente — intermittent max. pressure
P_1 = pressione massima continua — continuous max. pressure

CONFIGURATION TABLE - GR.2 - GERMAN PORTS

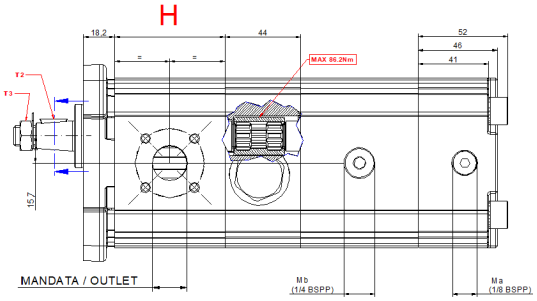


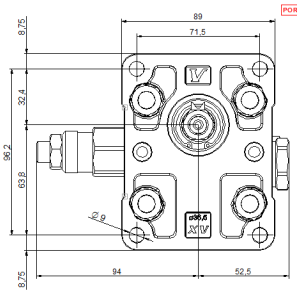
ELEMENT "LO"	
DISPLACEMENT	
49	LO-2P/14
51	LO-2P/17
53	LO-2P/19
55	LO-2P/22
57	LO-2P/26
59	LO-2P/30
61	LO-2P/34
63	LO-2P/40

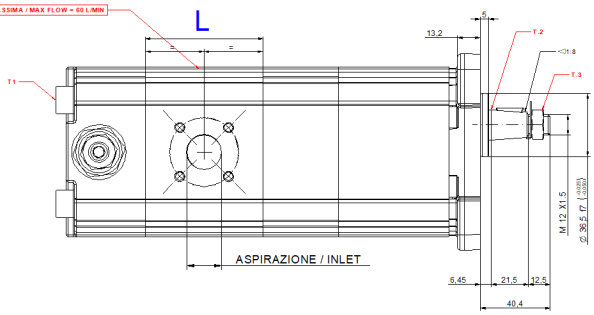
ELEMENT "HI"	
DISPLACEMENT	
41	XV-2P/ 4
43	XV-2P/ 6
45	XV-2P/ 9
47	XV-2P/ 11
49	XV-2P/14

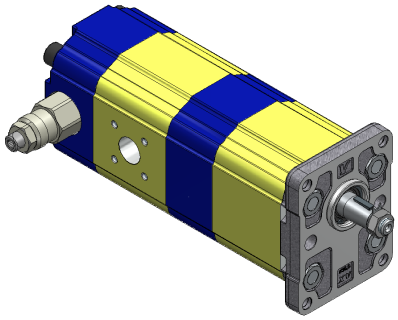
CALIBRATION RANGE				
D	D	=	14 – 70	bar
	T	=	35 – 105	bar
	Q	=	70 – 210	bar

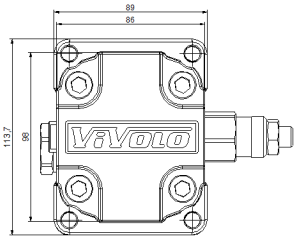
DIMENSION GR.2 - FLANGE Ø36,5 - CO001- CLOCKWISE - GERMAN PORTS

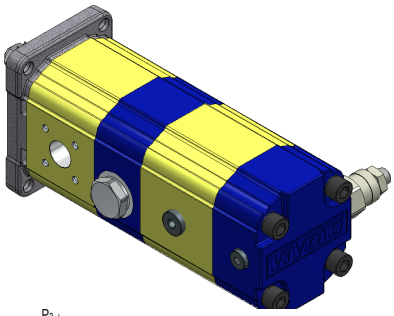




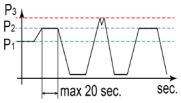








T.1 = 54÷58.9 [Nm] - screw tightening torque M10 T.3 = 40 [Nm] - torque wrench setting 19
T.2 = 233.2 [Nm] - admissible shaft torque (N.B. When choosing a shaft, always check the admissible torque).

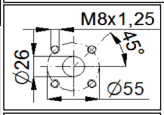
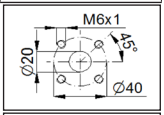
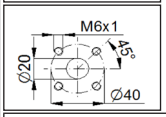
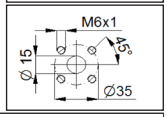


P3 = pressione massima di picco — peak max. pressure
P2 = pressione massima intermittente — intermittent max. pressure
P1 = pressione massima continua — continuous max. pressure

HIGH						
TYPE	Displacement	H	Max. Pressure		Min speed	Max speed
	cm³/rev		P1 (bar)	P3 (bar)	rpm	rpm
HI-2P/04	4.20	47	260	300	700	3500
HI-2P/06	6.00	50				
HI-2P/09	8.40	54				
HI-2P/11	10.80	58				
HI-2P/14	14.40	64	250	290		

LOW					
TYPE	Displacement	L	Disjunction pressure	Min speed	Max speed
	cm³/rev		Pmax (bar)	rpm	rpm
LO-2P/14	14.40	64	70/105/210*	700	3500
LO-2P/17	16.80	68			
LO-2P/19	19.20	72			3100
LO-2P/22	22.80	78			2700
LO-2P/26	26.20	82	70/105/180*		2300
LO-2P/30	30.00	90	70/105/160*		2000
LO-2P/34	34.20	97	70/105/140*		1700
LO-2P/40	39.60	106	70/105/120*		1500

* see calibration range valve

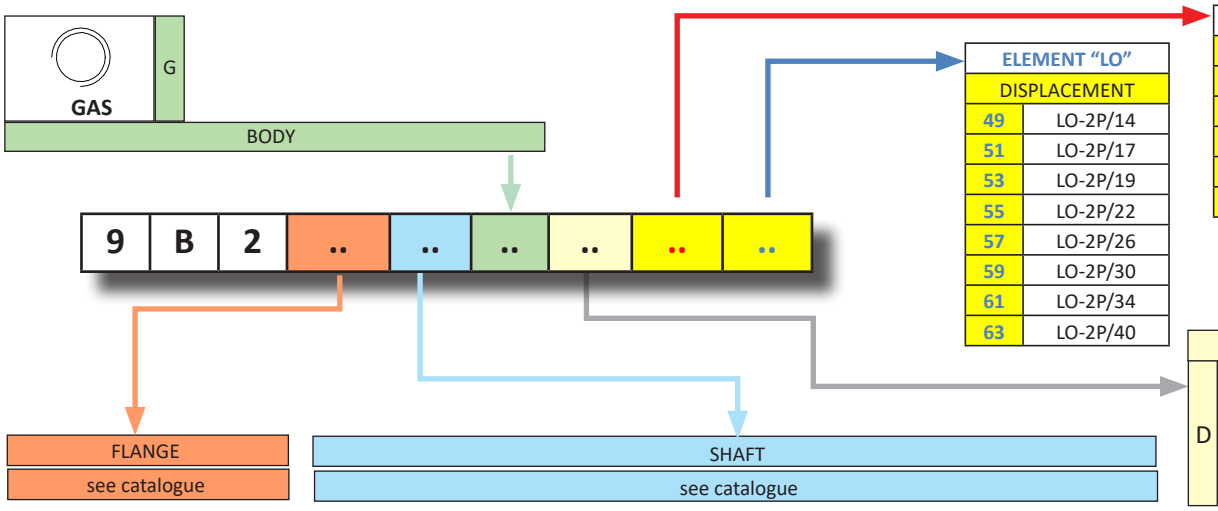
OUTLET	INLET
	
	

The dimensions and the INLET / OUTLET positions depend on the operating conditions. Contact the UT.

CODE:

9	B	2	02	E	Q	..	..	..

CONFIGURATION TABLE - GR.2 - BSPP PORTS

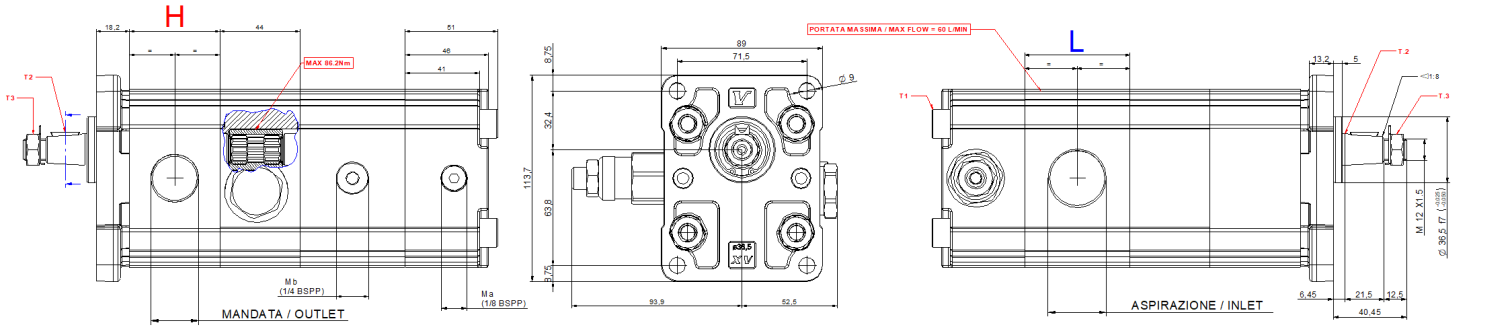


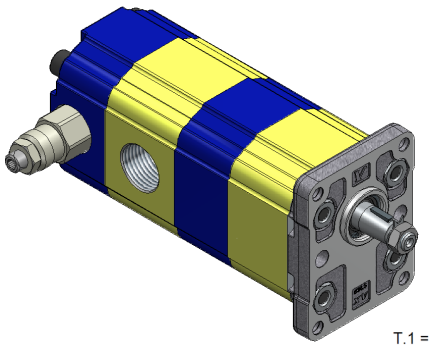
ELEMENT "LO"	
DISPLACEMENT	
49	LO-2P/14
51	LO-2P/17
53	LO-2P/19
55	LO-2P/22
57	LO-2P/26
59	LO-2P/30
61	LO-2P/34
63	LO-2P/40

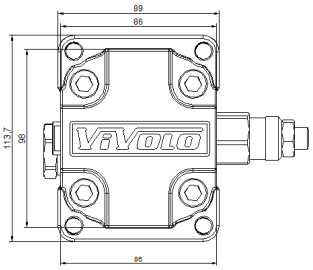
ELEMENT "HI"	
DISPLACEMENT	
41	XV-2P/ 4
43	XV-2P/ 6
45	XV-2P/ 9
47	XV-2P/ 11
49	XV-2P/14

CAMPO DI TARATURA			
D	D	= 14 – 70	bar
	T	= 35 – 105	bar
	Q	= 70 – 210	bar

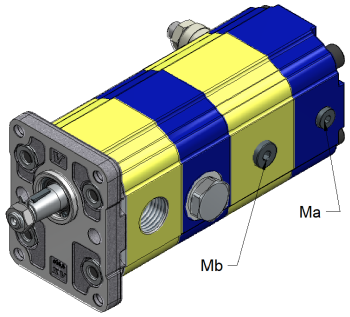
DIMENSION GR.2 - FLANGE ø36,5 - CO001- CLOCKWISE - GERMAN PORTS







SEZIONE D-D



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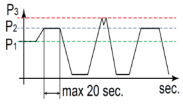
HI-2P/06	6.00	50				
HI-2P/09	8.40	54				
HI-2P/11	10.80	58				
HI-2P/14	14.40	64	250	290		

LOW					
TYPE	Displacement	L	Disjunction pressure	Min speed	Max speed
	cm³/rev		Pmax (bar)	rpm	rpm
LO-2P/14	14.40	64	70/105/210*	700	3500
LO-2P/17	16.80	68			
LO-2P/19	19.20	72			3100
LO-2P/22	22.80	78			2700
LO-2P/26	26.20	82	70/105/180*		2300
LO-2P/30	30.00	90	70/105/160*		2000
LO-2P/34	34.20	97	70/105/140*		1700
LO-2P/40	39.60	106	70/105/120*		1500

* see calibration range valve



P3 = pressione massima di picco — peak max. pressure
P2 = pressione massima intermittente — intermittent max. pressure
P1 = pressione massima continua — continuous max. pressure

OUTLET	INLET
1" BSPP	3/4" BSPP
3/4" BSPP	1/2" BSPP

The dimensions and the INLET / OUTLET positions depend on the operating conditions. Contact the UT.

CODE:

9	B	2	02	E	G	..	..	..

Vivoil Oleodinamica Vivolo reserves the right to make changes to this publication as it sees fit at any time without prior notice in order to keep the information correct and up to date with technical progress.

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

VIVOIL OLEODINAMICA VIVOLO