USE AND MAINTENANCE MANUAL

CE TWO SPEED GEARBOXES

High Precision Mechanical Industries Development

BARUFFALDI
MACHINE TOOL COMPONENTS

WARNINGS

Before setting at work, carefully read instructions for use and follow them!

Only qualified personnel, that has carefully read instructions, is allowed to operate on BF gearboxes.

Responsibility and warranty are excluded if:

- Instructions for use are not followed
- The gearbox is not operated in a correct way
- Maintenance is not performed correctly and regularly
- Functional changes of any type are brought without manufacturer's consent
- Original spare parts are not used

NOTE:

This symbol highlights critical operations:

- *a wrong procedure can cause damages to the gearbox*
- *non observance can impair operator's safety*

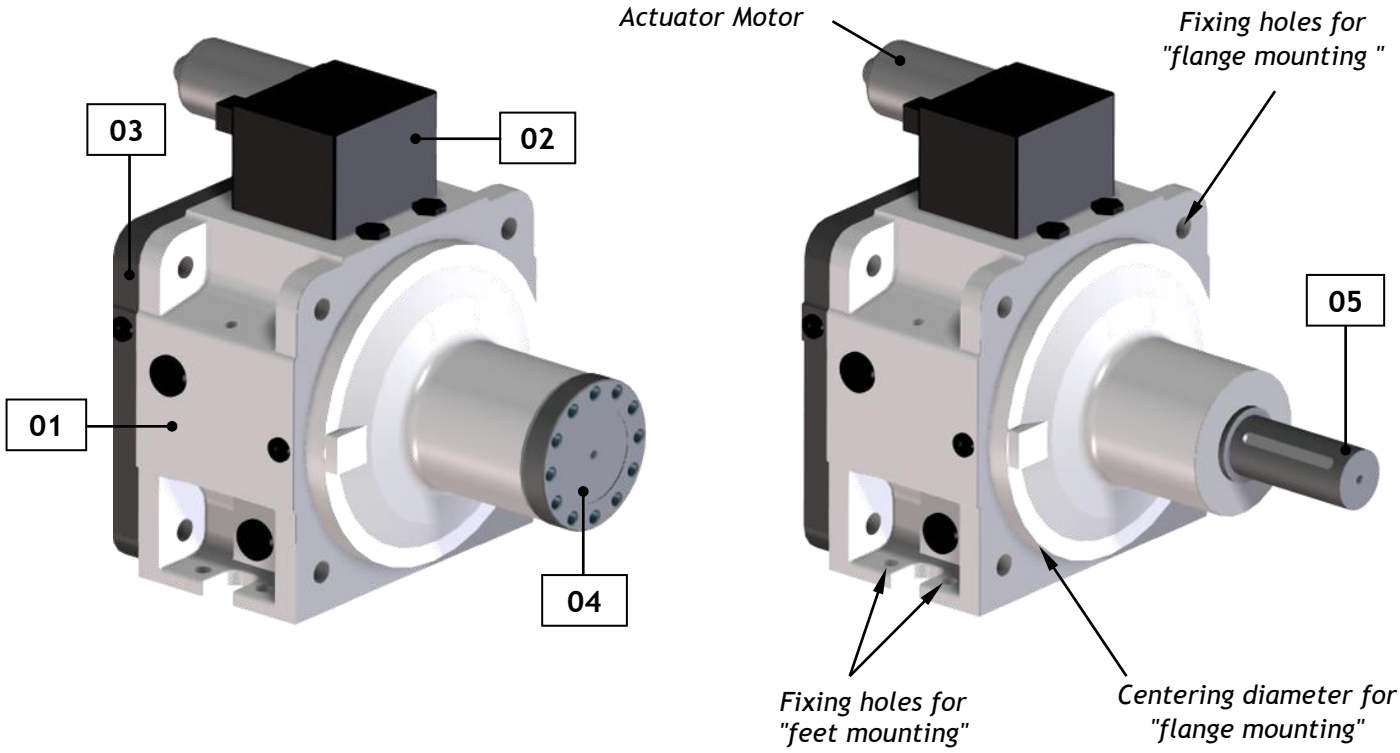
Operating the gearbox for long periods in high speed mode can produce a local damage on the engaged teeth of the gears. This may turn in noisy operation.

Thus, it is necessary to operate the gearbox in low speed mode for a few seconds after max.1 hour operation in high speed mode, in order to change the engagement position and to allow the lubrication of the gears.

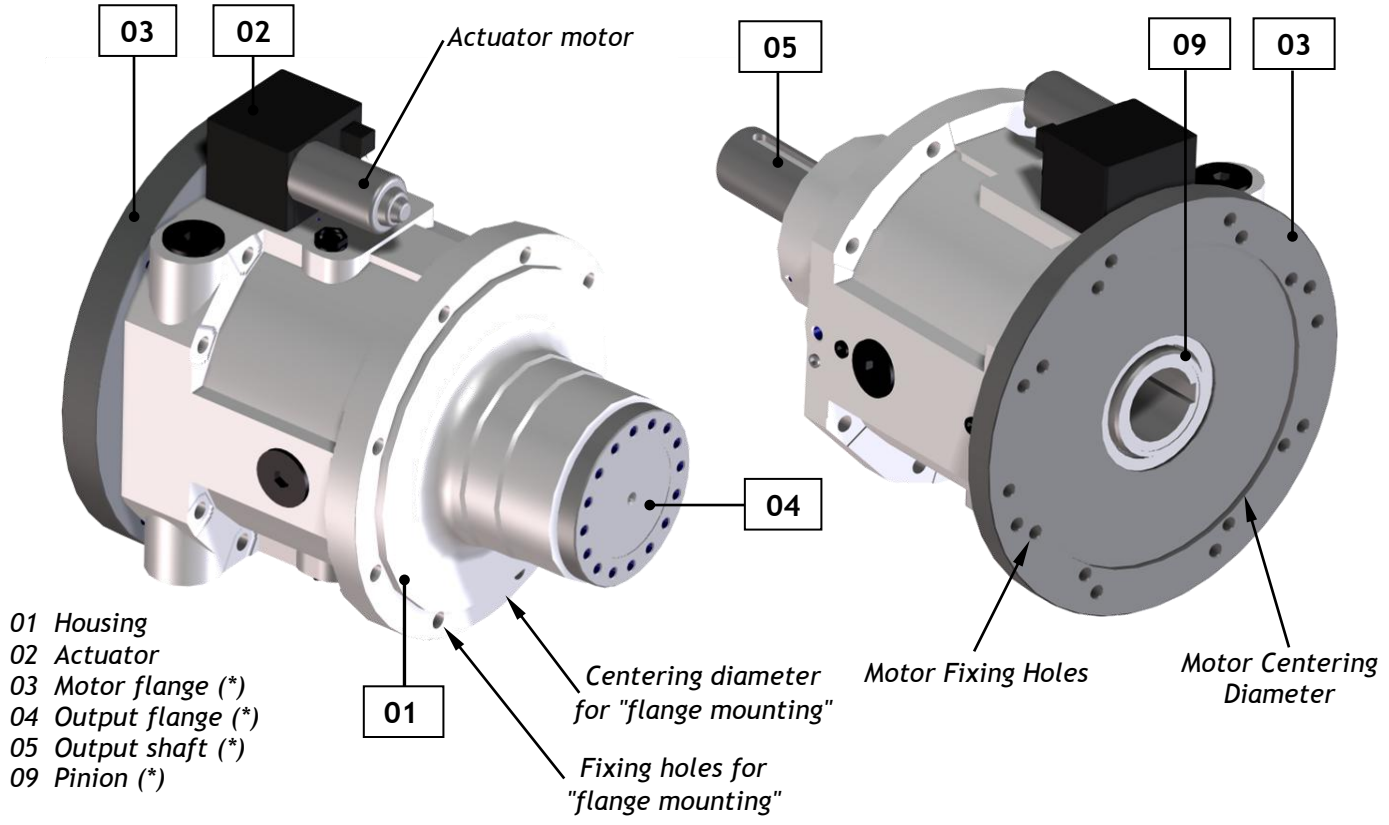
All gearboxes are delivered without oil.
Always make sure that a proper lubrication is applied to the gearbox, according to the ordered code.

1 STRUCTURE OF THE GEARBOX

Flange Output	Shaft Output



Flange Output - Gearbox type CE 20 - Shaft Output



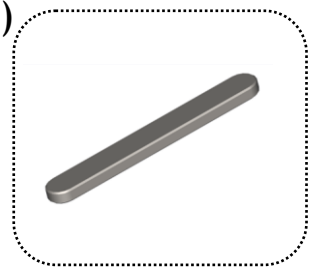
01 Housing
02 Actuator
03 Motor flange (*)
04 Output flange (*)
05 Output shaft (*)
09 Pinion (*)

(*) according to the ordering code

1.1 DELIVERY CONDITIONS

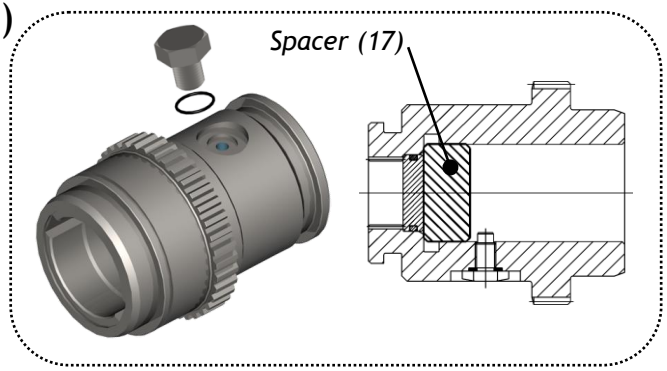
***All Gearboxes are delivered with*:**

- Test report
- Electrical connector **(a)** complete with plug and relevant pins
- Balancing insert **(b)** for motor shaft balancing *(if necessary)*
- Oil level sensor **(c)** *(on request)*

(a)  + (b)  + (c) 

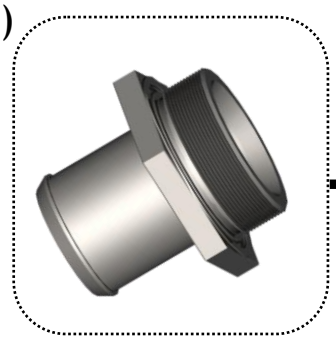
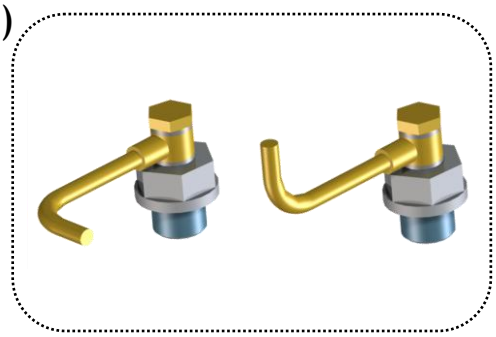
Additional components only for Gearboxes type CE 12-14

- Pinion **(d)** according to the ordered motor, with o-ring and screw
- Only for some motors, spacer (17), to be inserted in the pinion

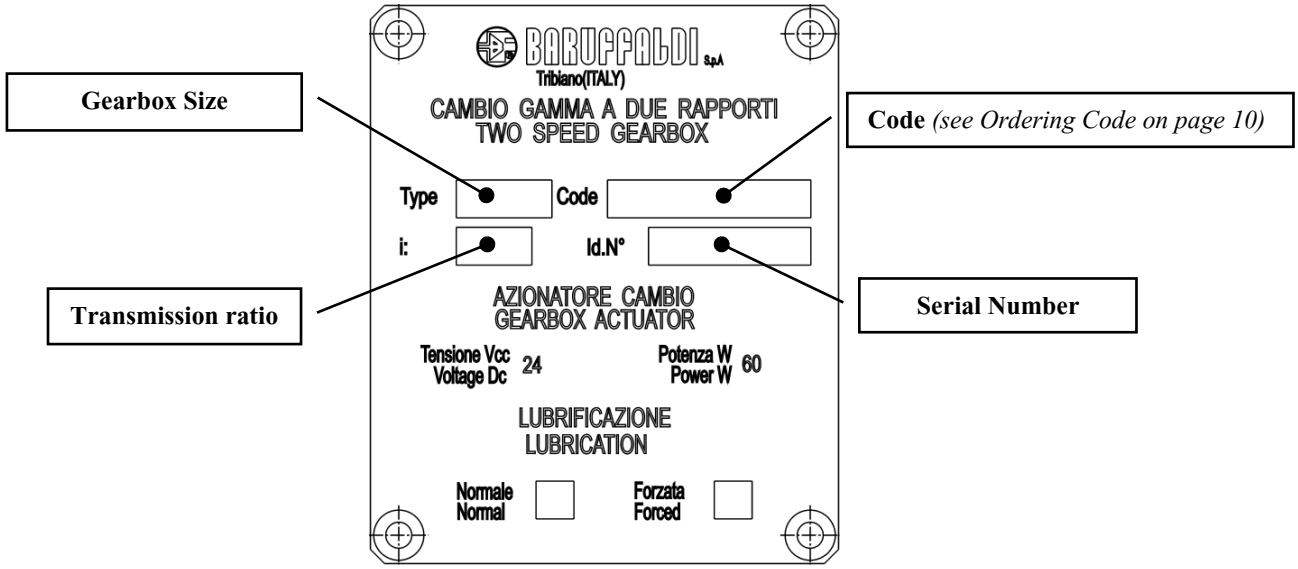
(d) 

Additional components only for Gearboxes type CE 20

- Drain fitting **(e)**
- Vent fitting **(f)**

(e)  + (f) 

1.2 DATA LABEL

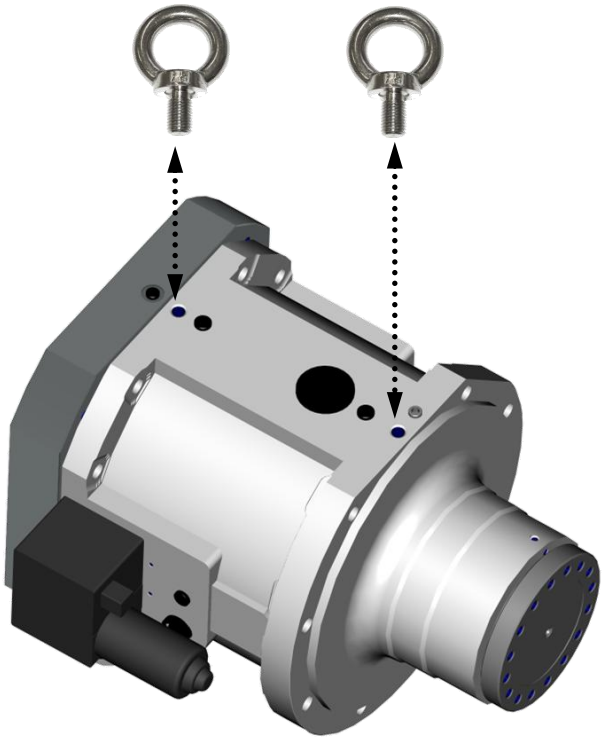


1.3 HANDLING AND LIFTING THE GEARBOXES

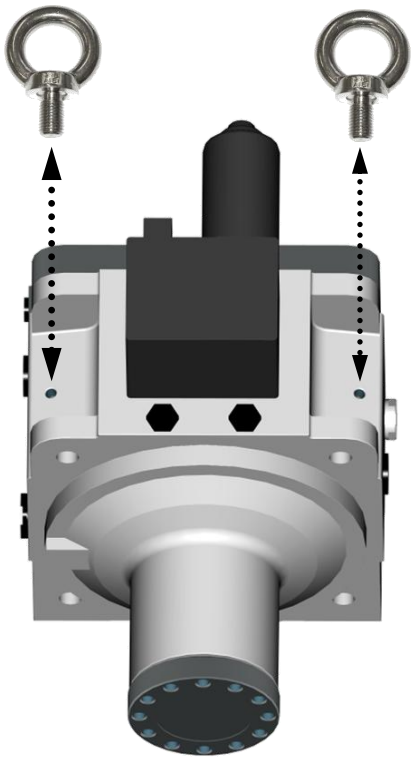
GEARBOX	CE						
Size	**11**	**12**	**13**	**14**	**16**	**18**	**20**
Eyebolt hole dimension	M10	M10	M10	M12	M12	M12	M20
Approximate weight (kg) (depending on motor flange)	45	50	80	90	190/230	190/230	190/230

Use the holes shown below for gearbox lifting

CE 20



CE 11-12-13-16-18



1.4 TECHNICAL DATA

Size / Taglia			CE11		CE12		CE13			CE14			CE16		CE18		CE20
Ratio / Rapporto			i=4	i=4,48	i=4	i=5	i=4	i=4,4	i=4,9*	i=4	i=5	i=5.5	i=4	i=5	i=4	i=5	i=4
Nominal power / Potenza nominale		kw	19	19	22	22	40	40	40	50	50	50	60	60	63	63	84
Nominal speed / Velocità nominale		RPM	1500		1500		1500			1500			1250		1000		1000
Nominal input torque / Coppia nominale in entrata	(S1) Nm	i=4	120	-	140	-	260	-	-	325	-	-	450	-	600	-	800
		i=4.4	-	-	-	-	-	260	-	-	-	-	-	-	-	-	-
		i=4.48	-	120	-	-	-	-	-	-	-	-	-	-	-	-	-
		i=4.923	-	-	-	-	-	-	260	-	-	-	-	-	-	-	-
		i=5	-	-	-	140	-	-	-	-	280	-	-	450	-	600	-
		i=5.5	-	-	-	140	-	-	-	-	-	280	-	-	-	-	-
Nominal input torque / Coppia nominale in entrata	(S6) Nm	i=4	150	-	160	-	400	-	-	400	-	-	630	-	840	-	900
		i=4.4	-	-	-	-	-	400	-	-	-	-	-	-	-	-	-
		i=4.48	-	150	-	-	-	-	-	-	-	-	-	-	-	-	-
		i=4.923	-	-	-	-	-	-	400	-	-	-	-	-	-	-	-
		i=5	-	-	-	160	-	-	-	-	325	-	-	630	-	840	-
		i=5.5	-	-	-	160	-	-	-	-	-	325	-	-	-	-	-
Nominal output torque / Coppia nominale in uscita	Nm	i=4	480	-	560	-	1040	-	-	1300	-	-	1800	-	2400	-	3200
		i=4.4	-	-	-	-	-	1144	-	-	-	-	-	-	-	-	-
		i=4.48	-	540	-	-	-	-	-	-	-	-	-	-	-	-	-
		i=4.923	-	-	-	-	-	-	1280	-	-	-	-	-	-	-	-
		i=5	-	-	-	700	-	-	-	-	1400	-	-	2250	-	3000	-
		i=5.5	-	-	-	700	-	-	-	-	-	1540	-	-	-	-	-
Max permitted input speed / Numero di giri massimo in entrata		RPM	8000	8000	8000	8000	7000	7000	7000	6300	6300	6300	5000	5000	5000	5000	5000
Mass moment of inertia** / Momento d'inerzia di massa**	i=1 ($kgcm^2$)		134		189		310			624			1587		1630		2066
	i=4	output	400		378		1136			1408			6208		6256		6896
	($kgcm^2$)	input	25		23,6		71			88			388		391		431
	i=4.4	output	-		-		1355			-			-		-		-
	($kgcm^2$)	input	-		-		70			-			-		-		-
	i=4.48	output	400		-		-			-			-		-		-
	($kgcm^2$)	input	20		-		-			-			-		-		-
	i=4.923	output	-		-		1570			-			-		-		-
	($kgcm^2$)	input	-		-		68			-			-		-		-
	i=5	output	-		550		-			2075			9400		9450		-
	($kgcm^2$)	input	-		22		-			83			376		378		-
	i=5.5	output	-		-		-			2450			-		-		-
	($kgcm^2$)	input	-		-		-			80			-		-		-
Max angular backlash / Gioco angolare massimo	α	Arcmin	≤ 25		≤ 25		≤ 25			≤ 25			≤ 25		≤ 25		≤ 25
Max radial backlash / Gioco radiale massimo	X	mm	0,03		0,03		0,03			0,03			0,03		0,03		0,03
Max axial backlash / Gioco assiale	Y	mm	0,25		0,25		0,25			0,25			0,25		0,25		0,25
Max vibration value / Valore massimo vibrazioni		mm/s	1		1		1			1			1		1		1
At test run speed / velocità di riferimento test		RPM	6000		6000		6000			6000			4000		4000		4000
Weight ca. / Peso circa		kg	45		65		80			90			190÷230		190÷230		190÷230
Oil fill volume / Volume d'olio	dm^3	Opp. (B5)	0,6		1,1		2,1			3,1			-		-		-
		Indicative value; refer to the level indicator. indicativo fare riferimento al livello della spia.															Valore
Oil grade for: / Viscosità olio:	Splash lubrication / Lubrificazione a sbattimento		HLP 68 as per ISO VG68		Recirculation lubrication / Lubrificazione forzata				HLP 46 as per ISO VG46				Rec. Lub. With heat exchanger / Lub. For. con scambiatore di calore				HLP 32 as per ISO VG32
Oil change interval*** / Intervallo cambio olio***		h	5000														
Oil temperature / Temperatura olio			Max 120°c permitted depending on application, installation position,lubrication and cooling														

1.5 ACTUATOR (SHIFTING UNIT) ELECTRICAL DATA

Needed power supply 24Vcc ± 10% min 5A / Alimentatore necessario 24Vcc ± 10% min 5A		
Shifting unit power consumption / consumo potenza azionatore	W	60
Supply voltage / Tensione di alimentazione	Vcc	24

Nominal current / Corrente nominale	In (A)	2,5
Starting current / Corrente di avvio	Ia (A)	8.5
Inner clutch slipping current / Corrente di frizionamento	A	3.5±0.5

** Only for splash lubrication*

*** On request*

1.6 ORDERING CODE

Trasmission ratio Rapporto di trasmissione			code
Ratio Rapporto	4	CE 11 - CE 12 - CE 13 - CE 14 CE 16 - CE 18 - CE 20	4
Ratio Rapporto	5	CE 12 - CE 14 CE 16 - CE 18	5
Ratio Rapporto	4.48	CE 11	5
Ratio Rapporto	4.4	CE 13	7
Ratio Rapporto	4.923	CE 13	8
Ratio Rapporto	5.5	CE 14	9

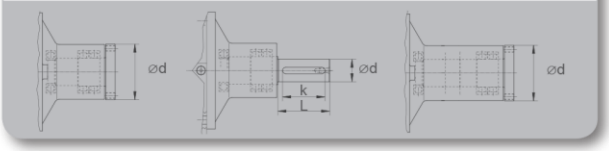
Size Grandezza		code
CE 11	19 KW	11
CE 12	22 KW	12
CE 13	40 KW	13
CE 14	50 kW	14
CE 16	60 KW	16
CE 18	63 KW	18
CE 20	84 KW	20

Input motor shaft balancing Bilanciamento albero motore	code
Balanced without key Bilanciato senza chiavetta	0
Balanced with half key Bilanciato con mezza chiavetta	1
Balanced with full key Bilanciato con chiavetta intera	2

VERSION Standard VERSIONE Standard	01
With oil sensor and actuator at 180° Con sensore olio e azionatore a 180°	06
With actuator at 180° Con azionatore a 180°	07
With oil sensor Con sensore olio	08
With double bearing Con doppio cuscinetto	10
With double bearing and oil sensor Con doppio cuscinetto e sensore olio	20
With angular contact bearings Con cuscinetti obliqui	21
Whit bigger oil drain hole Con foro di scarico maggiorato	24
Only for CE 14 , long neck gearbox Solo per CE 14, cambio a collo lungo	27
Only for CE 20, compact gearbox with output shaft for coaxial assembly Solo per CE20, cambio compatto uscita albero adatto per montaggi coassiali	30

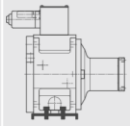
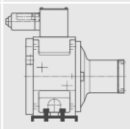
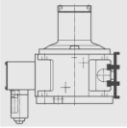
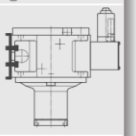
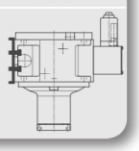
2 3 ▪ ▪ ▪ ▪

Output unit Tipo di uscita	code	Output unit Tipo di uscita	code
Flange Flangia CE 11 Ø 100 CE 12 Ø 100 CE 13 Ø 118 CE 14 Ø 118 CE 16 Ø 140 CE 18 Ø 150 CE 20 Ø 180	1	Long shaft without key Albero lungo senza chiavetta CE 14 L=128 Ød=55 k= — CE 20 L=160 Ød=65 k= —	5
Shaft with key Albero con chiavetta CE 11 L= 80 Ød=42 k= 70 CE 12 L= 80 Ød=42 k= 70 CE 13 L=110 Ød=48 k= 90 CE 14 L=110 Ød=55 k=100 CE 16 - CE 18 - CE 20 L=140 Ød=65 k=125	2	Shaft with double key Albero con doppia chiavetta CE 13 L=110 Ød=48 k= 90 CE 14 L=110 Ød=55 k=100	6
Shaft without key Albero liscio senza chiavetta CE 11 L= 80 Ød=42 k= — CE 12 L= 80 Ød=42 k= — CE 13 L=110 Ød=48 k= — CE 14 L=110 Ød=55 k= — CE 16 L=140 Ød=65 k= — CE 20 L=140 Ød=65 k= —	3	Short shaft with double key Albero ridotto con doppia chiavetta CE 13 L= 70 Ød=42 k=60 CE 14 L= 70 Ød=42 k=60	7
Long shaft with key Albero lungo con chiavetta CE 14 L=128 Ød=55 k=125 CE 20 L=160 Ød=65 k=125	4	Short shaft without key Albero ridotto senza chiavetta CE 13 L= 70 Ød=42 k= — CE 14 L= 70 Ød=42 k= —	8



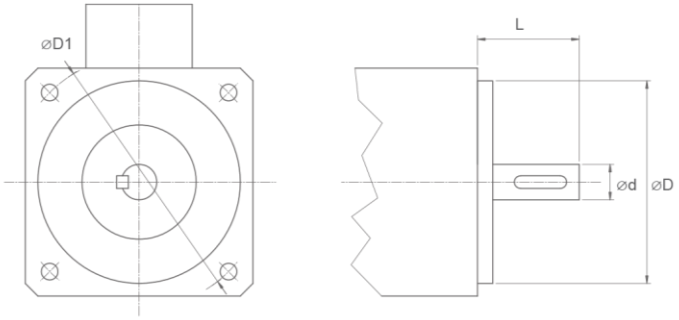
Cod	Motor Size Dimensioni del motore
*	see next page vedi pagina seguente

Cod	Options Opzioni
B	Angular backlash reduced Gioco angolare ridotto
X	Sealed cover actuator Azionatore a tenuta sul coperchio
F	Oil flow rate switch Flussostato

code	Lubrication Lubrificazione	Assembling Piazzamento
0	CE 11-12-13-14 Horizontal OPP/OPS Max input speed 4500 rpm SPLASH LUBRICATION CE 11-12-13-14 Orizzontale OPP/OPS Velocità massima in entrata 4500 rpm LUBRIFICAZIONE A SBATTIMENTO	
1	CE 11-12-13-14-16-18-20 Horizontal OPP/OPS FORCED LUBRICATION CE 11-12-13-14-16-18-20 Orizzontale OPP/OPS LUBRIFICAZIONE FORZATA	
2	CE 11-12-13-14-16-18-20 Vertical Upward VFA FORCED LUBRICATION CE 11-12-13-14-16-18-20 Verticale alto VFA LUBRIFICAZIONE FORZATA	
3	CE 11-12-13-14-16-18-20 Vertical downward VFB FORCED LUBRICATION CE 11-12-13-14-16-18-20 Verticale basso VFB LUBRIFICAZIONE FORZATA	
4	CE 12-14 Vertical downward VFB Max input speed 4500 rpm SPLASH LUBRICATION CE 12-14 Verticale basso VFB Velocità massima in entrata 4500 rpm LUBRIFICAZIONE A SBATTIMENTO	

1.7 MOTOR FLANGE DIMENSIONS

Motor dimensions provided by the manufacturer
Dimensioni del motore fornite dal produttore



CE 11

Motor Code / Codice motore	Diameter / Diametro	Length / Lunghezza	Centering / Centraggio	Distance between center / Interasse fori
	d	L	D	D1
0	38	80	180	215
1	32	80	180	215
2	42	110	250	300
3	48	110	180	215
4	48	110	230	265
5	48	110	250	300
6	42	113	114.3	200
7	42	110	230	265
8				
A				

CE 12

Motor Code / Codice motore	Diameter / Diametro	Length / Lunghezza	Centering / Centraggio	Distance between center / Interasse fori
	d	L	D	D1
0	38	80	180	215
1	38	80	230	265
2	42	110	250	300
3	48	110	180	215
4	48	110	230	265
5	48	110	250	300
6	28	60	180	215
7	42	110	230	265
8	32	80	180	215
A	55	110	230	265
E	55	110	250	300

CE 13

Motor Code / Codice motore	Diameter / Diametro	Length / Lunghezza	Centering / Centraggio	Distance between center / Interasse fori
	d	L	D	D1
0	42	110	250	300
1	55	110	230	265
2	55	110	300	350
3	60	140	300	350
4	48	110	250	300
5	48	110	230	265
6	55	110	250	300
7	42	110	300	350
8	42	110	230	265
A	55	110	280	325

CE 14

Motor Code / Codice motore	Diameter / Diametro	Length / Lunghezza	Centering / Centraggio	Distance between center / Interasse fori
	d	L	D	D1
0	42	110	250	300
1	55	110	230	265
2	55	110	300	350
3	60	140	300	350
4	48	110	250	300
5	48	110	230	265
6	55	110	250	300
7	38	80	230	265
8	42	110	230	265
A	48	110	300	350
B	60	140	350	400

CE 16 - CE 18 - CE 20

Motor Code / Codice motore	Diameter / Diametro	Length / Lunghezza	Centering / Centraggio	Distance between center / Interasse fori
	d	L	D	D1
0	60	140	300	350
1	65	140	350	400
2	75	140	450	500
3	80	170	350	400
4	75	140	300	350
5	65	140	450	500
6	70	140	350	400
7	55	110	300	350
8	65	140	300	350

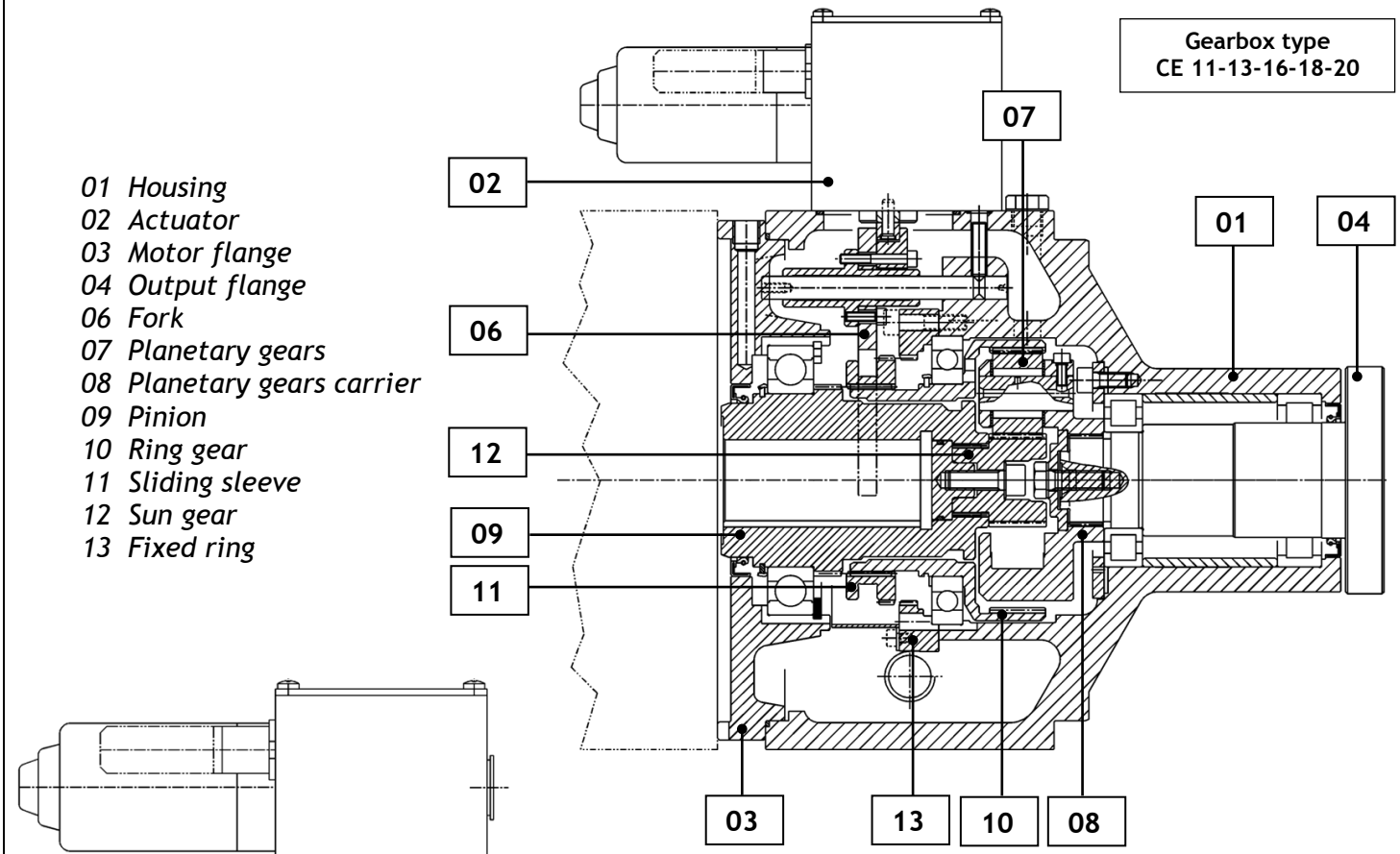
On demand, link flanges can be provided for special motors not included in the above list.

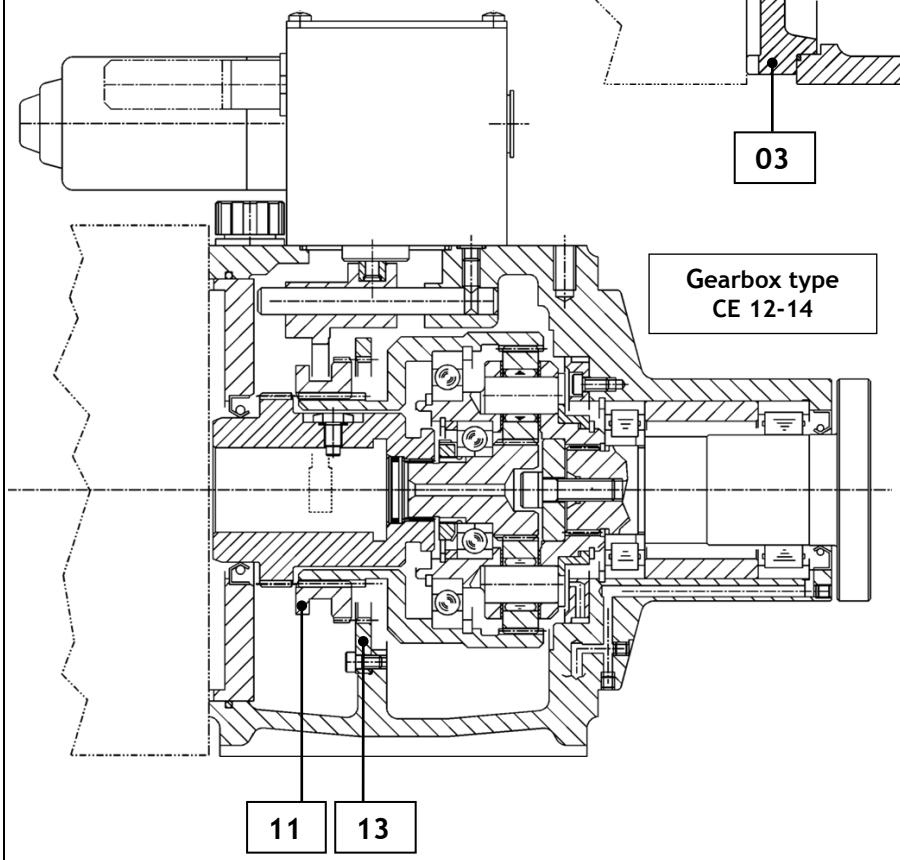
2 FUNCTIONING PRINCIPLE

2.1 MAIN DESCRIPTION

The actuator (02), acting on the fork (06), moves the sliding sleeve (11) to engage either the pinion (09) or the fixed ring (13).
When the sliding sleeve engages the pinion, the gearbox is in ***high speed*** mode (1:1).
When the sliding sleeve engages the fixed ring, the gearbox is in ***low speed*** mode (1:i).
When the sliding sleeve engages neither the pinion, nor the fixed ring, the gearbox is in ***neutral mode***, i.e. the output shaft is disconnected from the input shaft.

01 Housing
02 Actuator
03 Motor flange
04 Output flange
06 Fork
07 Planetary gears
08 Planetary gears carrier
09 Pinion
10 Ring gear
11 Sliding sleeve
12 Sun gear
13 Fixed ring





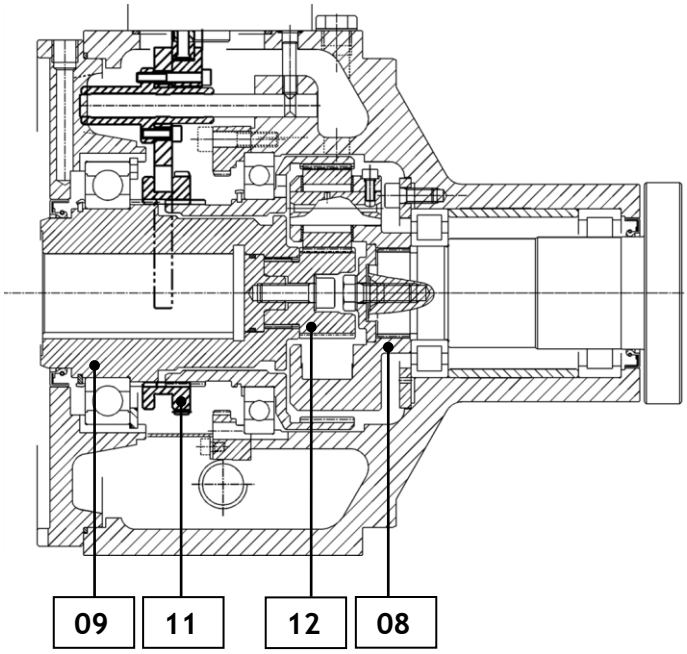
2.2.1 Gearbox in high speed mode (1:1)

In this operating mode, the sliding sleeve (11) is engaged with the pinion (09).
Motion coming from the motor goes to the planetary unit both through the ring gear (10) and the sun gear (12), so the planet carrier (08) turns at the same speed of the motor.
The gearbox is in 1:1 mode (direct mode).

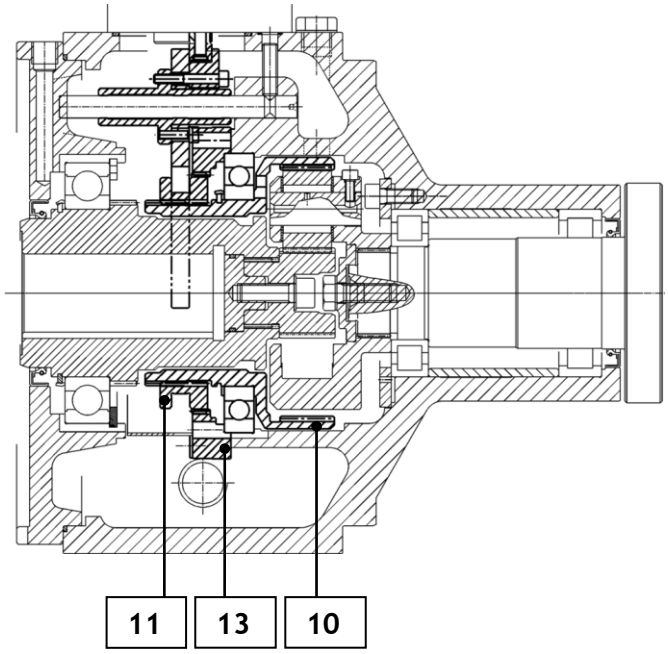
2.2.2 Gearbox in low speed mode (1:i)

In this operating mode, the sliding sleeve (11) is engaged with the fixed ring (13).
Motion coming from the motor goes to the planetary unit through the sun gear (12), while the ring gear (10) is still because it is engaged with the fixed ring (13).
The gearbox is in 1:i mode (reduction mode).

High speed mode (1:1)

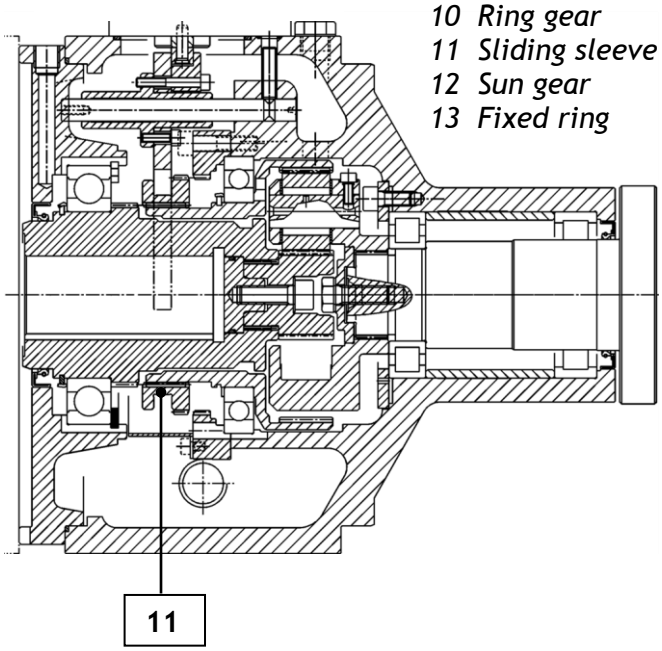


Low speed mode (1:i)



08 Planetary gears carrier
09 Pinion
10 Ring gear
11 Sliding sleeve
12 Sun gear
13 Fixed ring

Neutral mode



2.2.3 Gearbox in neutral mode

In this operating mode, the sliding sleeve (11) is engaged neither with the pinion (09) nor with the fixed ring (13).
Motion coming from the motor goes to the planetary unit through the sun gear (12), but, being the ring gear (10) free to rotate, no torque is transmitted to the planet carrier (or at least a very low value due to friction).
In this configuration the gearbox is in neutral mode.

2.2 GENERAL OPERATING RULES

Planetary gearboxes can be used in the three positions described above.

Low speed mode (chapter 2.2.2) can be used without time limitations, the gearbox can operate continuously, provided all parameters are within the gearbox specifications.

During **high speed mode** operation (chapter 2.2.1), the motor torque is transmitted to the output shaft through the planetary unit, though there is no relative speed in its components.
In fact, sun gear (12) and ring gear (10) turn at the same speed, so the planetary gears (7) have no relative speed with reference to the sun gear and ring gear.
It means that the torque is transmitted by the same gears teeth, that might be stressed and result in increased noise over time.

In order prevent teeth damages and increased noise, it is mandatory to switch to low speed mode for a few seconds every 1 hour of continuous operation in high speed mode, whatever the speed is.
This will cause the planetary gears (7) to turn, changing the teeth that transmit torque and allowing a proper lubrication too.

For all other operating specifications, please refer to chapter 5.3

3 GEARBOX START-UP

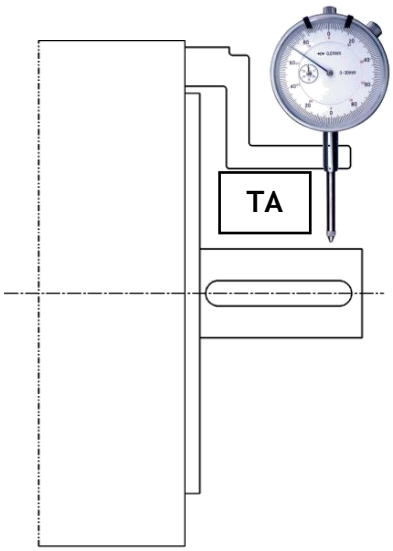
3.1 MOTOR SPECIFICATIONS

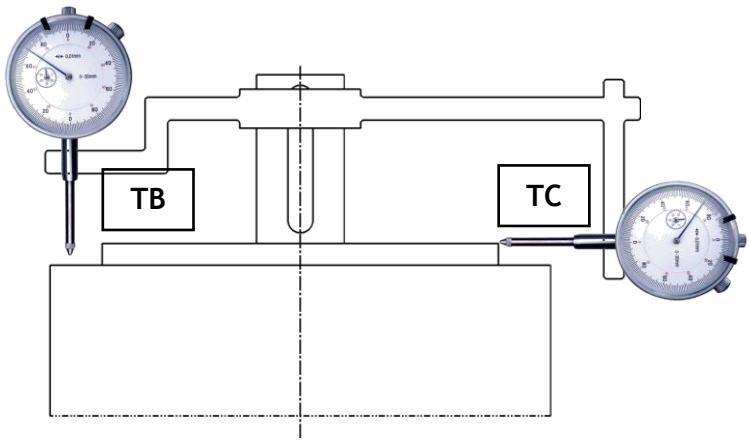
3.1.1 Dimensions and tolerances

The motor applied to the gearbox should comply with the following specifications:

- Size and power admitted by the gearbox
- Motor without seal on the shaft (all gearboxes are sealed towards the motor)
- Construction tolerances according to **DIN 42955-R** *(see below)*
- Vibration level **R**

Construction Tolerances according to DIN 42955-R			
Motor Size (center height - mm)	**TA**	**TB**	**TC**
112	0.025	0.050	0.050
132	0.025	0.063	0.063
160	0.030	0.063	0.063



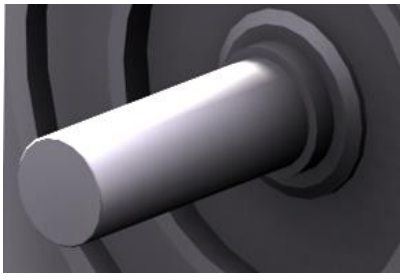


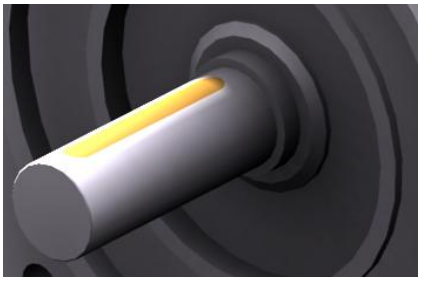
3.1.2 Motor balancing

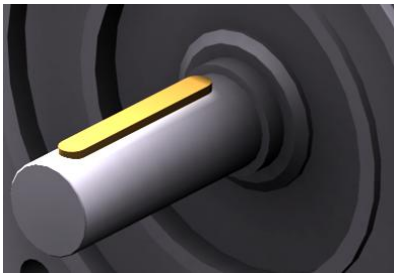
Motors can be supplied with key or with straight shaft (no key).
In case the motor has a key, it can be balanced in two different ways, i.e. with half key or with full key.

The gearbox must be balanced according to the balancing of the motor shaft, to avoid unwanted vibrations and the balancing way must be specified when ordering the gearbox (see chapter 1.6).

0 - Straight shaft (no key) **1 - Shaft with half key** **2 - Shaft with full key**







3.1.3 Matching motor - gearbox balancing

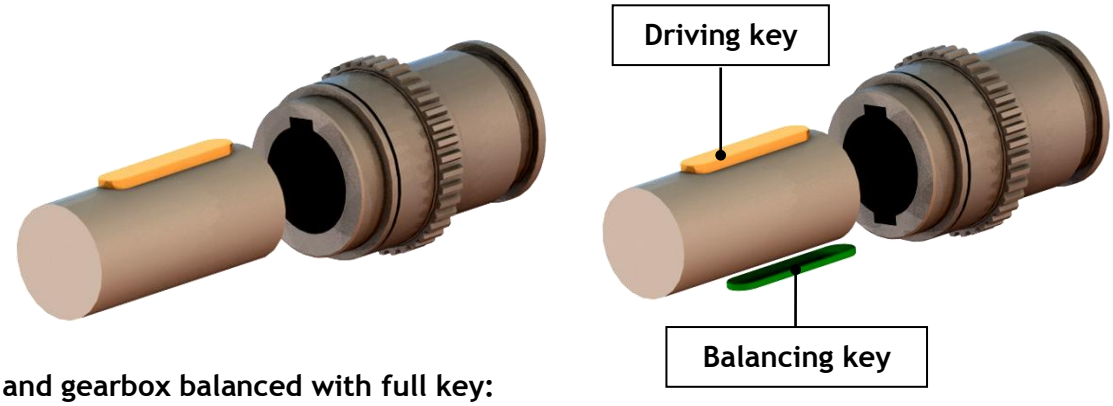
- ***If the motor shaft is straight (no key)***, there is no balancing problem because both the motor shaft and the gearbox pinion are balanced: the gearbox can be fitted directly to the motor by means of the clamping unit provided, see chapters 3.2.2/3.3.2.

- ***If the motor shaft has a key***, according to the balancing option, here are the possible situations:

- **Motor and gearbox balanced with half key:**

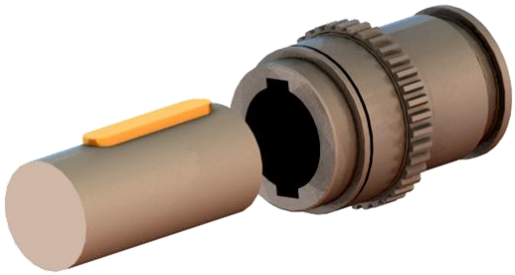
  - ***Pinion with 1 key-slot***: simply fit the key into the motor shaft slot and assemble the gearbox with the motor following the instructions on chapters 3.2-3.3.

  - ***Pinion with 2 key-slots***: fit the driving key into the motor shaft slot, insert the balancing key in the second pinion slot (opposite the first one) and assemble the gearbox with the motor following the instructions on chapters 3.2-3.3.



- **Motor and gearbox balanced with full key:**

  - In this case, the gearbox pinion has always two slots: simply fit the key into the motor shaft slot and assemble the gearbox with the motor following the instructions on chapters 3.2-3.3. No angular orientation is requested, any of the pinion slots can be used as driving slot.



3.1.4 Screws tightening torque

All screws used on gearboxes are 12.9 class and must always be tightened to the torques indicated in the chart.

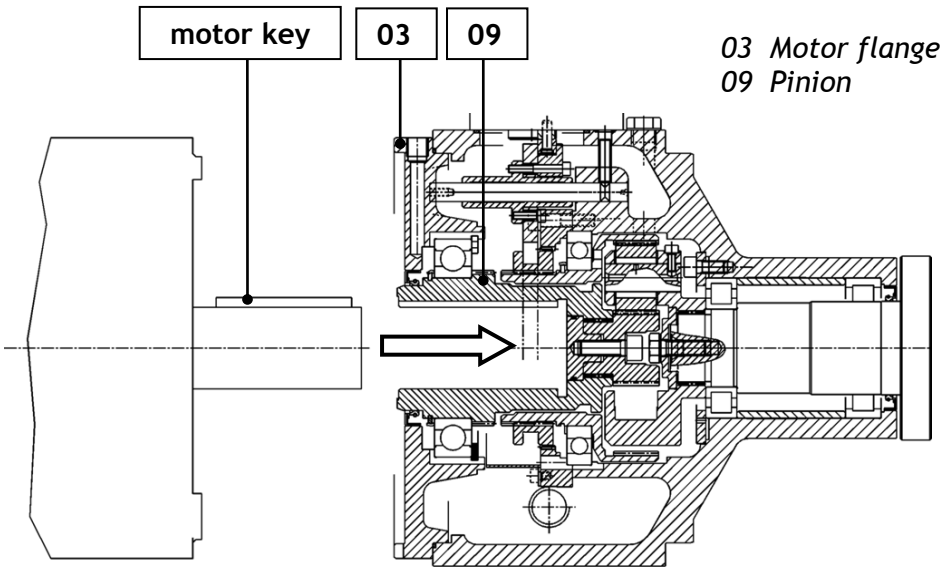
Screws (12.9)	Tightening Torque (Nm)
M5	10
M6	17
M8	40
M10	80
M12	140
M16	340
M20	660

3.2 ASSEMBLING THE MOTOR ON THE GEARBOX - GEARBOX TYPE CE 11 - 13 - 16 - 18 - 20

3.2.1 Motor shaft with key

Always check the full motor code and the gearbox code before proceeding.
Before assembling the motor, always refer to chapter 3.1.3 for the proper balancing of the pinion.

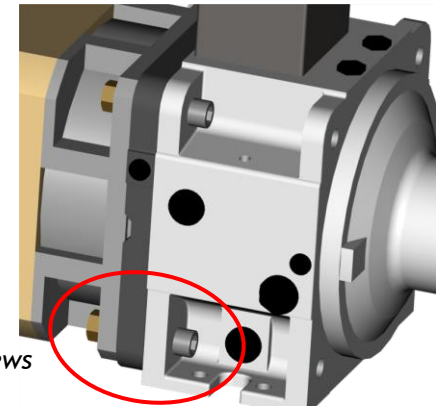
a) Turn the motor shaft until the key is on top
b) Align the pinion (09) slot with the motor key
c) Gently fit the motor on the gearbox



d) Tighten the screws

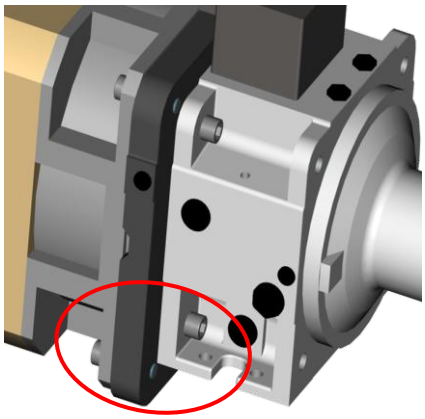
The gearbox flange (03) is fixed to the gearbox housing by means of screws.
If the PCD of the flange-fixing screws is the same as the PCD of the motor-fixing screws, it is necessary to remove the screws (generally n°2) supplied and put longer screws and nuts for final assembly (see picture below, left).
If the PCD of the flange fixing screws is different to the PCD of the motor-fixing screws, then you just have to fix the motor to the flange with proper screws

flange PCD = motor PCD



Longer screws and nuts

flange PCD ≠ motor PCD



Gearboxes type CE11-13-16-18-20 <u>for motors with key</u>, come as a complete unit that must not be disassembled, not even if the screws must be changed (see above)!
Do not remove the motor flange from the gearbox, the seal might be damaged!

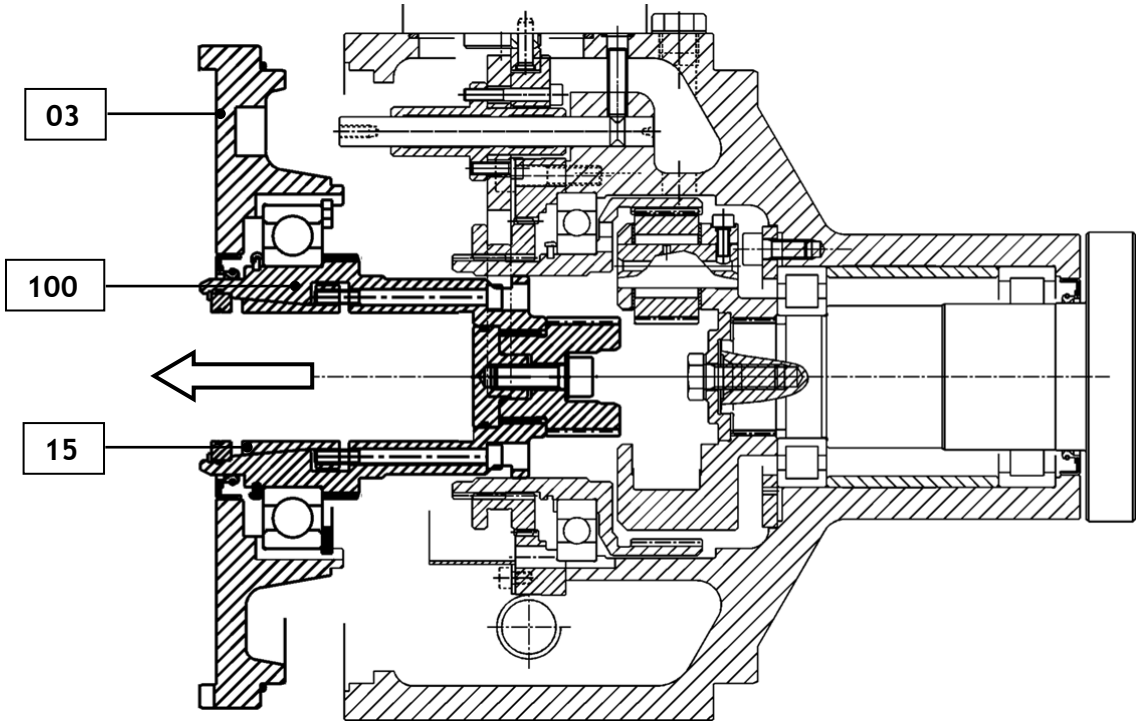
3.2.2 Motor shaft without key (straight shaft) - conical clamping unit

This assembling operation is rather delicate.
Carefully follow the procedure described below!

Step 1

- **REMOVE FLANGE (3) + PINION CLAMPING UNIT (100) FROM THE GEARBOX**

Loosen the screws that fix the motor flange to the gearbox housing and gently pull the flange until the whole assembly is removed. Pay attention not to damage the gears, as this would result in unwanted noise during operation.



Step 2

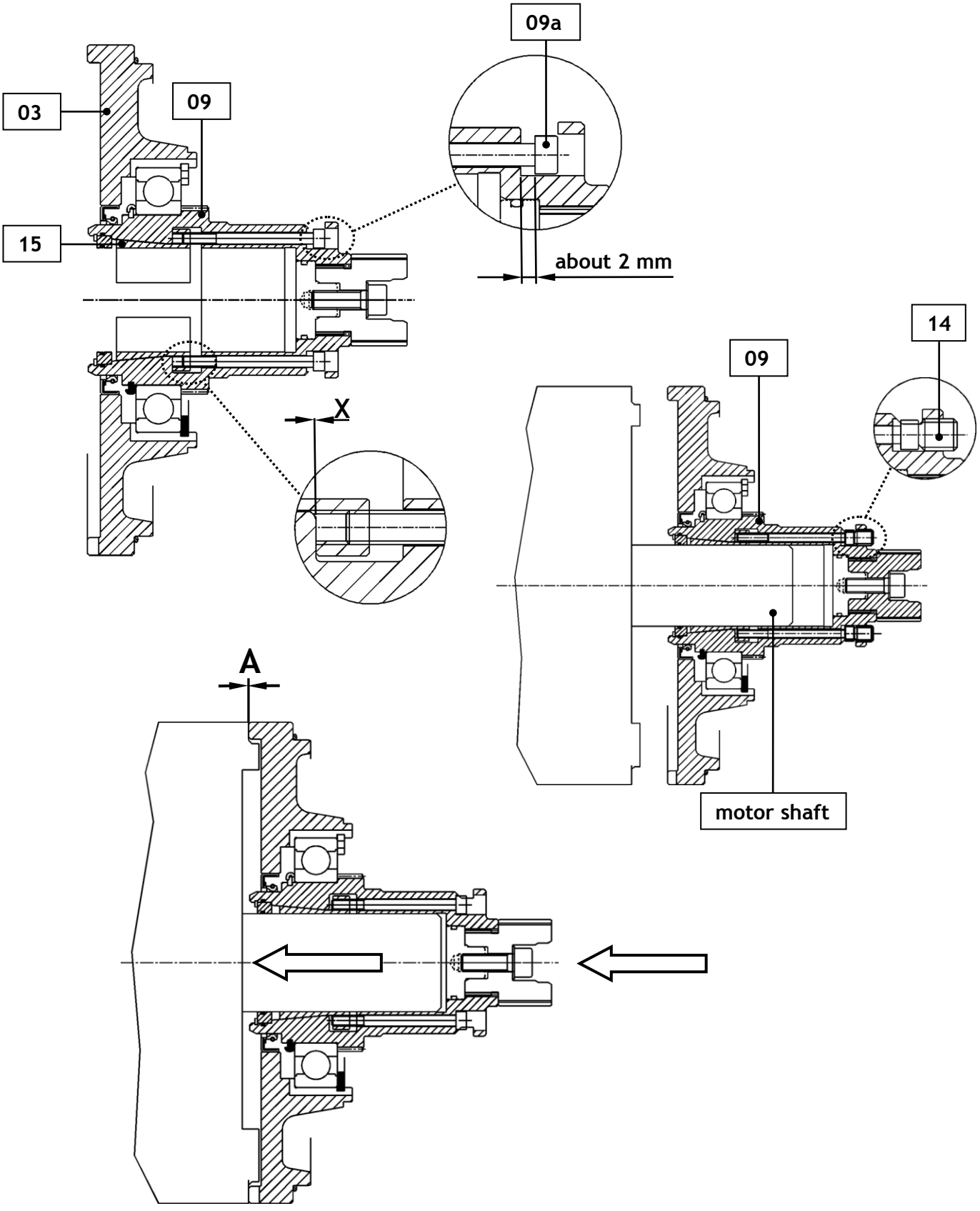
- **FIT THE PINION CLAMPING UNIT (100) ON THE MOTOR SHAFT (pictures on next page)**

a) Clean both motor shaft and pinion (9) hole
b) Oil the areas that get in touch (hole/ shaft) **
c) Before fitting the pinion (9) on the motor shaft, slightly loosen the screws (9a) so that they're about ***2 mm*** from the pinion surface, while clamper sectors (15) are in position (X)
d) Insert the pinion group unit (100) with motor interface flange (03) on the motor shaft
e) Push both pinion (100) and screws (9a) until the gearbox flange is against the motor surface **A**. To allow clamper sectors (15) to slide and prevent them from getting stuck, screws heads should always be kept about ***2 mm*** from the pinion (9) surface and the sectors should always be in position (X) during motor shaft insertion.

NOTE: some gearboxes are equipped with threaded holes for set screws (14) to help keep the screws (9a) and the sectors (15) in the right position during motor shaft insertion: always remove the set screws when finished.
If there are no threaded holes, make sure that the sectors are always in position (X) and do not get stuck, by hitting them with a hammer from time to time during motor shaft insertion.

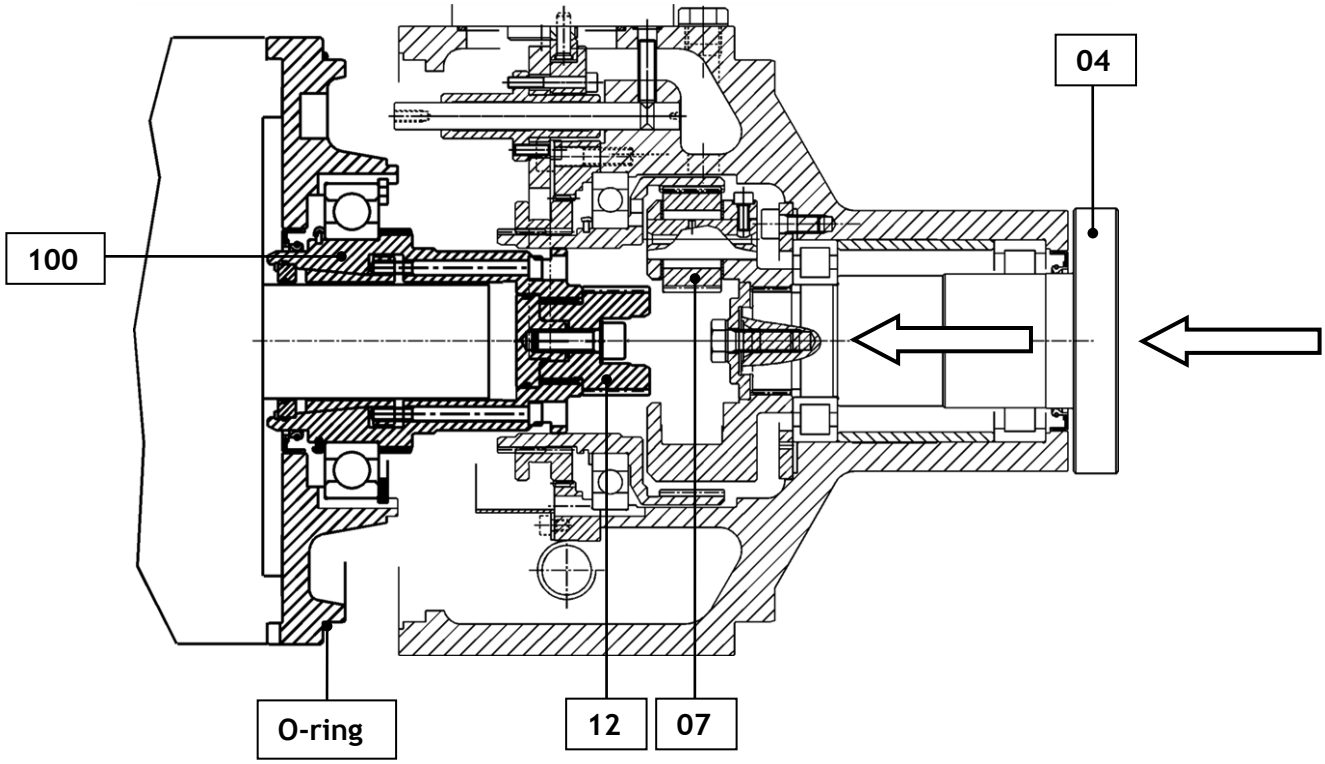
(**) Don't use Molybdenum Disulphide lubricants to prevent slipping of the clamping unit!

f) Fasten the flange to the motor with the screws supplied
g) Tighten the screws (9a) by hand after removing set screws (14), if present
h) Gradually fasten the screws, step by step, till the right tightening torque is reached (see chapter 3.1.4)



Step 3

- **ASSEMBLE THE GEARBOX UNIT WITH MOTOR+ PINION CLAMPING UNIT (100)**



i) Check that the O-ring is in place
j) Gently push the gearbox towards the motor flange, until they get in contact. Turning the output shaft by hand can help engage the sun gear (12) with the planets (07)
k) Tighten the screws: see chapter 3.2.1 - d) for the possible configurations

When inserting the sun gear (12) inside the planetary unit, pay attention not to damage the gears, as this would result in increased noise during operation. If you feel that the gears do not engage smoothly, slowly turn the output shaft (04) by hand until the sun gear engages properly.

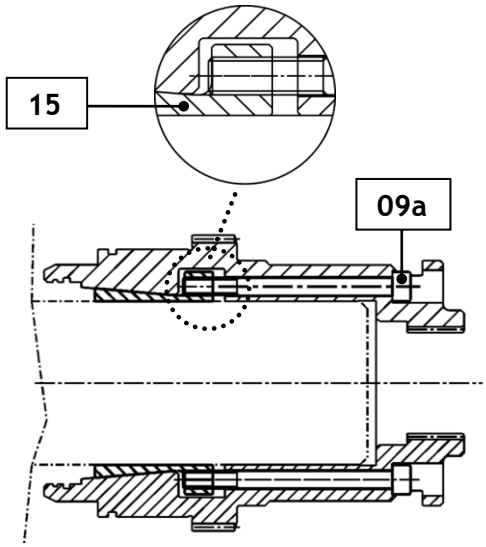
No warranty will be applied if the gearbox is noisy in low gear, due to sun gear damages produced during motor flange assembly operations.

3.2.3 Disassembling the clamping unit (100) from motor shaft

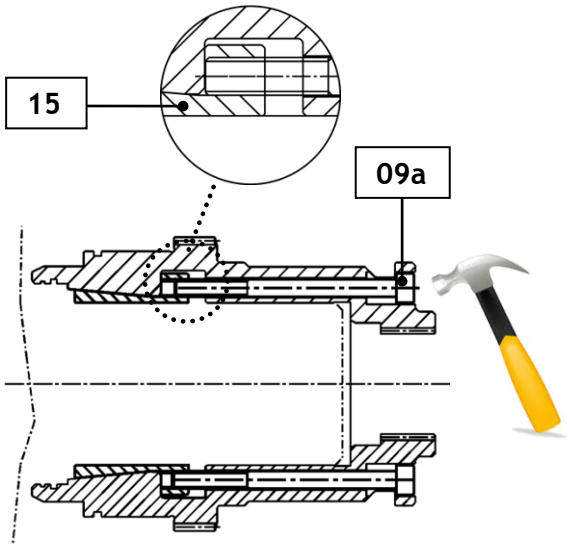
During maintenance operations, it may be necessary to remove the motor from the gearbox.
If the pinion is locked by means of a clamping unit, you should follow the instructions below.

a) Remove the screws that fix the motor flange to the gearbox
b) Pull the gearbox unit away from the motor+flange+pinion, until the sun gear is out of the gearbox
c) Remove the screws that fix the motor flange to the motor
d) Loosen the screws (9a) of the clamping sectors (15) for about 2 mm
e) With a hammer, hit the head of the screws of the clamping sectors (9a) one by one at 180° in order to release the clamping sectors and make disassembling operations possible

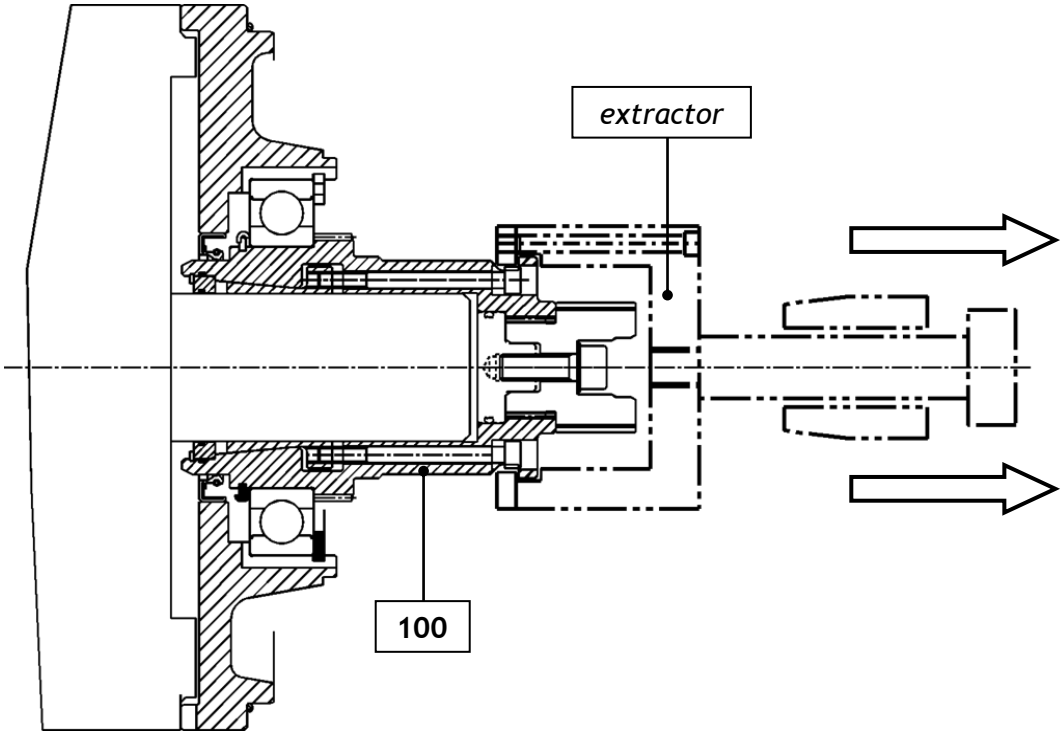
clamping sectors locked



clamping sectors released



f) As shown in the picture below, you may need to use an "*extractor*" in order to disassemble the pinion clamping unit (100)
g) If you find difficulties in removing the pinion clamping unit (100), you may repeat the operations described above in point e)



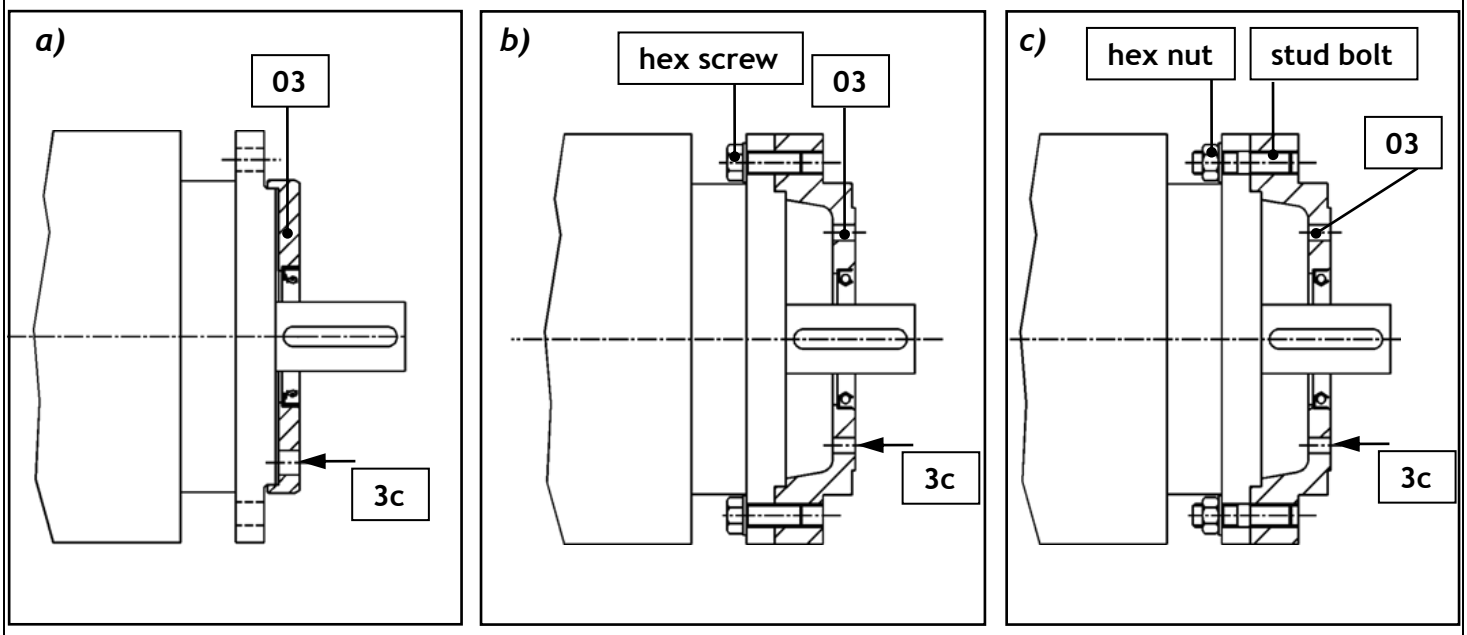
3. 3 ASSEMBLING THE MOTOR ON THE GEARBOX - GEARBOX TYPE CE 12 - 14

For gearboxes type CE12 and CE14, the procedure is different from all other gearboxes.

3.3.1 Motor shaft with key

Step 1 • **ASSEMBLING THE MOTOR FLANGE ON THE MOTOR**

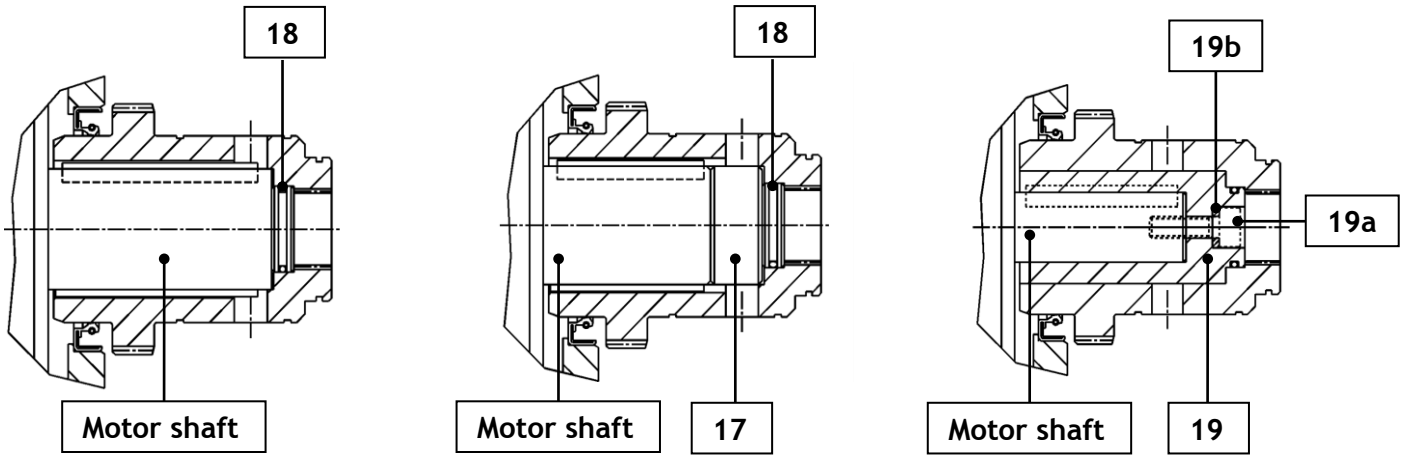
Some motors have fixing holes that are in the same position as those for fixing the motor flange to the gearbox. In this case, the flange is only a centering element, therefore it must be assembled on the motor as shown in picture **a).**
For all other motors, the flange must be assembled as shown in picture **b)** or picture **c)**.



For horizontal mounting, the drain hole (3c) on the motor flange (03) must be at the bottom.

Step 2 • **ASSEMBLING THE PINION ON THE MOTOR SHAFT**

Fit the pinion (09) on the motor shaft, together with plug+O-ring (18) and spacer (17 - only if necessary).



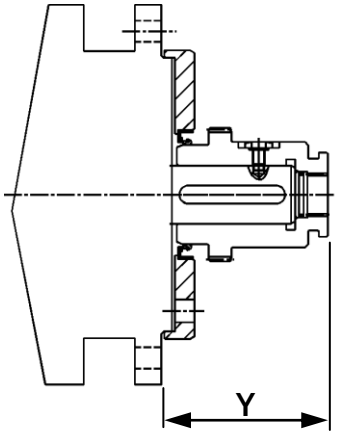
Only for very small motor shafts, there can be an adaptation bush (19), that must be fixed on the motor shaft by means of a screw (19a), to be locked with the relevant sealing ring (19b).

Step 3

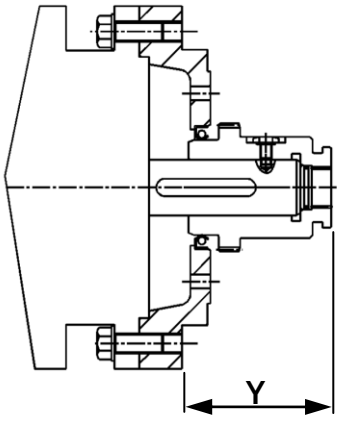
- **SCREWING THE PINION ON THE MOTOR SHAFT**

After fitting the pinion, it is necessary to screw it to the motor shaft.
Before this operation, check the dimension Y according to the drawings/chart below.

Option 'a'
(see "Step 1")

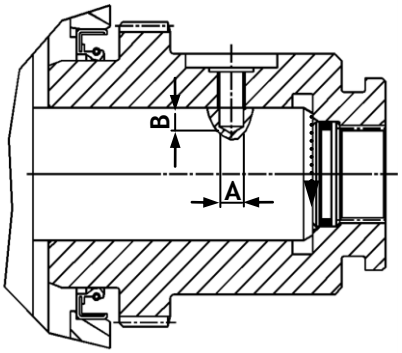


Option 'b' and 'c'
(see "Step 1")



Assembling dimension 'Y'	
CE 12	101.5 mm
CE 14	138 mm

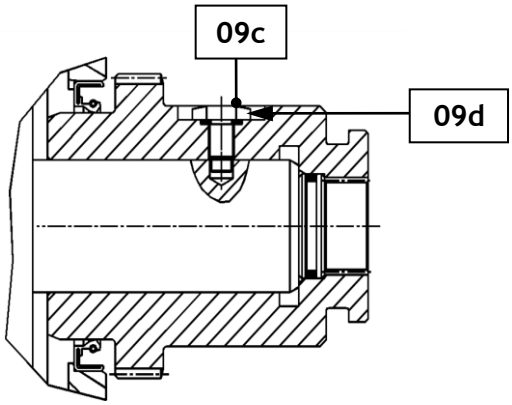
With the pinion inserted as described above, drill a hole in the pinion and in the motor shaft as shown below. This operation should not be performed with the '***special version***' as described in ***"step 2"***.



Make sure that the pinion is completely inserted on the motor shaft.

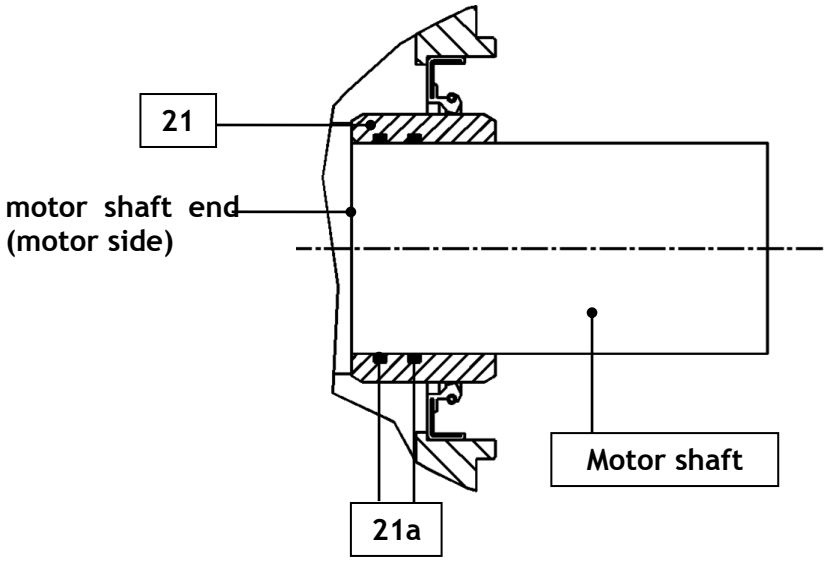
Size	Ø A mm	B mm
CE 12	6.75	4
CE 14	8.5	5

After drilling the hole, place the O-ring (09d) on the pinion spot-facing and tighten the locking screw (09c) until the screw head is in contact with the pinion.



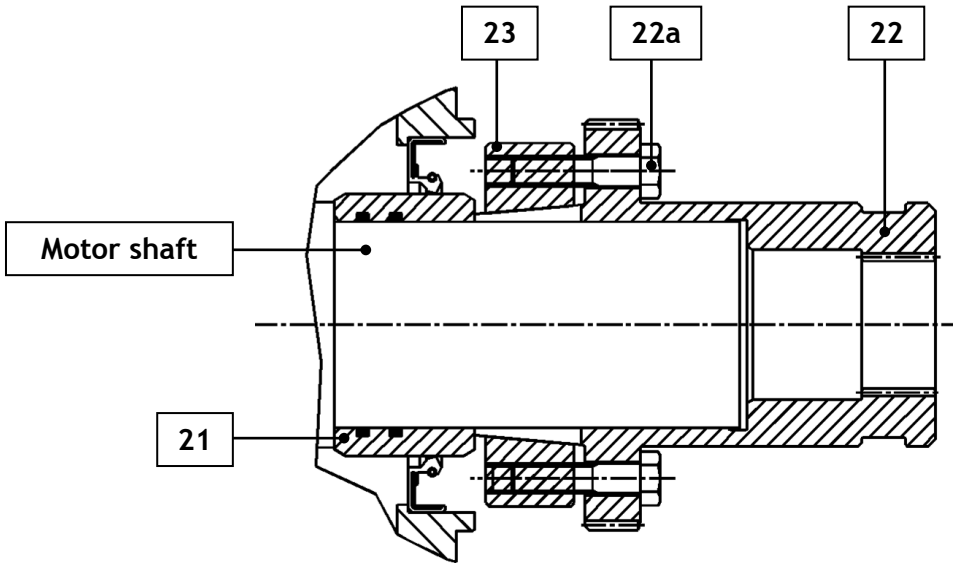
09c + 09d

3.3.2 Motor shaft without key (straight shaft) - conical clamping unit



a) Assemble the bush (21) with relevant gaskets (21a) on the motor shaft, until shaft end
b) Clean motor shaft and pinion (22) hole
c) Oil the pinion/shaft contact surfaces on both pinion and motor shaft (**)
d) Assemble the pinion (22) with the clamping ring (23) on the motor shaft, against bush (21)
e) Tighten the screws (22a) by hand to lock the clamping system
f) Tighten the screws (22a) step by step by means of a torque wrench, one opposite the other, to the torque indicated in the chart below

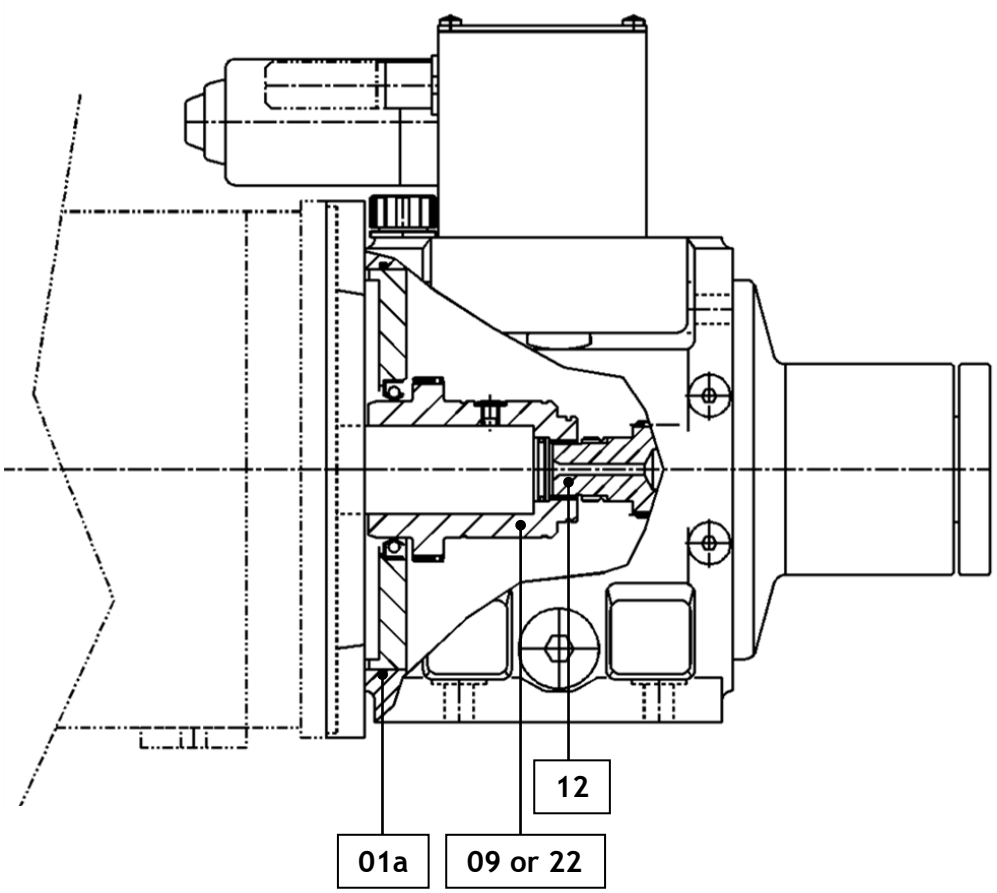
(**) Don't use Molybdenum Disulphide lubricants to prevent slipping of the clamping unit!



Size	12.9 screws	Torque (Nm)
CE 12	M6	17
CE 14	M8	40

3.3.4 Assembling the gearbox on the motor

Check that the O-Ring (01a) is in place.
Assemble motor + flange + pinion to the gearbox, so that the free end of the pinion (09 or 22) fits the spline of the sun gear (12).



After assembling, check that the gearbox rotation is free.

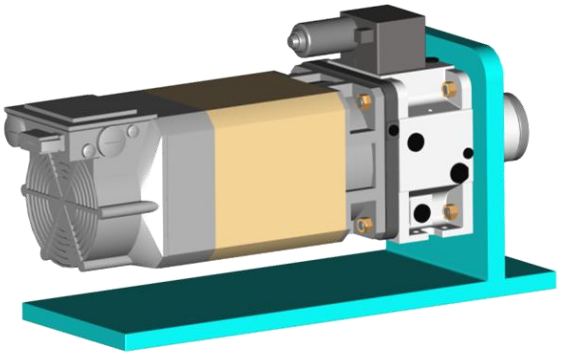
3.4 MOTOR-GEARBOX ASSEMBLING OPTIONS

Motor and gearbox can be assembled on the machine in different ways, according to the design of the machine.
All gearboxes, except CE20, have a centering diameter + fixing holes on the front flange (for "flange mounting") and feet with holes (for "feet mounting") - see Chapter 1.

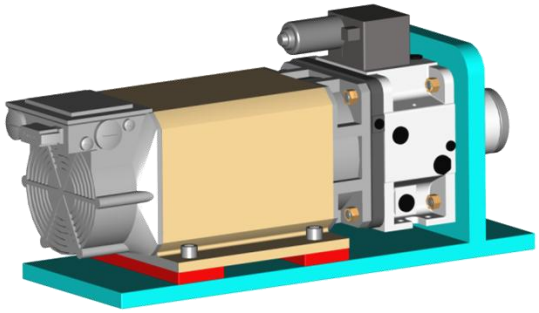
CE20 has no feet, so it can only be assembled as "flange mounting".

If the motor is long and/or heavy, in order to reduce the vibrations, it is strongly suggested to additionally fix the motor by means of its feet.
In this case, use shims under the motor feet (shown in red color - upon customer's supply), that must be adapted by grinding, after checking their thickness during assembling operations.
Below are the options available.

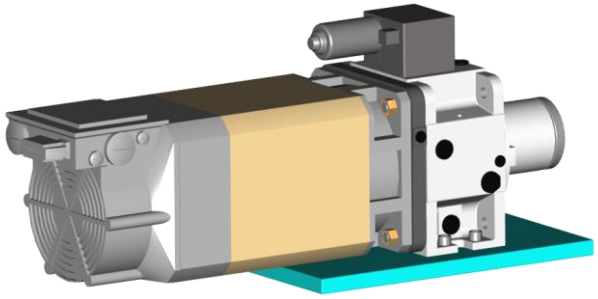
"Gearbox flange mounting"



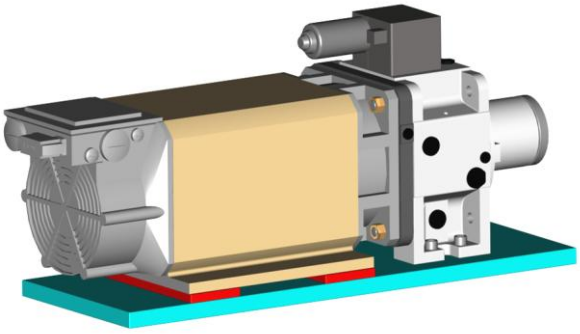
"Gearbox flange mounting + motor feet"



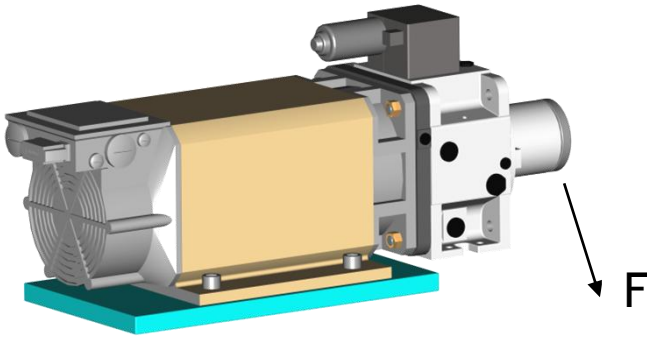
"Gearbox feet mounting"



"Gearbox feet mounting + motor feet"



Only if the motor is very heavy and the radial loads on the gearbox output side are not high, this solution can be used as well.



Do not use this solution if the load "F" on the output side of the gearbox is high (e.g. with Poly-V belts)! The motor feet may not be dimensioned for holding high forces.

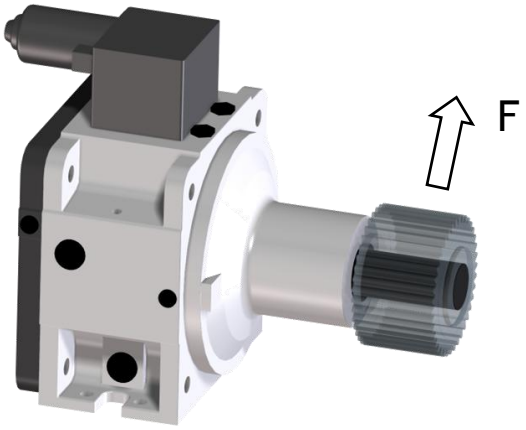
3.5 GEARBOX OUTPUT

3.5.1 Verifying gearbox output loading capacity

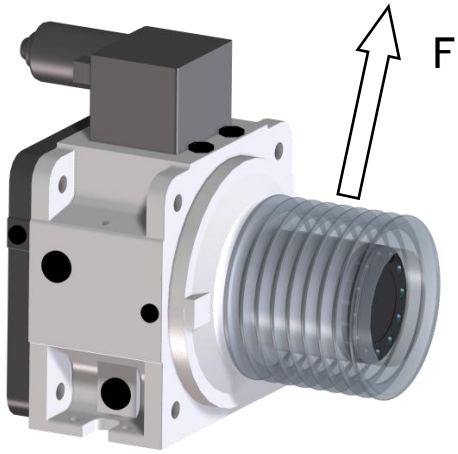
Gearboxes can be supplied in shaft-output or flange-output configuration.

Shaft-output is normally used when the gearbox is assembled coaxial to the machine or connected to it by means of a timing belt or a gear (1).
In these cases, the radial forces are usually low-medium but they're applied far from the gearbox bearings, creating a multiplying effect on the bearings load.

Flange-output is normally used when the connection to the machine is made by means of Poly-V belts (or similar) that transmit the torque by friction. In this case, the belt is usually wide and the belt tension can be very high.
Using flange output gearboxes allows mounting the pulley according to drawing (2): the radial force is applied in between the output bearings so that the load is proportionally held by both of them.



(1) Shaft-output gearbox
The loads (F) are usually low-medium and they're applied far from the gearbox bearings.



(2) Flange-output gearbox
The loads (F) are usually high and they're applied in between the gearbox bearings.

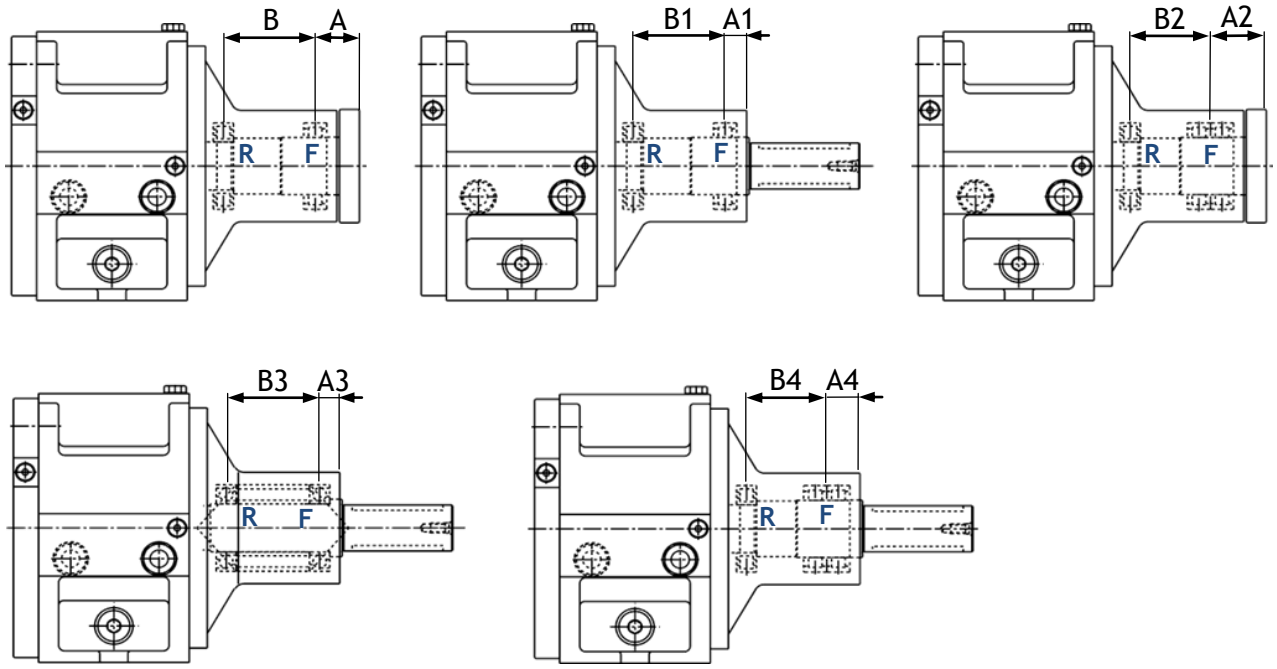
It is always necessary to verify the gearbox bearings life, referring to the data indicated on chapter 3.5.2.

In case the bearings life is too low, it is necessary to modify the machine design so that the radial force is better distributed on the gearbox output bearings.
If this is not possible, the machine should be equipped with an additional support for the radial force.

When using helical gears on the output side, an axial thrust arises, whatever output configuration is used, together with the radial force.
It is always necessary to verify if the bearings can hold both the radial and the axial force and to calculate their life accordingly.
In many cases, the axial force can reduce the bearings life significantly, so an additional support should be foreseen to withstand it.

3.5.2 Gearbox output bearings: position and loading capacity

Table 1 Tabella 1		Bearing R Cuscinetto R		Bearing F Cuscinetto F			Second bearing Secondo cuscinetto	
		Type Tipo	Loading capacity N Capacità di carico N	Type Tipo	Loading capacity N Capacità di carico N		Type Tipo	Loading capacity N Capacità di carico N
Standard	CE 11	NUP 208 ECP	62.000	NU 2208 ECP	81.500		X	X
	CE 12	NUP 208 ECP	62.000	NU 2208 ECP	81.500		X	X
	CE 13	NUP 210 ECP	73.500	NU 2210 ECP	90.000		X	X
	CE 14	NUP 211 ECP	96.500	NU 2211 ECP	114.000		X	X
Double bearing Doppio cuscinetto	CE 13	NUP 210 ECP	73.500	NU 2210 ECP	90.000	(+)	NU 2210 ECP	90.000
	CE 14	NUP 211 ECP	96.500	NU 2211 ECP	114.000	(+)	NU 2211 ECP	114.000
	CE 16	NUP 2111 EC	114.000	RNU 2211 ECP	114.000	(+)	RNU 2211 ECP	114.000
	CE 18	NUP 2213 ECP	170.000	NU 2213 ECP	170.000	(+)	NU 2213 ECP	170.000
	CE 20	21314 E	285.000	NU 314 ECP	236.000	(+)	NU 314 ECP	236.000
Angular contact bearing Cuscinetti obliqui	CE 13	7210 BEGAP	40.000	7210 BEGAP	40.000		X	X
	CE 14	7211 BEGAP	49.000	7211 BEGAP	49.000		X	X
	CE 20	7314 BEP	119.000	7314 BEP	119.000		X	X



STANDARD flange output
Uscita flangia STANDARD

	CE11	CE12	CE13	CE14
A (mm)	39	39	44	47,5
B (mm)	71,5	71,5	91,5	87

STANDARD shaft output
Uscita albero STANDARD

	CE11	CE12	CE13	CE14
A1 (mm)	24	24	24	27,5
B1 (mm)	71,5	71,5	91,5	87

Flange output with double bearing
Uscita flangia doppio cuscinetto

	CE13	CE14	CE16	CE18	CE20
A2 (mm)	55.5	60	64	72	79
B2 (mm)	80	74,5	133	161,5	110,5

Shaft output with angular contact bearings
Uscita albero cuscinetti obliqui

	CE13	CE14	CE20
A3 (mm)	6,5	7	8
B3 (mm)	151	154	175

Shaft output with double bearing
Uscita albero doppio cuscinetto

	CE13	CE16	CE18	CE20
A4 (mm)	35,5	44,5	44,5	56
B4 (mm)	80	133	161,5	110,5

4 ASSEMBLING POSITIONS AND LUBRICATION

Lubrication is a basic factor for the right operation of the gearbox over time.
Before starting the gearbox, always check and follow the gearbox way of lubrication (see chapter 1.6).
Do not operate the gearbox without oil as it would fail in a short time!

4.1 CHOOSING THE LUBRICATION MODE

CE gearboxes are designed for working with 2 different lubrication modes:

- **Splash lubrication (see chapter 4.2)**

  The gearbox is filled with a proper amount of oil and then plugged.
  During operation, the gearbox will develop a certain amount of heat, due to the oil splashing, that will raise the gearbox temperature.
  For this reason, this way of lubrication is used only when there are frequent shifting operations, frequent speed changes, variable turning speeds and frequent machine downtimes such as, for example, rests for tool changes.
  Splash lubrication should not be used if the gearbox speed exceeds 4500 rpm and/or its operation is continuous for long periods.
  Moreover, it cannot be used in some assembly positions (see chapter 4.2) in which the oil wouldn't lubricate properly all the inner parts.

  In order to evaluate the gearbox thermal conditions during working, it is strongly suggested to carry out tests with an ordinary working cycle.

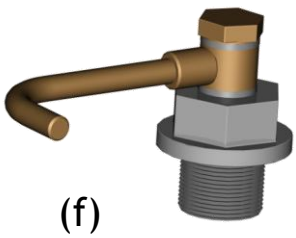
  The gearbox can stand temperatures up to 120 °C (oil 110°C) without problems.

- **Recirculating lubrication (see chapter 4.3)**

  The gearbox is connected to an oil supply unit, that ensures a continuous oil recirculation.
  This continuous oil flow produces a better lubrication of the inner parts and improves the heat dissipation.
  For these reasons, this way of lubrication is used In case of continuous rotation at high speeds and with short downtimes.
  It is also used in some assembly positions, even if the speeds and operating times are not high, because it is the only way to lubricate all the inner parts properly.

All Baruffaldi gearboxes are designed for operation with inner pressure equal to outer (atmospheric) pressure.
Any overpressure will increase seals closing force thus causing a greater friction, higher heat production and early wear.
Any depressure will decrease seals closing force thus allowing oil leakage and internal pollution due to dust, fluids and so on.
According to the gearbox model and the assembling position, *vent valves (**f**, **g**)* are supplied on the gearbox, in order to keep the inner pressure equal to the outer pressure.

Make sure that
the air orifice is not stuck



(f)

(g)

4.2 SPLASH LUBRICATION

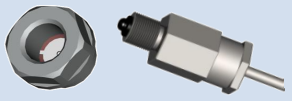
Splash lubrication is used when there are frequent shifting operations, frequent speed changes, variable turning speeds and frequent machine downtimes such as, for example, rests for tool changes.
This lubrication system is suitable only for applications with maximum input speed 4500 rpm and in the assembling positions indicated below.
In all other cases, recirculating lubrication must be used.

Suitable assembling positions for Splash Lubrication		CE 11	CE 12	CE 13	CE 14	CE 16 - 18 - 20
Horizontal standard Maximum input speed 4500 rpm	B5 OPP	YES	YES	YES	YES	NO
Horizontal turned Maximum input speed 4500 rpm	B5 OPP	YES	YES	YES	YES	NO
Vertical downwards Maximum input speed 4500 rpm	V1 VFB VPB	NO	YES	NO	YES	NO
Vertical upwards	V35 VFA VPA	NO	NO	NO	NO	NO

For CE 16-18-20 gearboxes and for vertical upwards assembling position, splash lubrication is not allowed. For such gearboxes and for all vertical upwards assembling positions, only recirculating oil lubrication is allowed.

Before operating the gearbox, pour oil inside it until it reaches the oil level, according to the table below, then plug the unit.

The oil for splash lubrication must have a viscosity according to ISO VG 68, it must be compatible with sealing elements, it must have good resistance to aging and it should develop a high protection towards corrosion and wear.

Assembling position		Approx. oil amount in liters				Oil level indicator	
		CE 11	CE 12	CE 13	CE 14	CE 16-18-20	
Horizontal	OPP B5	0,6	1,1	2,2	3,1	X	

All gearboxes are supplied without oil.
Before operating a gearbox equipped for splash lubrication, fill it with oil until it reaches the middle of the oil sight-glass or the oil level sensor, if supplied.
The oil amount indicated above is only indicative.

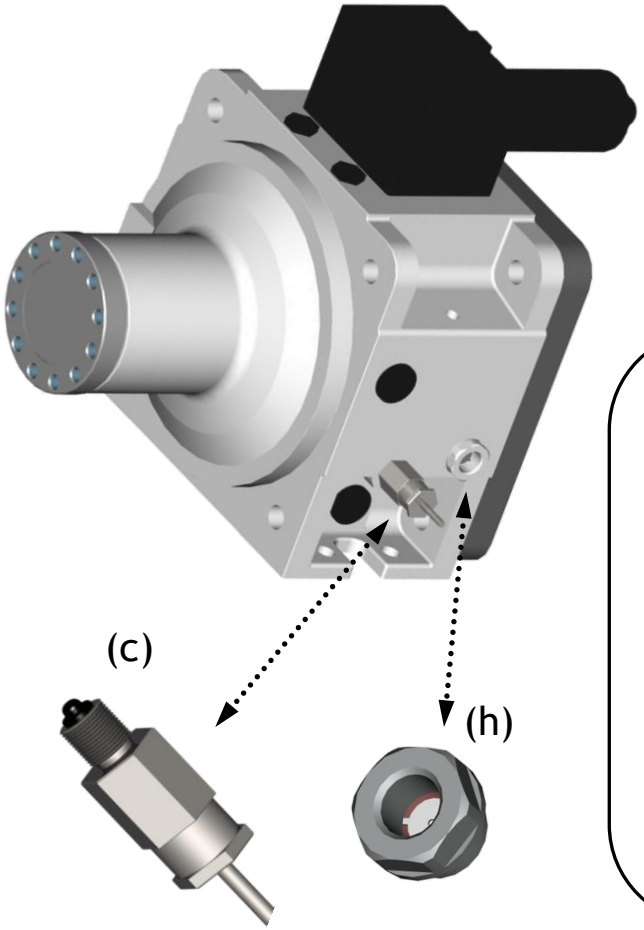
Oil level must be checked periodically, to avoid lack of lubrication over time.
In any case, oil must be replaced at least every 5000 hrs of work.

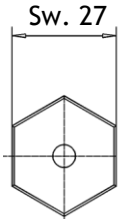
4.2.1 Monitoring the oil level: Oil Sight-glass and Oil Level Sensor

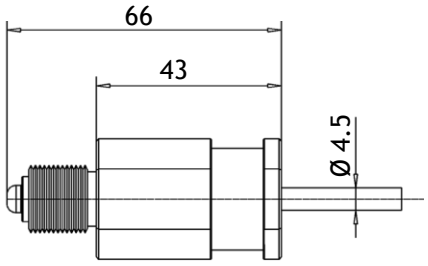
Gearboxes that are supplied for splash lubrication, are equipped with an oil sight-glass (standard supply). In this case, when filling the gearbox with oil, check that the level reaches approximately the middle of the sight-glass, keeping the unit in horizontal position upon its feet. The oil amount indicated in the table above (chapter 4.1) is only approximate.

In order to keep the oil level under control over time, it is strongly suggested to use an additional ***oil level sensor (c)*** assembled on the gearbox; upon request, Baruffaldi can supply a suitable sensor (code 999.912.06547).

Fill the gearbox with oil until it reaches the middle of the *oil sight-glass* ***(h)*** or the oil level sensor, when supplied.

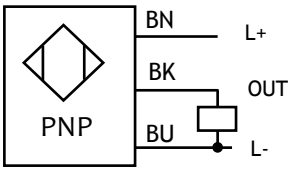






(NO) - Normally Open sensor output is: open in air and closed in the presence of liquids

Key	BN	brown	supply voltage
	BK	black	output
	BU	blue	(GND/0V)



When output is activated, the sensor provides the power supply to the load.

Standard gearboxes are equipped with an oil sight-glass.
The oil level sensor is an option and must be specified when ordering the unit.

4.3 OIL RECIRCULATING LUBRICATION (FORCED LUBRICATION)

Using oil recirculating lubrication, in any assembling position, improves heat dissipation in the gearbox. In case of continuous use at high rotation speed and with short downtimes, oil recirculating lubrication is necessary.

In order to have a proper recirculating lubrication, there are different holes on the gearbox housing, to be used according to the different assembling positions and working conditions (chapters 4.3 to 4.16). Oil stagnation into the gearbox must be avoided, because it may cause overheating and reduce gearbox efficiency. Make sure that the air pipe or the breather are not stuck and allow ventilation.

In case of oil return by fall-down, follow the instructions on pipe type and dimension.
Make sure that the oil input flow rate as well as the oil output flow rate (if a suction pump is used) are steady and in accordance with the required values.
Pay attention to the use of the service holes according to the different applications.

In order to have an effective recirculating lubrication, the following indications should be followed:

- The oil tank must be placed in a ventilated and cold area
- The tank capacity should be at least 10 times the recirculating oil quantity
- Oil return pipe must be straight, bends should be avoided (whenever possible)
- Oil return pipe for fall down should have inner diameter Ø min = 20 mm
- Oil back pressure in the return pipe from the gearbox must be avoided
- A 60 µm filter and a pressure limitation valve on the oil supply unit should also be used as a safeguard
- Overall rate for CE 11-12-13-14 is 1,5 L/min
- Overall rate for CE 16-18-20 is 3 L/min

Whenever a further reduction in working temperature is required, or if it is necessary to keep the gearbox temperature within a strict range, recirculating lubrication may be used in the following ways:

- Recirculating lubrication with intermediate tank
- Recirculating lubrication with air-heat exchanger
- Recirculating lubrication with cooling heat exchanger (chiller)

According to the way of lubrication of the gearbox, oil must be according to the following chart:

- splash lubrication: **HLP 68 as per ISO VG 68**
- recirculating lubrication with intermediate tank: **HLP 46 as per ISO VG 46**
- recirculating lubrication with air-oil heat exchanger: **HLP 32 as per ISO VG 32**
- recirculating lubrication with cooling heat exchanger (chiller): **HLP 32 as per ISO VG 32**

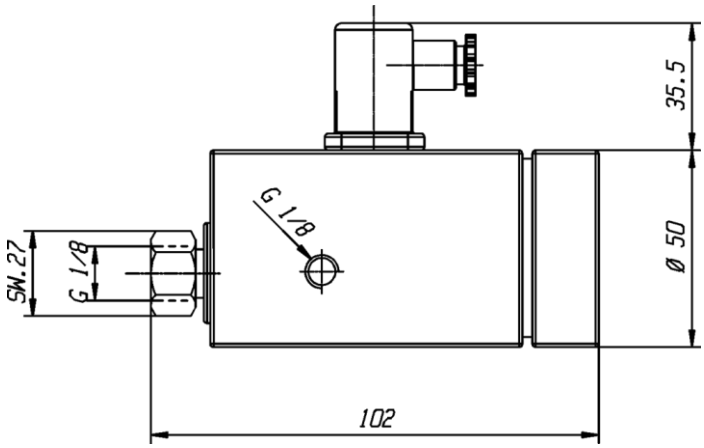
If the instructions on lubrication are not followed, the gearbox may be irreparably damaged. If the gearbox is damaged by wrong or lack of lubrication, no warranty will be applied.

4.3.1 Monitoring the oil flow: Oil Flow Rate Switch

Lubrication is a vital factor for the gearboxes. A lack of lubrication, even for a few seconds, can damage the gearbox components and bring the unit to failure in a short time.

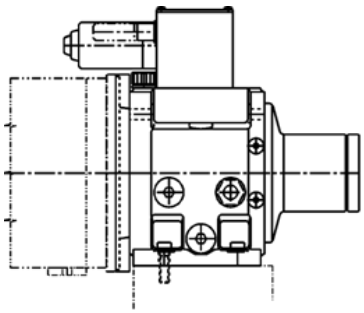
In order to monitor the oil flow over time, the use of a Flow Rate Switch is strongly suggested, to be connected to the oil supply circuit. Upon request, Baruffaldi can provide a suitable Flow Rate Switch, as shown below.

CE 11-12-13-14	1,50 l/min	Flow Rate Switch OFI 1.5	996.002.01468.2
CE 16-18-20	3,00 l/min	Flow Rate Switch OFI 3	996.002.01468.3

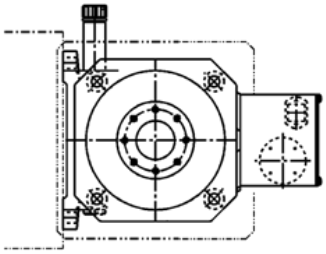


4.4 GEARBOX ASSEMBLING DESIGNATION

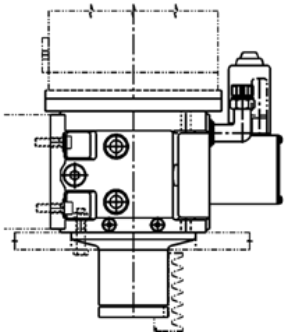
The different assembling positions on the machine are identified with a specific code, ase described below



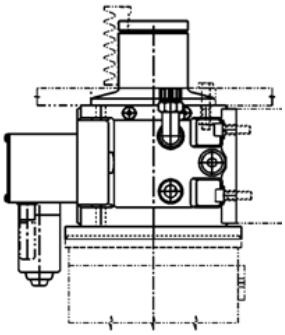
OPP
B5 Horizontal



OPS
B5 Horizontal turned



VFB
V1 Vertical downward



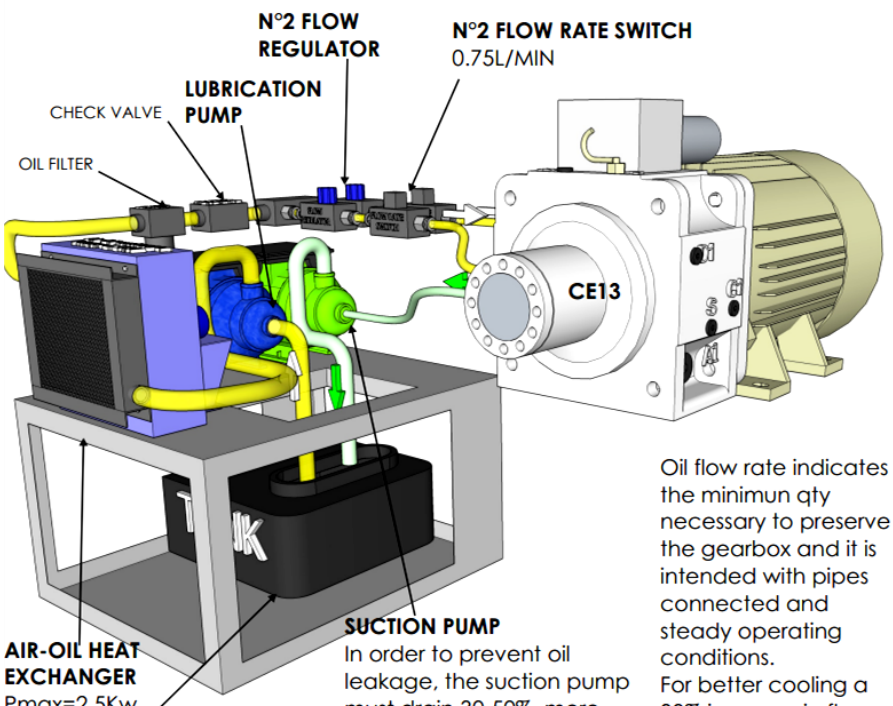
VFB
V3 Vertical downward

4.4 LUBRICATION EXAMPLES

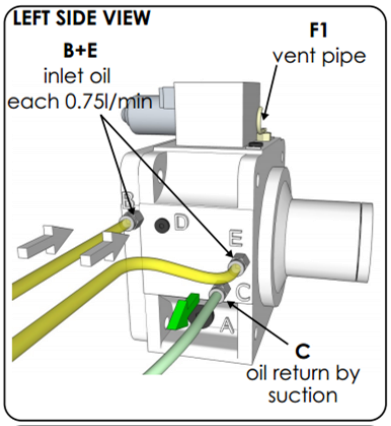
In the following pages, some examples of lubrication layouts are shown for some gearbox sizes.

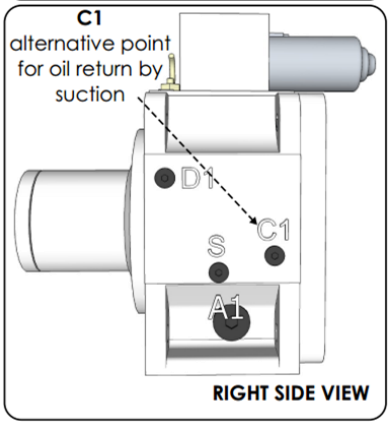
Changing the connection points, these examples can be used as reference for all gearbox sizes.

4.4.1 CE 13 - Horizontal assembly - Forced Lubrication With Suction Pump

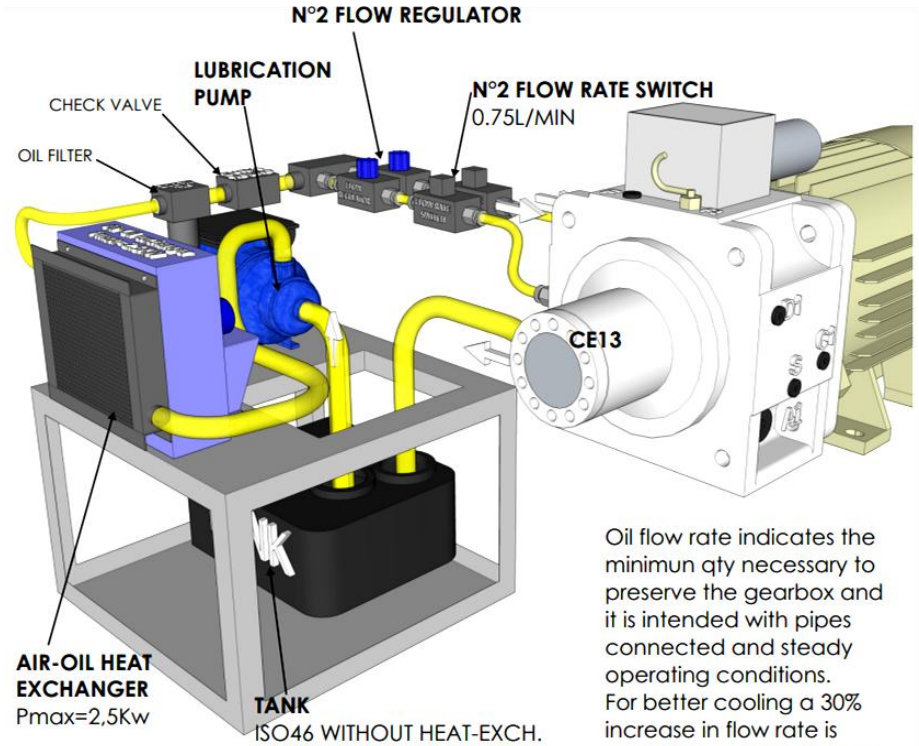


Oil flow rate indicates the minimun qty necessary to preserve the gearbox and it is intended with pipes connected and steady operating conditions.
For better cooling a 30% increase in flow rate is allowed, provided that the suction pump can drain properly.

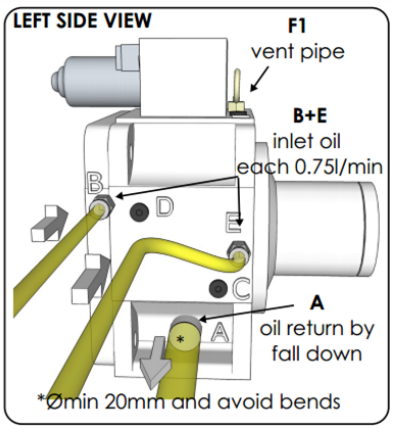


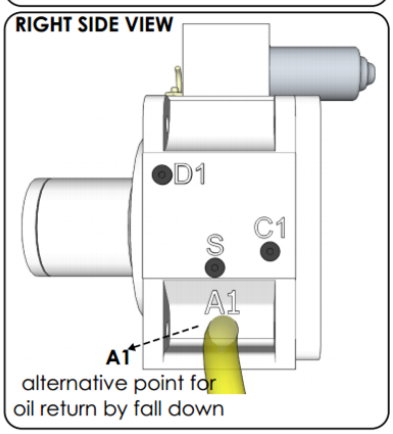


4.4.2 CE 13 - Horizontal assembly - Forced Lubrication With Oil Return By Fall Down

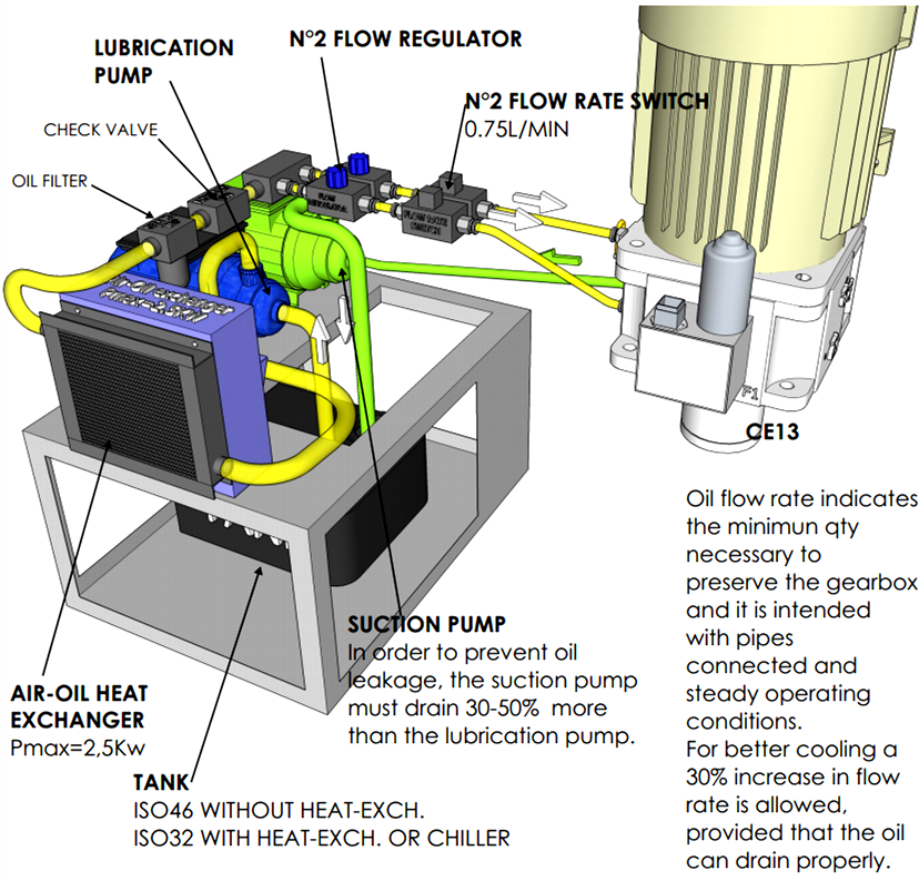


Oil flow rate indicates the minimun qty necessary to preserve the gearbox and it is intended with pipes connected and steady operating conditions.
For better cooling a 30% increase in flow rate is allowed, provided that the oil can drain properly.

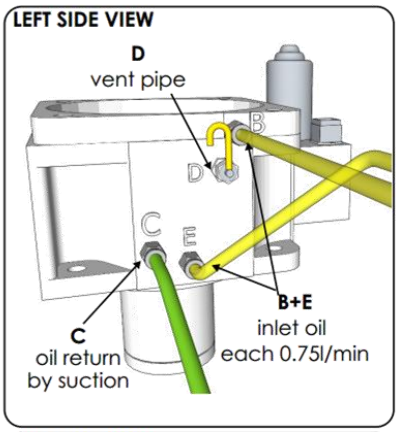


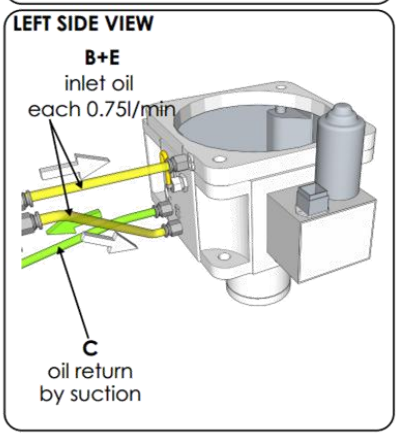


4.4.3 CE 13 - Vertical Down Assy - Forced Lubrication With Oil Return By Suction

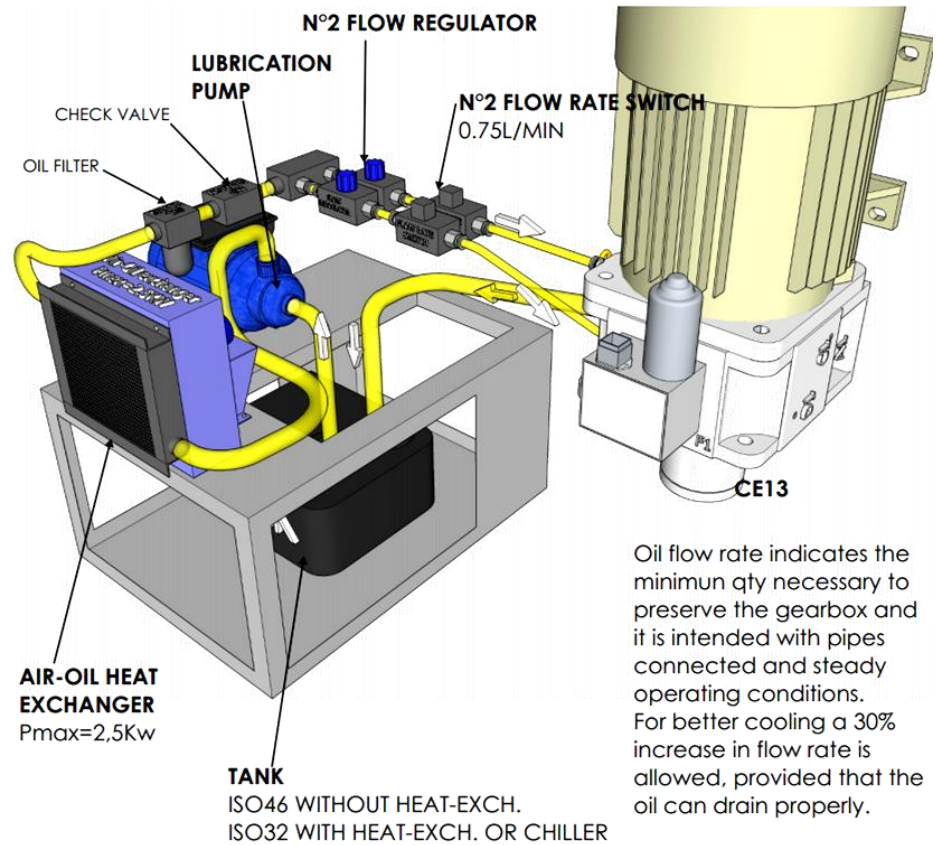


Oil flow rate indicates the minimun qty necessary to preserve the gearbox and it is intended with pipes connected and steady operating conditions.
For better cooling a 30% increase in flow rate is allowed, provided that the oil can drain properly.

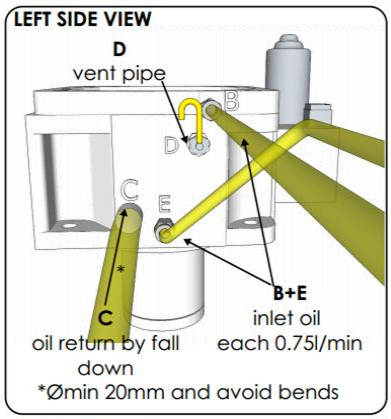


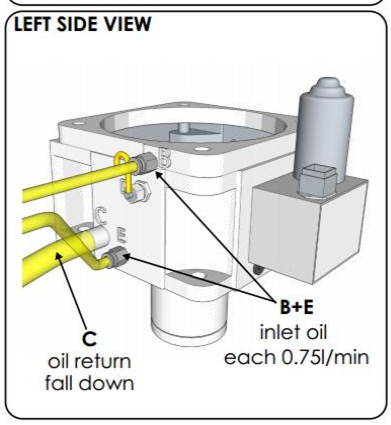


4.4.4 CE 13 - Horizontal Assy - Forced Lubrication With Oil Return By Fall Down

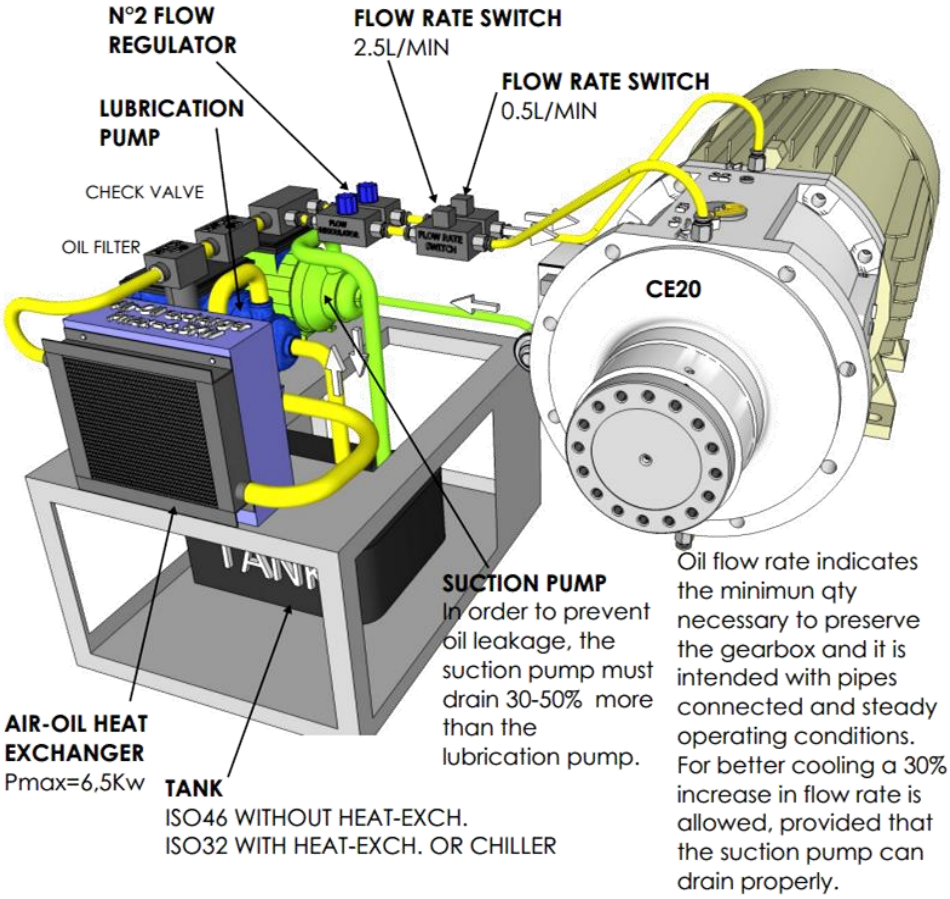


Oil flow rate indicates the minimun qty necessary to preserve the gearbox and it is intended with pipes connected and steady operating conditions.
For better cooling a 30% increase in flow rate is allowed, provided that the oil can drain properly.

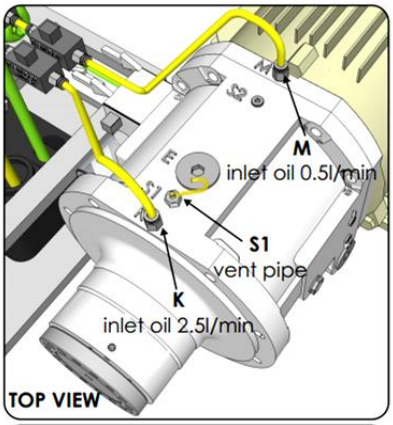


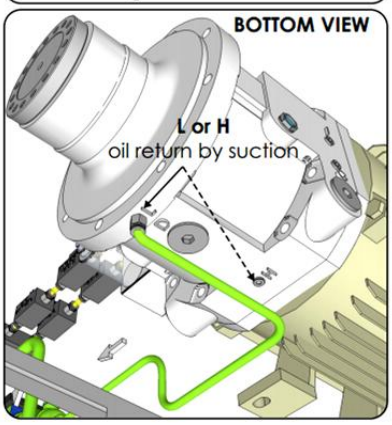


4.4.5 CE 20 - Horizontal Assembly - Forced Lubrication With Suction Pump

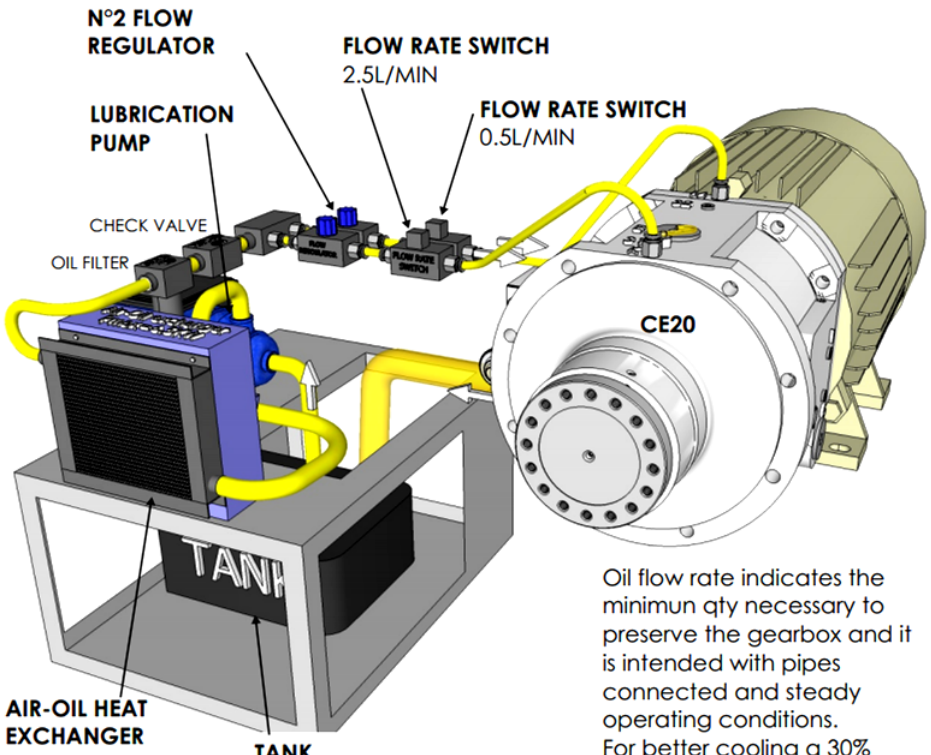


Oil flow rate indicates the minimun qty necessary to preserve the gearbox and it is intended with pipes connected and steady operating conditions. For better cooling a 30% increase in flow rate is allowed, provided that the suction pump can drain properly.

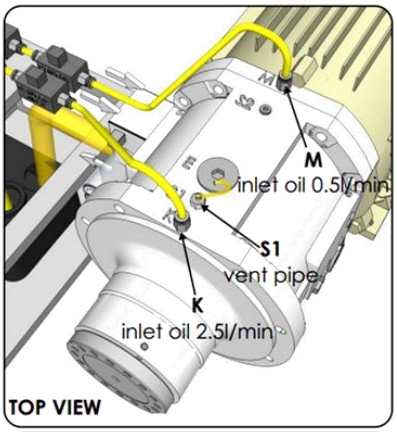


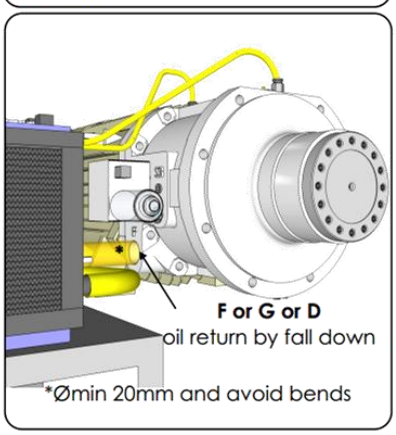


4.4.6 CE 20 - Horizontal Assembly - Forced Lubrication With Oil Return By Fall Down

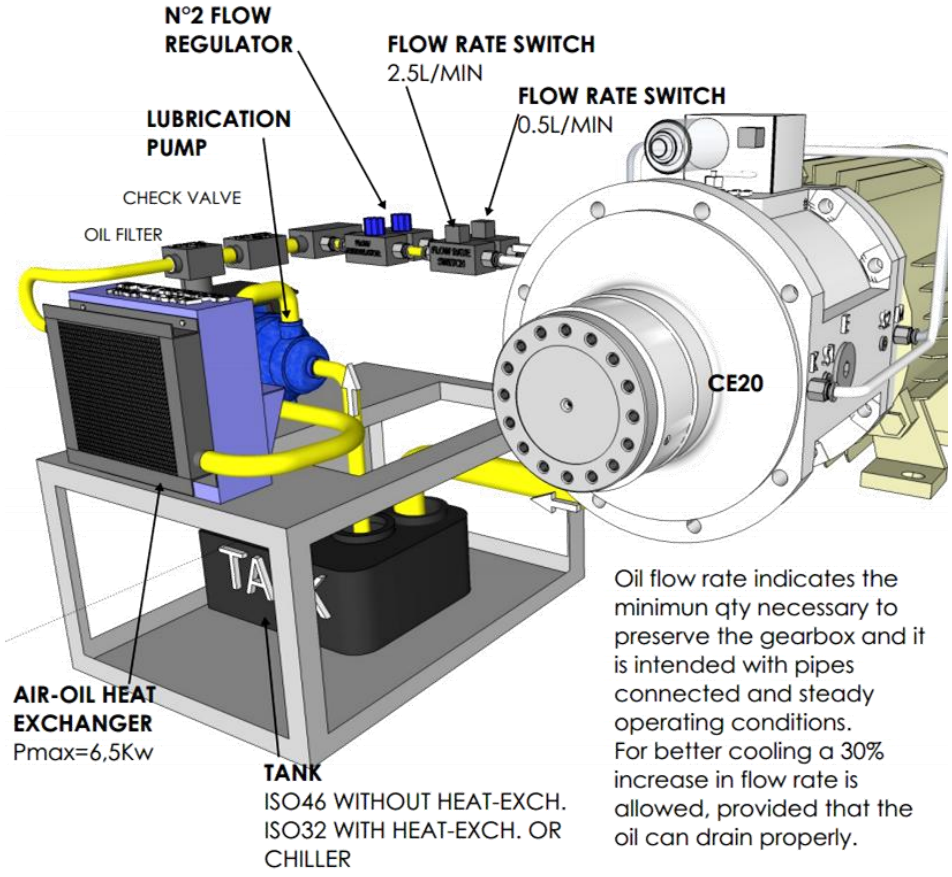


Oil flow rate indicates the minimun qty necessary to preserve the gearbox and it is intended with pipes connected and steady operating conditions. For better cooling a 30% increase in flow rate is allowed, provided that the oil can drain properly.

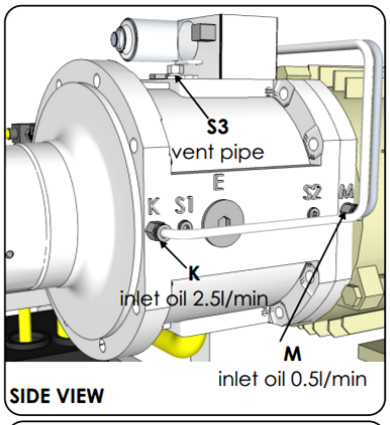


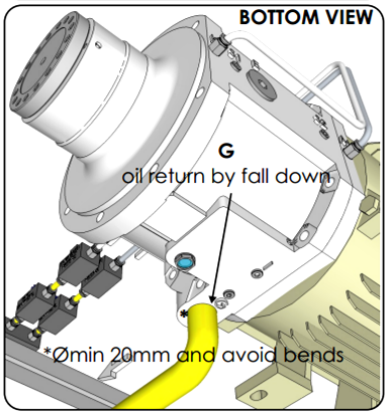


4.4.7 CE 20 - Horizontal Assembly - Forced Lubrication With Oil Return By Fall Down

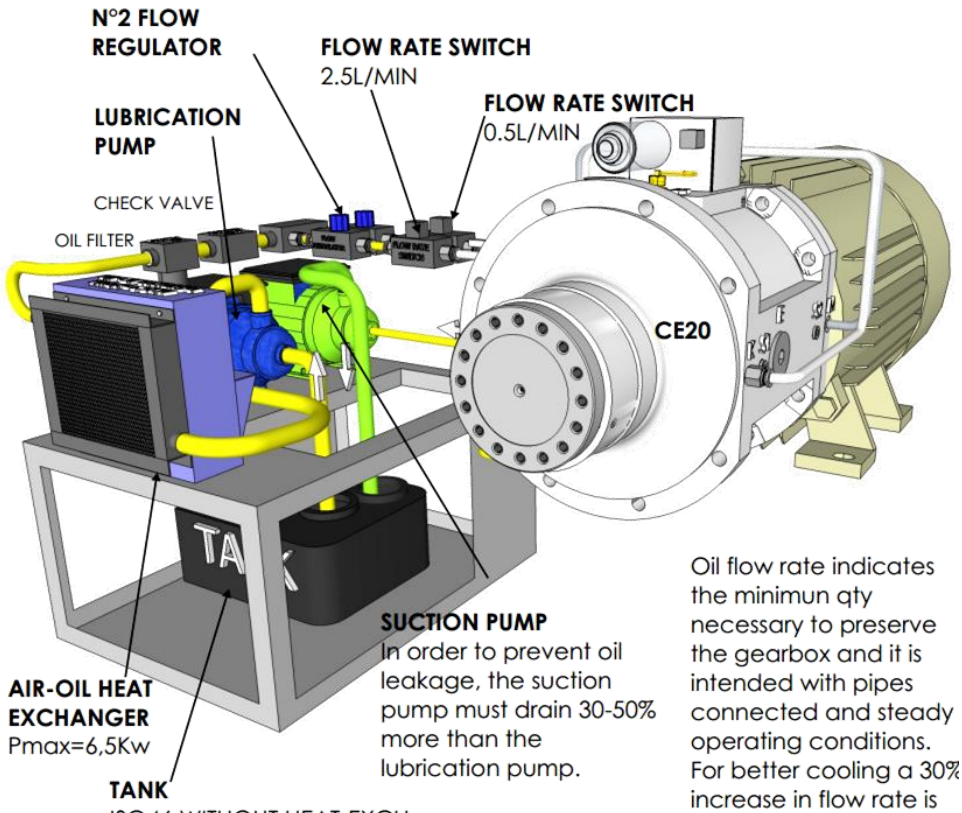


Oil flow rate indicates the minimun qty necessary to preserve the gearbox and it is intended with pipes connected and steady operating conditions. For better cooling a 30% increase in flow rate is allowed, provided that the oil can drain properly.

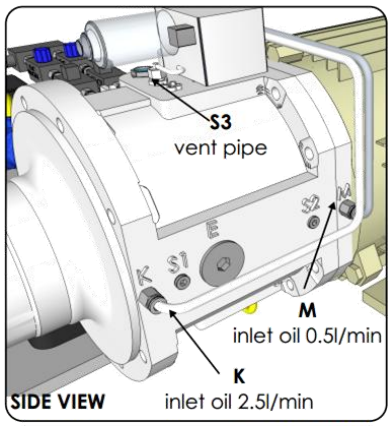


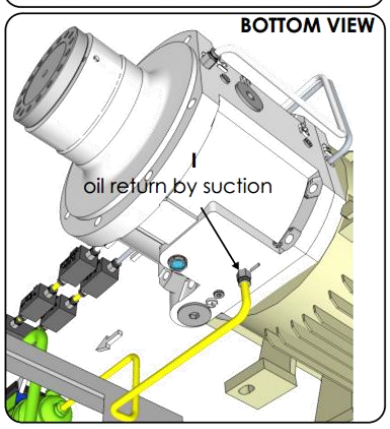


4.4.8 CE 20 - Horizontal Assembly - Forced Lubrication With Suction Pump

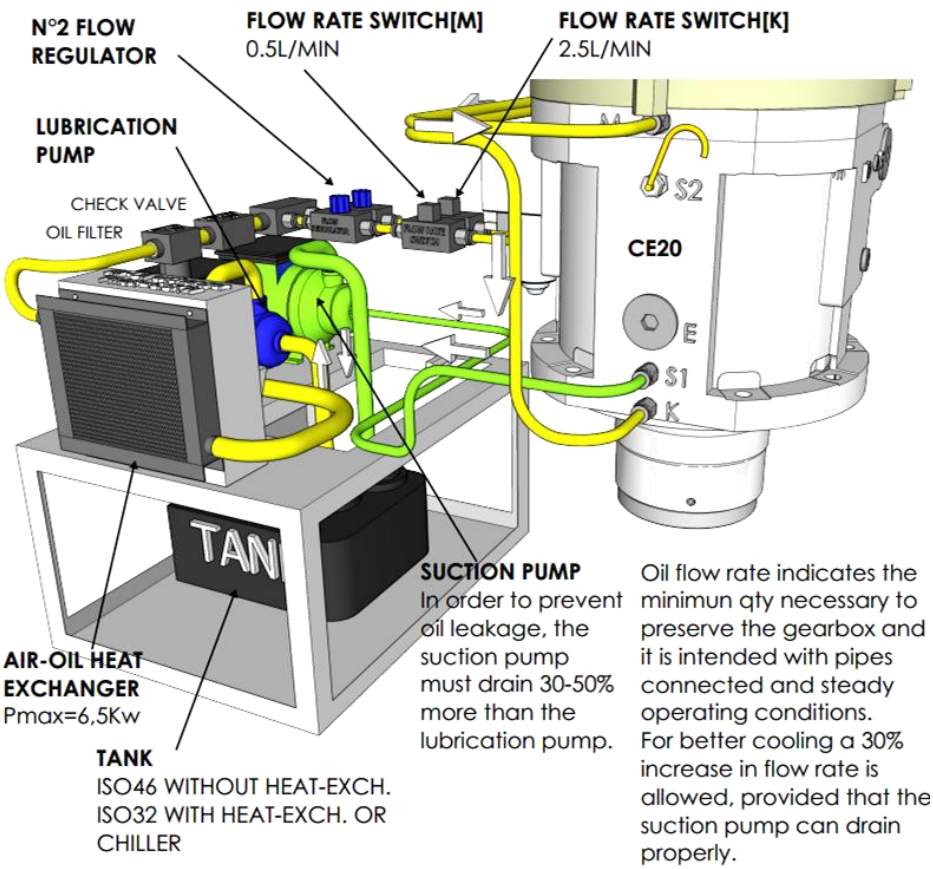


Oil flow rate indicates the minimun qty necessary to preserve the gearbox and it is intended with pipes connected and steady operating conditions. For better cooling a 30% increase in flow rate is allowed, provided that the oil can drain properly.

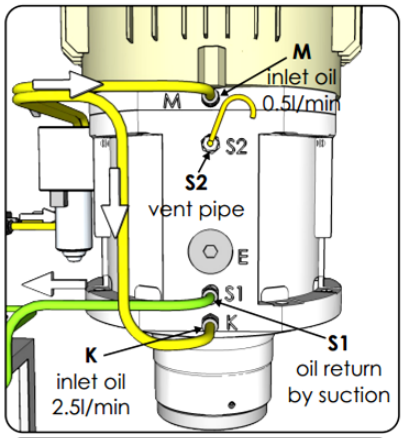


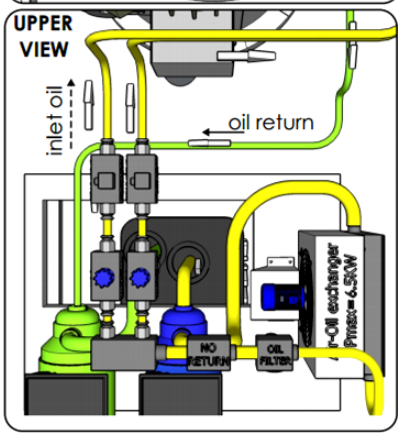


4.4.9 CE 20 - Vertical Down Assembly - Forced Lubrication With Suction Pump

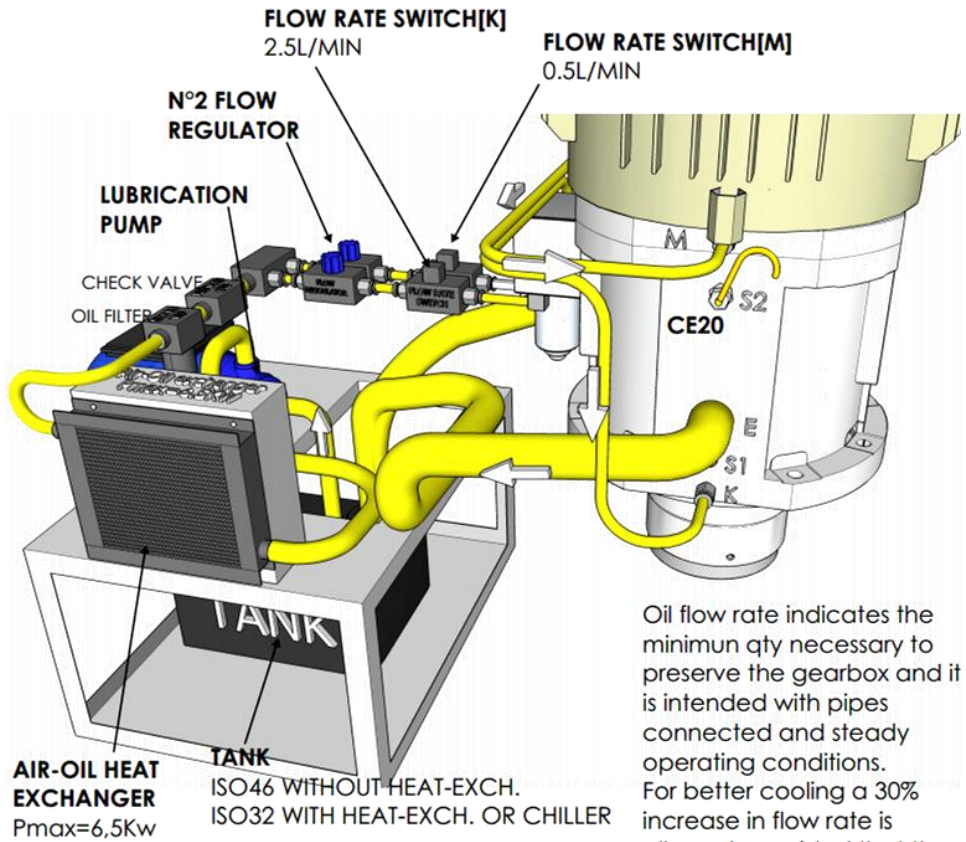


Oil flow rate indicates the minimun qty necessary to preserve the gearbox and it is intended with pipes connected and steady operating conditions. For better cooling a 30% increase in flow rate is allowed, provided that the suction pump can drain properly.

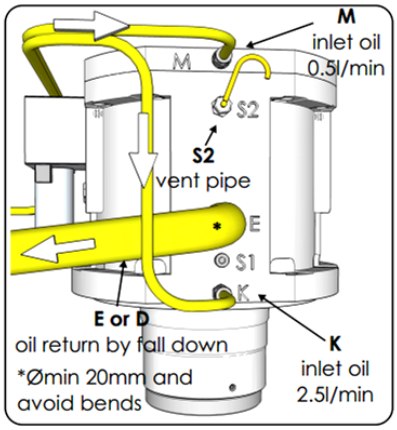


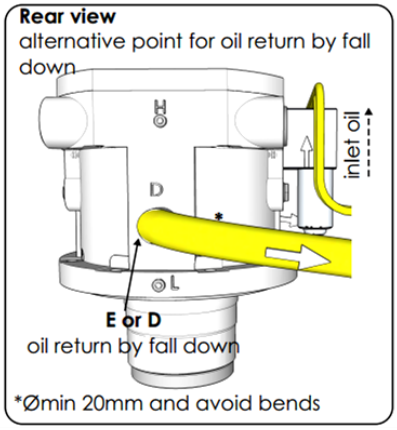


4.4.10 CE 20 Vertical Down Assy - Forced Lubrication With Oil Return By Fall Down



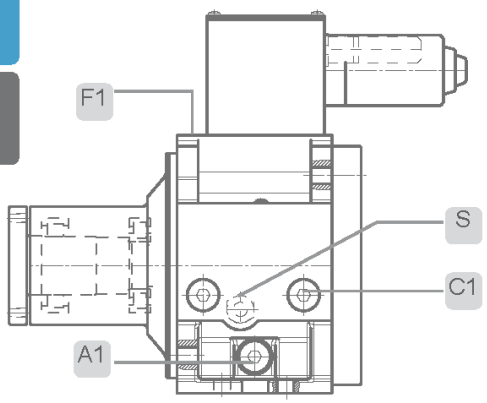
Oil flow rate indicates the minimun qty necessary to preserve the gearbox and it is intended with pipes connected and steady operating conditions. For better cooling a 30% increase in flow rate is allowed, provided that the oil can drain properly.

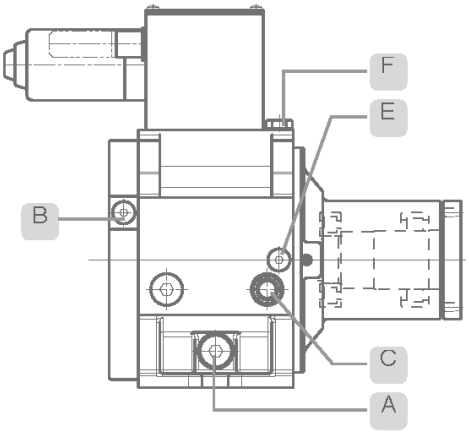




4.11 ASSEMBLING POSITIONS & LUBRICATION - CE 11

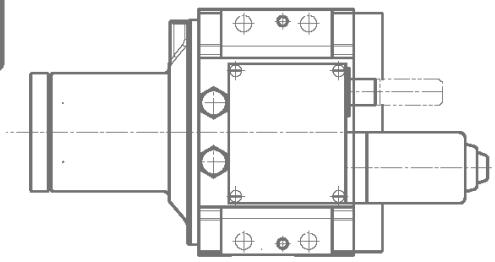
OPP
B5

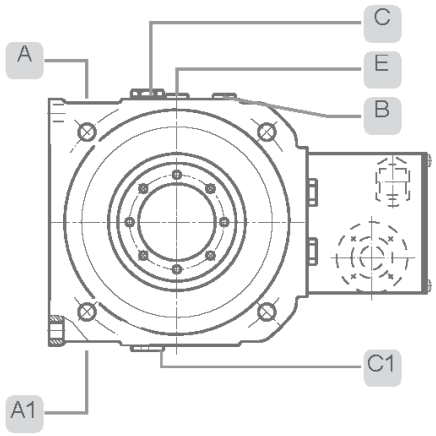




Horizontal **Orizzontale**	Oil inlet Entrata olio	Oil return by fall down Uscita olio a caduta (Pipe inner ø min. 20mm)	Oil return by suction Uscita olio aspirazione	Vent valve Valvola di sfiato	Oil level indicator Spia livello olio	Sensor on request Sensore a richiesta
Splash lubrication Lubrificazione a sbattimento	**F1** **F1** 3/8"G OIL FILL IN	**A or A1** **A** 1/2"G OIL DRAIN **A1** 1/2"G OIL DRAIN	X	**F** **F** 3/8"G	**C or C1** **C** 1/2"G **C1** 1/2"G	**S** **S** 3/8"G
Forced lubrication Lubrificazione forzata	**B+E** **B** 1/4"G 0,75 l/min **E** 1/4"G 0,75 l/min	**A or A1** **A** 1/2"G **A1** 1/2"G	**C or C1** **C** 1/2"G **C1** 1/2"G	**F1** **F1** 3/8"G	X	X

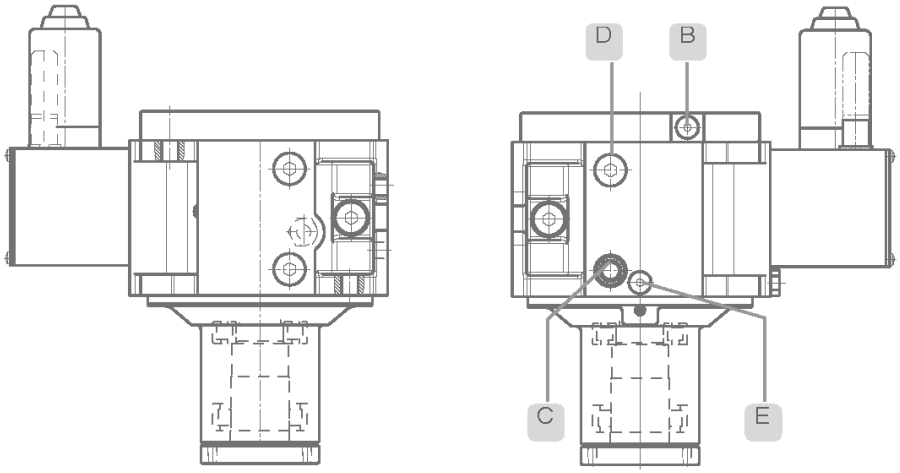
OPS
B5
90°





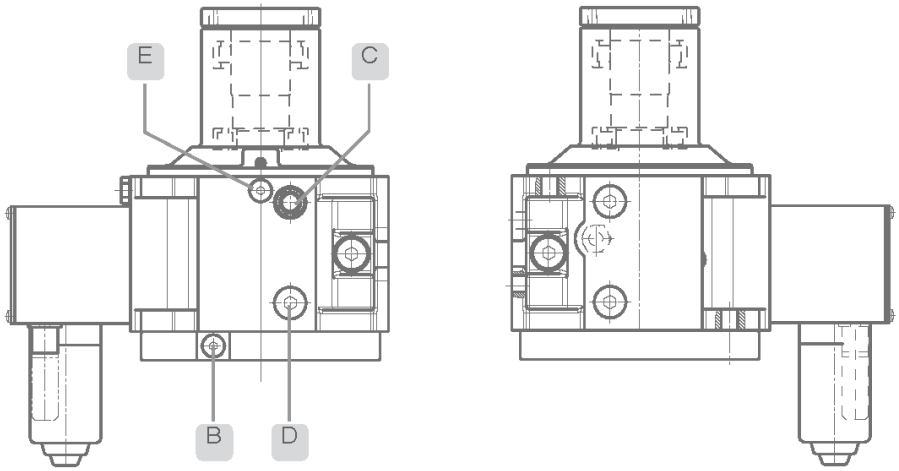
Horizontal turned **Orizzontale ruotato**	Oil inlet Entrata olio	Oil return by fall down Uscita olio a caduta (Pipe inner ø min. 20mm)	Oil return by suction Uscita olio aspirazione	Vent valve Valvola di sfiato	Oil level indicator Spia livello olio	Sensor on request Sensore a richiesta
Splash lubrication Lubrificazione a sbattimento	**A** **A** 1/2"G OIL FILL IN	**A1** **A1** 1/2"G OIL DRAIN	X	**C** **C** 1/2"G	X	X
Forced lubrication Lubrificazione forzata	**B+E** **B** 1/4"G 0,75 l/min **E** 1/4"G 0,75 l/min	**A1** **A1** 1/2"G	**C1** **C1** 1/2"G	**C** **C** 1/2"G	X	X

VFP
VPB
V1



Vertical downward **Verticale verso il basso**	Oil inlet Entrata olio	Oil return by fall down Uscita olio a caduta (Pipe inner ø min. 20mm)	Oil return by suction Uscita olio aspirazione	Vent valve Valvola di sfiato	Oil level indicator Spia livello olio	Sensor on request Sensore a richiesta
Splash lubrication Lubrificazione a sbattimento	X	X	X	X	X	X
Forced lubrication Lubrificazione forzata	**B+E** **B** 1/4"G 0,75 l/min **E** 1/4"G 0,75 l/min	**C** **C** 1/2"G	**C** **C** 1/2"G	**D** **D** 1/2"G	X	X

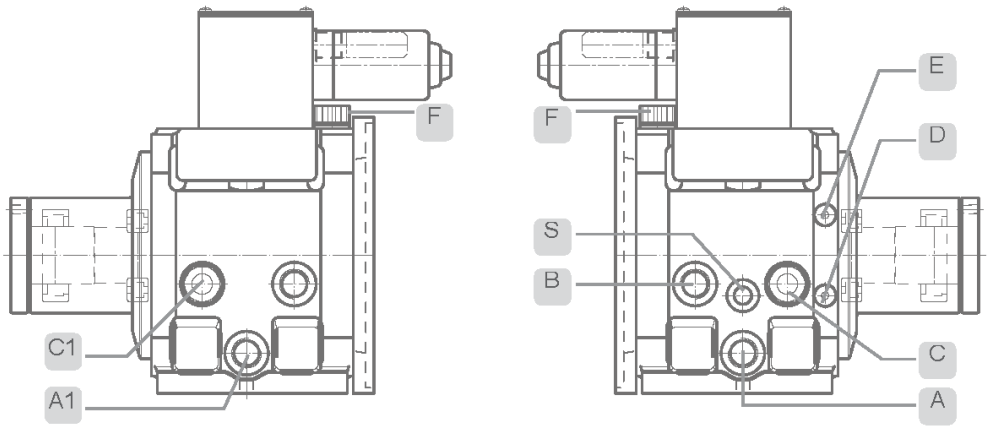
VFA
VPA
V3



Vertical upward **Verticale verso l'alto**	Oil inlet Entrata olio	Oil return by fall down Uscita olio a caduta (Pipe inner ø min. 20mm)	Oil return by suction Uscita olio aspirazione	Vent valve Valvola di sfiato	Oil level indicator Spia livello olio	Sensor on request Sensore a richiesta
Splash lubrication Lubrificazione a sbattimento	X	X	X	X	X	X
Forced lubrication Lubrificazione forzata	**E** **E** 1/4"G 1,50 l/min	**D** **D** 1/2"G	**B** **B** 1/4"G	**C** **C** 1/2"G	X	X

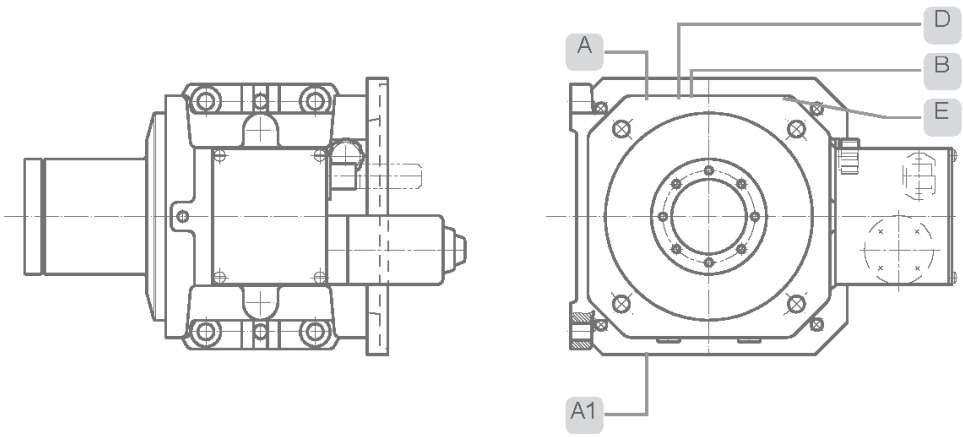
4.12 ASSEMBLING POSITIONS & LUBRICATION - CE 12

OPP
B5



Horizontal **Orizzontale**	Oil inlet Entrata olio	Oil return by fall down Uscita olio a caduta (Pipe inner ø min. 20mm)	Oil return by suction Uscita olio aspirazione	Vent valve Valvola di sfiato	Oil level indicator Spia livello olio	Sensor on request Sensore a richiesta
Splash lubrication Lubrificazione a sbattimento	**F** **F** 3/8"G OIL FILL IN	**A or A1** **A** 3/4"G OIL DRAIN **A1** 3/4"G OIL DRAIN	**X**	**F** **F** 3/8"G	**C or C1** **C** 3/4"G **C1** 3/4"G	**S** **S** 3/8"G
Forced lubrication Lubrificazione forzata	⚠ **B+E+D** **B** 1/4"G 0,50 l/min **E** 1/4"G 0,50 l/min **D** 1/4"G 0,50 l/min	**A or A1** **A** 3/4"G **A1** 3/4"G	**C or C1** **C** 3/4"G **C1** 3/4"G	**F** **F** 3/8"G	**X**	**X**

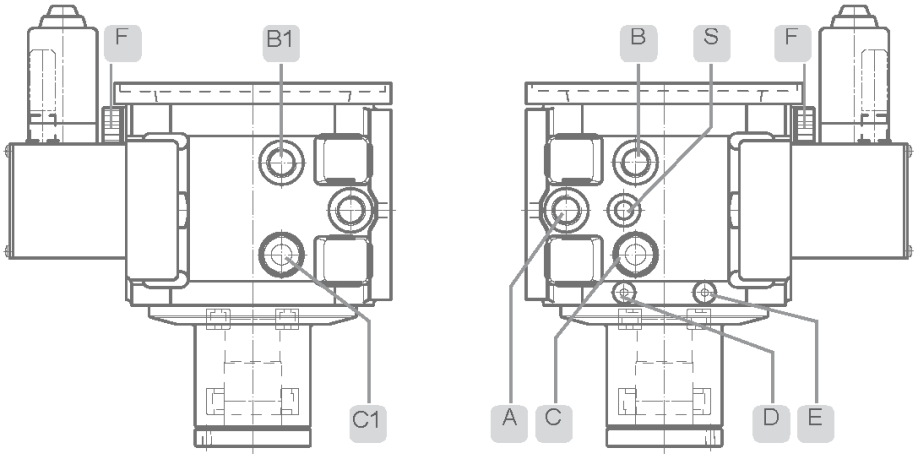
OPS
B5
90°



Horizontal turned **Orizzontale ruotato**	Oil inlet Entrata olio	Oil return by fall down Uscita olio a caduta (Pipe inner ø min. 20mm)	Oil return by suction Uscita olio aspirazione	Vent valve Valvola di sfiato	Oil level indicator Spia livello olio	Sensor on request Sensore a richiesta
Splash lubrication Lubrificazione a sbattimento	**A** **A** 3/4"G OIL FILL IN	**A1** **A1** 3/4"G OIL DRAIN	**X**	**A** **A** 3/4"G	**X**	**X**
Forced lubrication Lubrificazione forzata	⚠ **B+E+D** **B** 1/4"G 0,50 l/min **E** 1/4"G 0,50 l/min **D** 1/4"G 0,50 l/min	**A1** **A1** 3/4"G	**A1** **A1** 3/4"G	**A** **A** 3/4"G	**X**	**X**

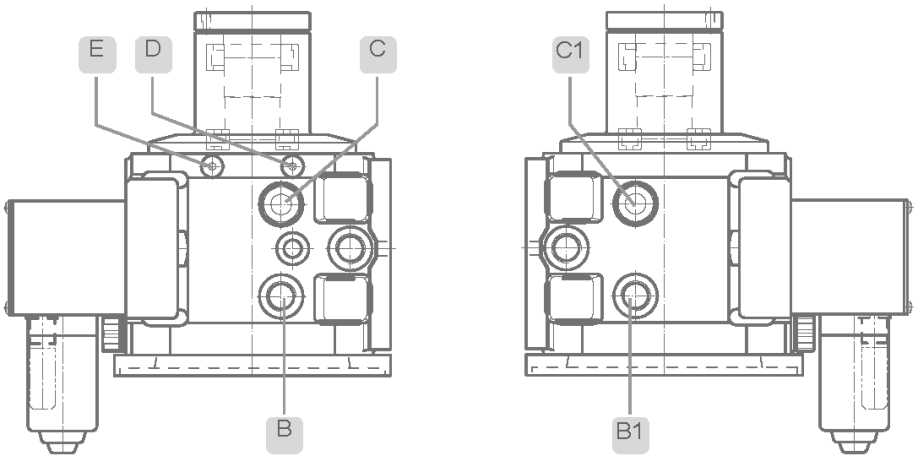
⚠ In position **B** and **B1**, injectors are fitted for lubrication oil.
Do not remove or turn, seizing danger!

VFP
VPB
V1



Vertical downward **Verticale verso il basso**	Oil inlet Entrata olio	Oil return by fall down Uscita olio a caduta (Pipe inner ø min. 20mm)	Oil return by suction Uscita olio aspirazione	Vent valve Valvola di sfiato	Oil level indicator Spia livello olio	Sensor on request Sensore a richiesta
Splash lubrication Lubrificazione a sbattimento	**B or B1** **B** 3/4"G OIL FILL IN **B1** 3/4"G OIL FILL IN	**C or C1** **C** 3/4"G OIL DRAIN **C1** 3/4"G OIL DRAIN	X	**F** **F** 3/8"G	**C or C1** **C** 3/4"G **C1** 3/4"G	**S** **S** 3/8"G
Forced lubrication Lubrificazione forzata	⚠**B+B1+E** **B** 1/4"G 0,50 l/min **B1** 1/4"G 0,50 l/min **E** 1/4"G 0,50 l/min	**C or C1** **C** 3/4"G **C1** 3/4"G	**D** **D** 1/4"G	**F** **F** 3/8"G	X	X

VFA
VPA
V3



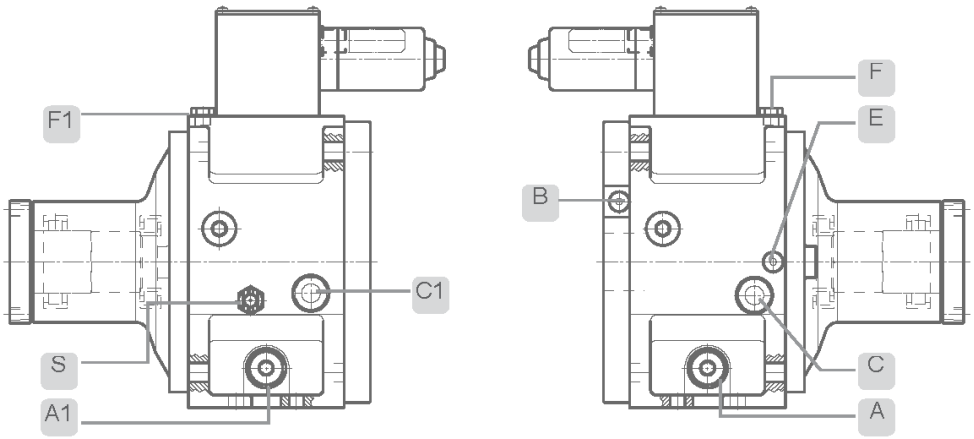
Vertical upward **Verticale verso l'alto**	Oil inlet Entrata olio	Oil return by fall down Uscita olio a caduta (Pipe inner ø min. 20mm)	Oil return by suction Uscita olio aspirazione	Vent valve Valvola di sfiato	Oil level indicator Spia livello olio	Sensor on request Sensore a richiesta
Splash lubrication Lubrificazione a sbattimento	X	X	X	X	X	X
Forced lubrication Lubrificazione forzata	**D +E** **D** 1/4"G 0,75 l/min **E** 1/4"G 0,75 l/min	⚠**B or B1** **B** 3/4"G **B1** 3/4"G	⚠**B or B1** **B** 3/4"G **B1** 3/4"G	**C or C1** **C** 3/4"G **C1** 3/4"G	X	X

⚠ In position **B** and **B1**, injectors are fitted for lubrication oil.
Do not remove or turn, seizing danger*!*

4.13 ASSEMBLING POSITIONS & LUBRICATION - CE 13

OPP

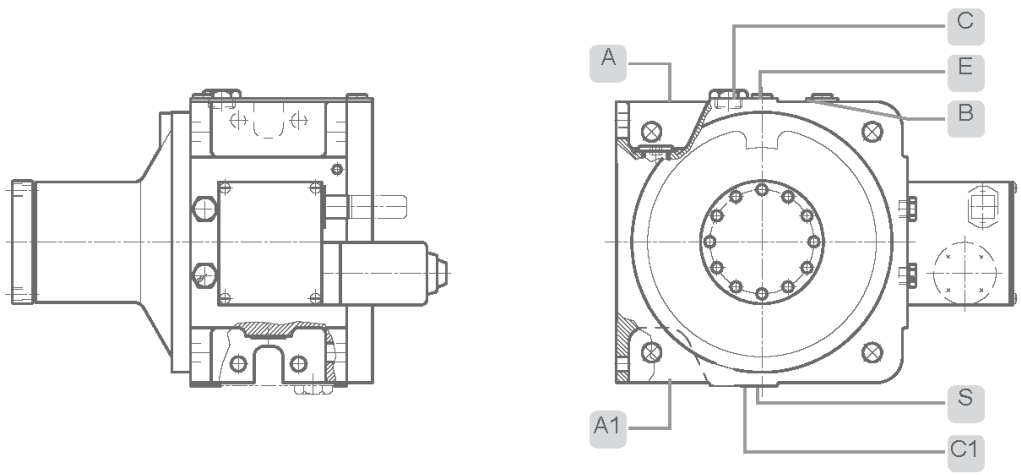
B5



Horizontal **Orizzontale**	Oil inlet Entrata olio	Oil return by fall down Uscita olio a caduta (Pipe inner ø min. 20mm)	Oil return by suction Uscita olio aspirazione	Vent valve Valvola di sfiato	Oil level indicator Spia livello olio	Sensor on request Sensore a richiesta
Splash lubrication Lubrificazione a sbattimento	**F1** **F1** 3/8"G OIL FILL IN	**A or A1** **A** 3/4"G OIL DRAIN **A1** 3/4"G OIL DRAIN	X	**F** **F** 3/8"G	**C or C1** **C** 3/4"G **C1** 3/4"G	**S** **S** 3/8"G
Forced lubrication Lubrificazione forzata	**B+E** **B** 1/4"G 0,75 l/min **E** 1/4"G 0,75 l/min	**A or A1** **A** 3/4"G **A1** 3/4"G	**C or C1** **C** 3/4"G **C1** 3/4"G	**F1** **F1** 3/8"G	X	X

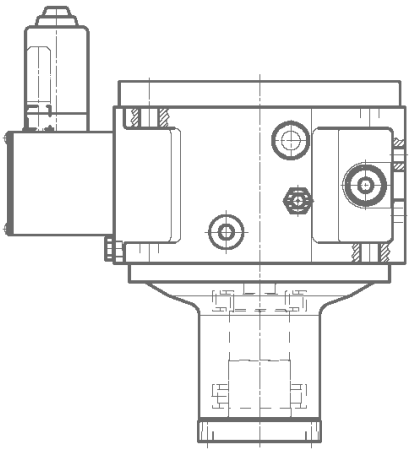
OPS

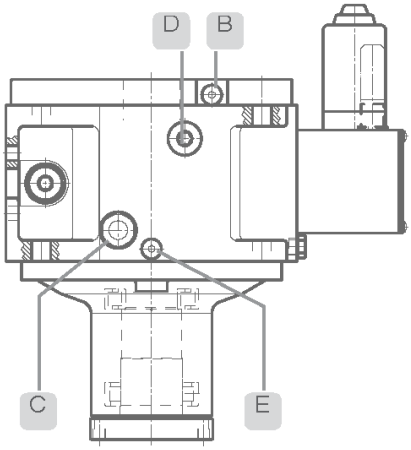
B5
90°



Horizontal turned **Orizzontale ruotato**	Oil inlet Entrata olio	Oil return by fall down Uscita olio a caduta (Pipe inner ø min. 20mm)	Oil return by suction Uscita olio aspirazione	Vent valve Valvola di sfiato	Oil level indicator Spia livello olio	Sensor on request Sensore a richiesta
Splash lubrication Lubrificazione a sbattimento	**A** **A** 3/4"G OIL FILL IN	**A1** **A1** 3/4"G OIL DRAIN	X	**C** **C** 3/4"G	X	X
Forced lubrication Lubrificazione forzata	**B+E** **B** 1/4"G 0,75 l/min **E** 1/4"G 0,75 l/min	**A1** **A1** 3/4"G	**S** **S** 3/8"G	**C** **C** 3/4"G	X	X

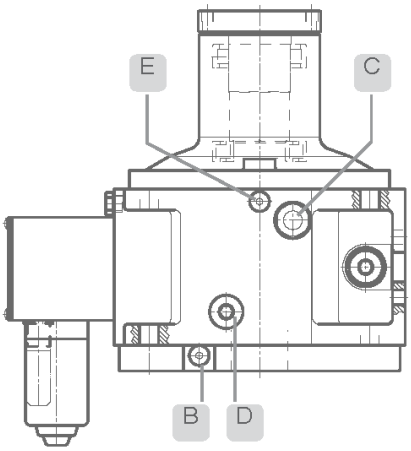
VFP
VPB
V1

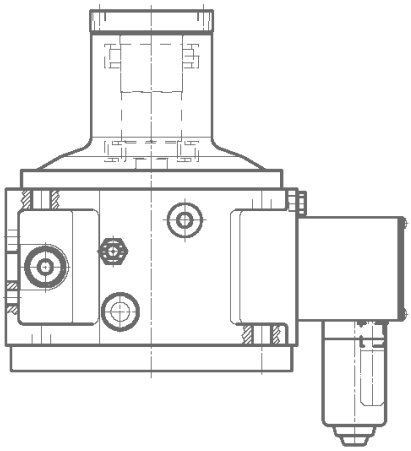




Vertical downward **Verticale verso il basso**	Oil inlet Entrata olio	Oil return by fall down Uscita olio a caduta (Pipe inner ø min. 20mm)	Oil return by suction Uscita olio aspirazione	Vent valve Valvola di sfiato	Oil level indicator Spia livello olio	Sensor on request Sensore a richiesta
Splash lubrication Lubrificazione a sbattimento	X	X	X	X	X	X
Forced lubrication Lubrificazione forzata	B+E **B** 1/4"G 0,75 l/min **E** 1/4"G 0,75 l/min	C **C** 3/4"G	C **C** 3/4"G	D **D** 3/4"G	X	X

VFA
VPA
V3



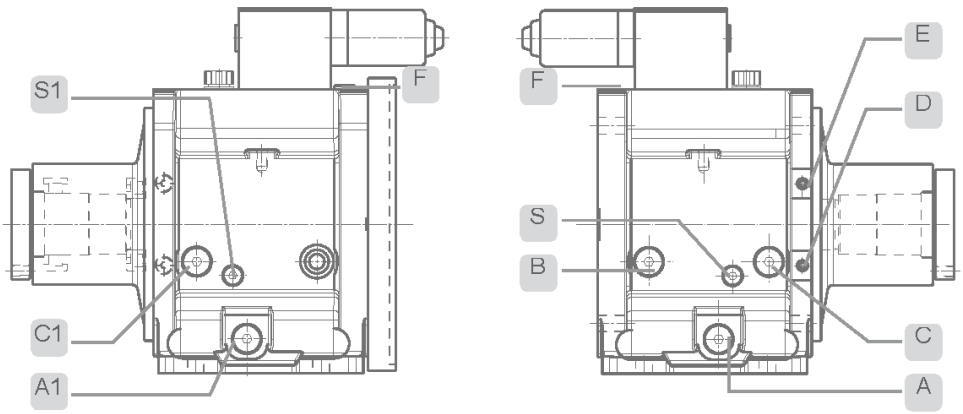


Vertical upward **Verticale verso l'alto**	Oil inlet Entrata olio	Oil return by fall down Uscita olio a caduta (Pipe inner ø min. 20mm)	Oil return by suction Uscita olio aspirazione	Vent valve Valvola di sfiato	Oil level indicator Spia livello olio	Sensor on request Sensore a richiesta
Splash lubrication Lubrificazione a sbattimento	X	X	X	X	X	X
Forced lubrication Lubrificazione forzata	E **E** 1/4"G 1,50 l/min	D **D** 3/4"G	B **B** 1/4"G	C **C** 3/4"G	X	X

4.14 ASSEMBLING POSITIONS & LUBRICATION - CE 14

OPP

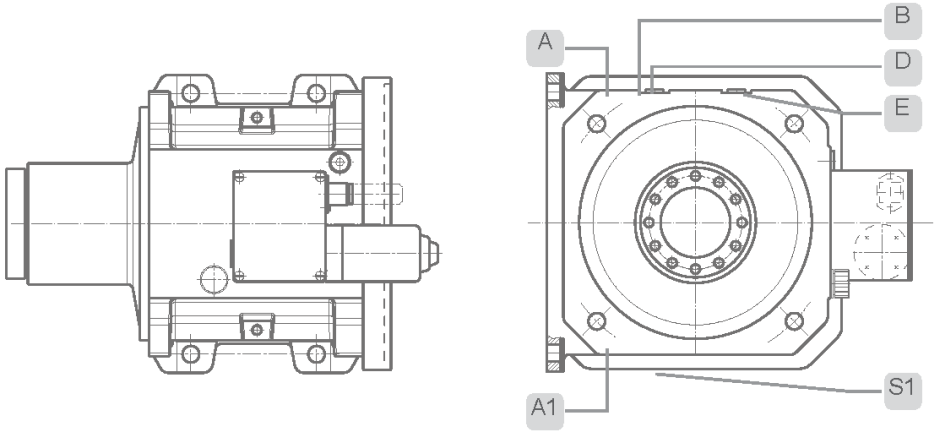
B5



Horizontal **Orizzontale**	Oil inlet Entrata olio	Oil return by fall down Uscita olio a caduta (Pipe inner ø min. 20mm)	Oil return by suction Uscita olio aspirazione	Vent valve Valvola di sfiato	Oil level indicator Spia livello olio	Sensor on request Sensore a richiesta
Splash lubrication Lubrificazione a sbattimento	**F** **F** 3/8"G OIL FILL IN	**A or A1** **A** 3/4"G OIL DRAIN **A1** 3/4"G OIL DRAIN	**X**	**F** **F** 3/8"G	**C or C1** **C** 3/4"G **C1** 3/4"G	**S** **S** 3/8"G
Forced lubrication Lubrificazione forzata	⚠ **B+E+D** **B** 1/4"G 0,50 l/min **E** 1/4"G 0,50 l/min **D** 1/4"G 0,50 l/min	**A or A1** **A** 3/4"G **A1** 3/4"G	**C or C1** **C** 3/4"G **C1** 3/4"G	**F** **F** 3/8"G	**X**	**X**

OPS

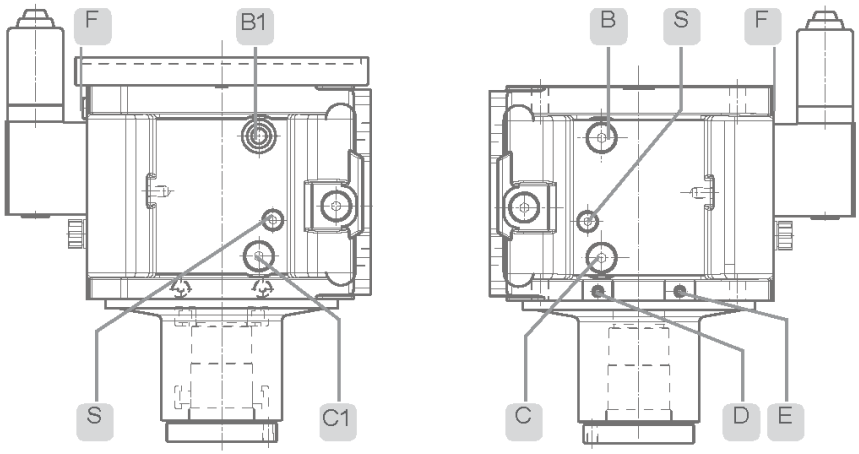
B5 90°



Horizontal turned **Orizzontale ruotato**	Oil inlet Entrata olio	Oil return by fall down Uscita olio a caduta (Pipe inner ø min. 20mm)	Oil return by suction Uscita olio aspirazione	Vent valve Valvola di sfiato	Oil level indicator Spia livello olio	Sensor on request Sensore a richiesta
Splash lubrication Lubrificazione a sbattimento	**A** **A** 3/4"G OIL FILL IN	**A1** **A1** 3/4"G OIL DRAIN	**X**	**A** **A** 3/4"G	**X**	**X**
Forced lubrication Lubrificazione forzata	⚠ **B+E+D** **B** 1/4"G 0,50 l/min **E** 1/4"G 0,50 l/min **D** 1/4"G 0,50 l/min	**A1** **A1** 3/4"G	**S1** **S1** 3/4"G	**A** **A** 3/4"G	**X**	**X**

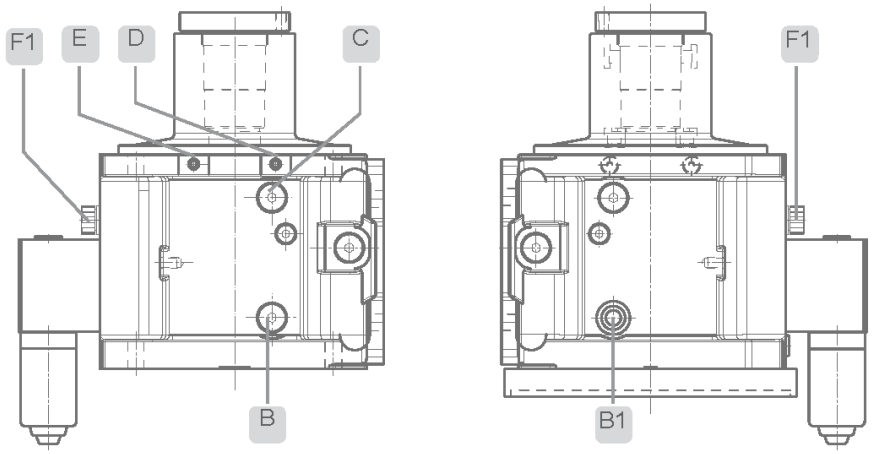
⚠ In position **B** and **B1**, injectors are fitted for lubrication oil.
Do not remove or turn, seizing danger!

VFP
VPB
V1



Vertical downward **Verticale verso il basso**	Oil inlet Entrata olio	Oil return by fall down Uscita olio a caduta (Pipe inner ø min. 20mm)	Oil return by suction Uscita olio aspirazione	Vent valve Valvola di sfiato	Oil level indicator Spia livello olio	Sensor on request Sensore a richiesta
Splash lubrication Lubrificazione a sbattimento	**B or B1** **B** 3/4"G **OIL FILL IN** **B1** 3/4"G **OIL FILL IN**	**C or C1** **C** 3/4"G **OIL DRAIN** **C1** 3/4"G **OIL DRAIN**	**X**	**F** **F** 3/8"G	**C or C1** **C** 3/4"G **C1** 3/4"G	**S** **S** 3/8"G
Forced lubrication Lubrificazione forzata	⚠**B+B1+E** **B** 1/4"G 0,50 l/min **B1** 1/4"G 0,50 l/min **E** 1/4"G 0,50 l/min	**C or C1** **C** 3/4"G **C1** 3/4"G	**D** **D** 1/4"G	**F** **F** 3/8"G	**X**	**X**

VFA
VPA
V3

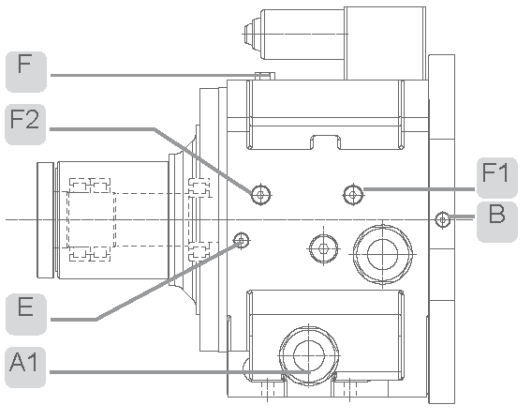


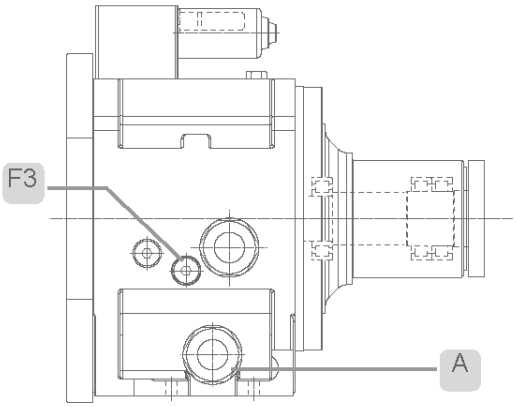
Vertical upward **Verticale verso l'alto**	Oil inlet Entrata olio	Oil return by fall down Uscita olio a caduta (Pipe inner ø min. 20mm)	Oil return by suction Uscita olio aspirazione	Vent valve Valvola di sfiato	Oil level indicator Spia livello olio	Sensor on request Sensore a richiesta
Splash lubrication Lubrificazione a sbattimento	**X**	**X**	**X**	**X**	**X**	**X**
Forced lubrication Lubrificazione forzata	**D +E** **D** 1/4"G 0,75 l/min **E** 1/4"G 0,75 l/min	⚠ **B or B1** **B** 3/4"G **B1** 3/4"G	⚠ **B or B1** **B** 3/4"G **B1** 3/4"G	**F1** **F1** 3/8"G	**X**	**X**

⚠ In position **B** and **B1**, injectors are fitted for lubrication oil.
Do not remove or turn, seizing danger!

4.15 ASSEMBLING POSITIONS & LUBRICATION - CE 16 & 18

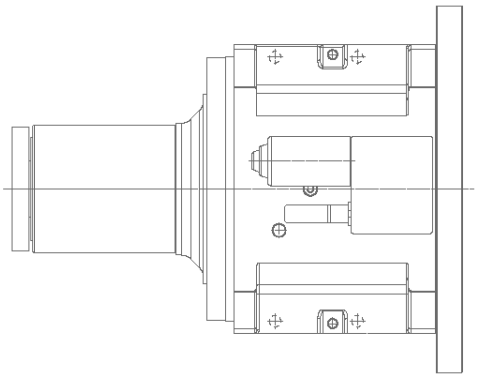
OPP
B5

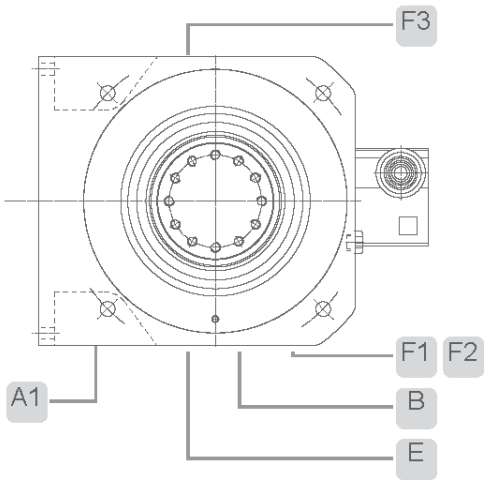




Horizontal **Orizzontale**	Oil inlet Entrata olio	Oil return by fall down Uscita olio a caduta (Pipe inner ø min. 20mm)	Oil return by suction Uscita olio aspirazione	Vent valve Valvola di sfiato	Oil level indicator Spia livello olio	Sensor on request Sensore a richiesta
Forced lubrication Lubrificazione forzata	**B+E** **B** M12x1,5 0,50 l/min **E** M12x1,5 2,50 l/min	**A or A1** **A** M48x2 **A1** M48x2	X	**F** **F** 3/8"G	X	X

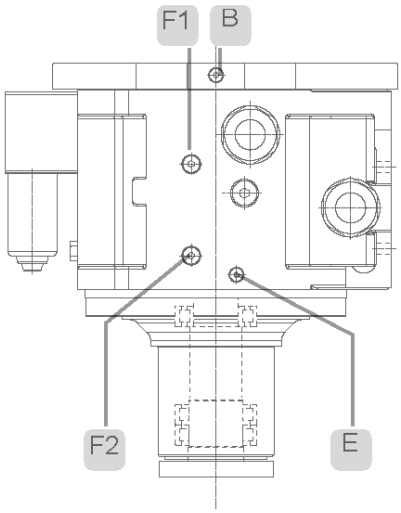
OPS
B5
90°

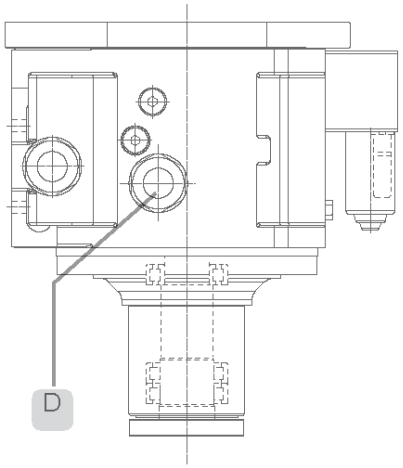




Horizontal turned **Orizzontale ruotato**	Oil inlet Entrata olio	Oil return by fall down Uscita olio a caduta (Pipe inner ø min. 20mm)	Oil return by suction Uscita olio aspirazione	Vent valve Valvola di sfiato	Oil level indicator Spia livello olio	Sensor on request Sensore a richiesta
Forced lubrication Lubrificazione forzata	**B+E** **B** M12x1,5 0,50 l/min **E** M12x1,5 2,50 l/min	**A1** **A1** M48x2	**F1 or F2** **F1** **F2** 3/8"G	**F3** **F3** 3/8"G	X	X

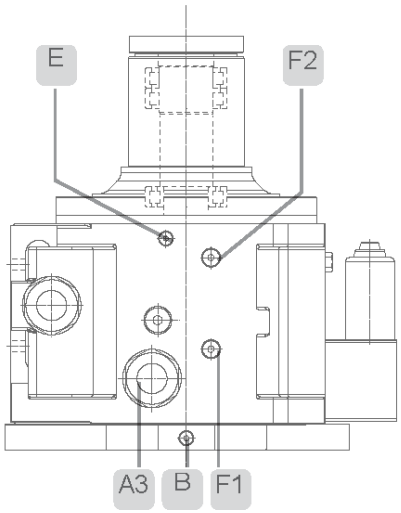
VFP
VPB
V1

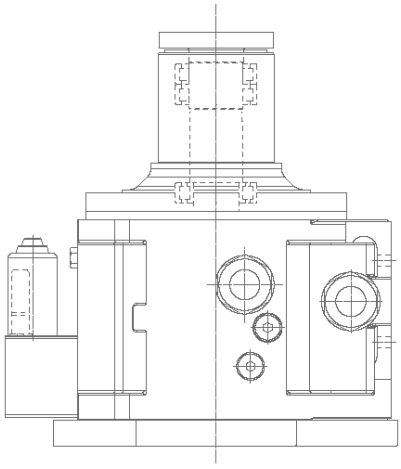




Vertical downward **Verticale verso il basso**	Oil inlet Entrata olio	Oil return by fall down Uscita olio a caduta (Pipe inner ø min. 20mm)	Oil return by suction Uscita olio aspirazione	Vent valve Valvola di sfiato	Oil level indicator Spia livello olio	Sensor on request Sensore a richiesta
Forced lubrication Lubrificazione forzata	**B+E** **B** M12x1,5 0,50 l/min **E** M12x1,5 2,50 l/min	**D** **D** M48x2	**F2** **F2** 3/8"G	**F1** **F1** 3/8"G	**X**	**X**

VFA
VPA
V3

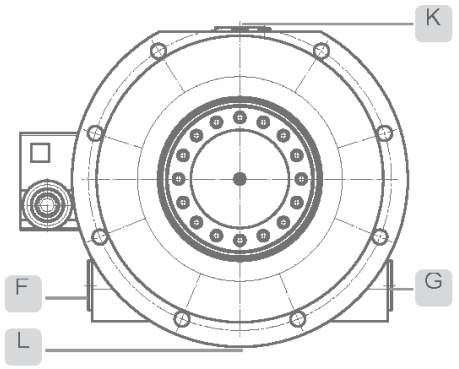


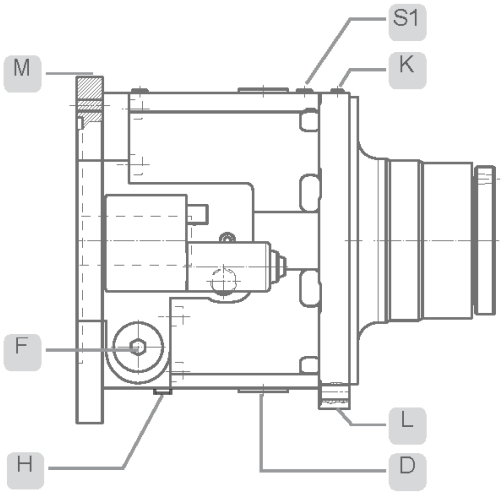


Vertical upward **Verticale verso l'alto**	Oil inlet Entrata olio	Oil return by fall down Uscita olio a caduta (Pipe inner ø min. 20mm)	Oil return by suction Uscita olio aspirazione	Vent valve Valvola di sfiato	Oil level indicator Spia livello olio	Sensor on request Sensore a richiesta
Forced lubrication Lubrificazione forzata	**E** **E** M12x1,5 2,50 l/min	**A3** **A3** M48x2	**F1** **F1** 3/8"G	**F2** **F2** 3/8"G	**X**	**X**

4.16 ASSEMBLING POSITIONS & LUBRICATION - CE 20

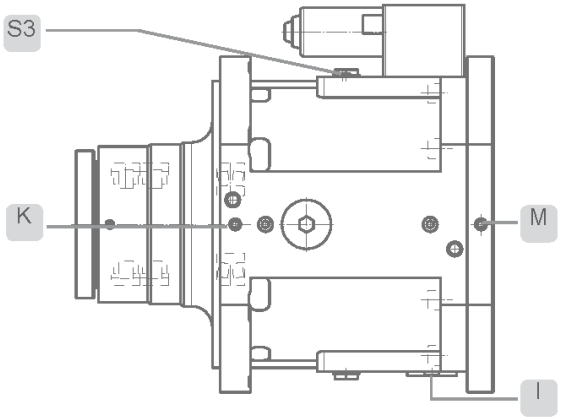
OPP
B5

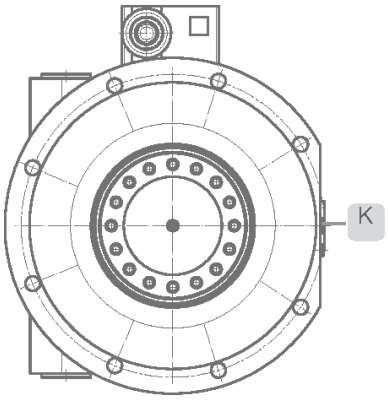




Horizontal **Orizzontale**	Oil inlet Entrata olio	Oil return by fall down Uscita olio a caduta (Pipe inner ø min. 20mm)	Oil return by suction Uscita olio aspirazione	Vent valve Valvola di sfiato	Oil level indicator Spia livello olio	Sensor on request Sensore a richiesta
Forced lubrication Lubrificazione forzata	**M+K** **M** M12x1,5 0,50 l/min **K** M12x1,5 2,50 l/min	**F or G or D** **F** M48x2 **G** M48x2 **D** M48x2	**L or H** **L** M20x1,5 **H** M20x1,5	**S1** **S1** 3/8"G	X	X

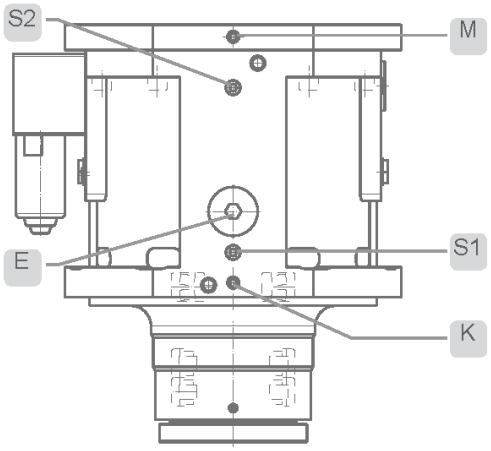
OPS
B5
90°

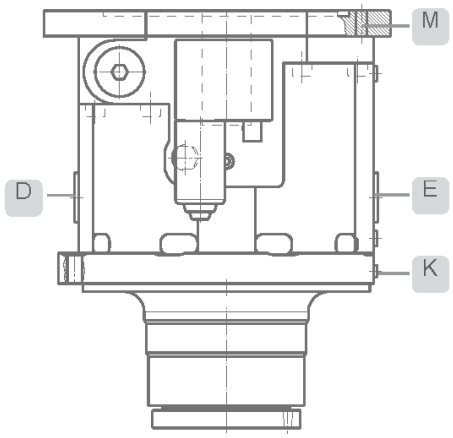




Horizontal turned **Orizzontale ruotato**	Oil inlet Entrata olio	Oil return by fall down Uscita olio a caduta (Pipe inner ø min. 20mm)	Oil return by suction Uscita olio aspirazione	Vent valve Valvola di sfiato	Oil level indicator Spia livello olio	Sensor on request Sensore a richiesta
Forced lubrication Lubrificazione forzata	**M+K** **M** M12x1,5 0,50 l/min **K** M12x1,5 2,50 l/min	**G** **G** M48x2	**I** **I** M20x1,5	**S3** **S3** 3/8"G	X	X

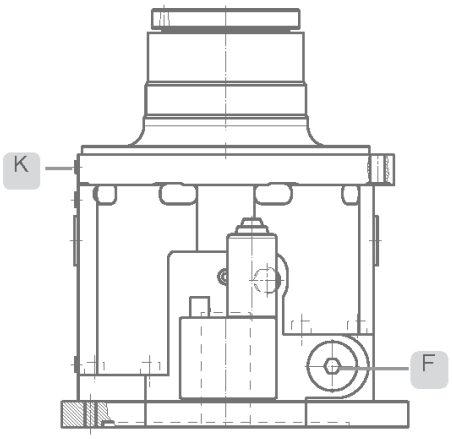
VFP
VPB
V1

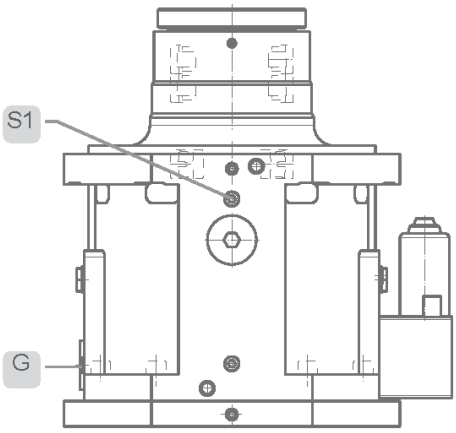




Vertical downward **Verticale verso il basso**	Oil inlet Entrata olio	Oil return by fall down Uscita olio a caduta (Pipe inner ø min. 20mm)	Oil return by suction Uscita olio aspirazione	Vent valve Valvola di sfiato	Oil level indicator Spia livello olio	Sensor on request Sensore a richiesta
Forced lubrication Lubrificazione forzata	**M+K** **M** M12x1,5 0,50 l/min **K** M12x1,5 2,50 l/min	**E or D** **E** M48x2 **D** M48x2	**S1** **S1** 3/8"G	**S2** **S2** 3/8"G	X	X

VFA
VPA
V3





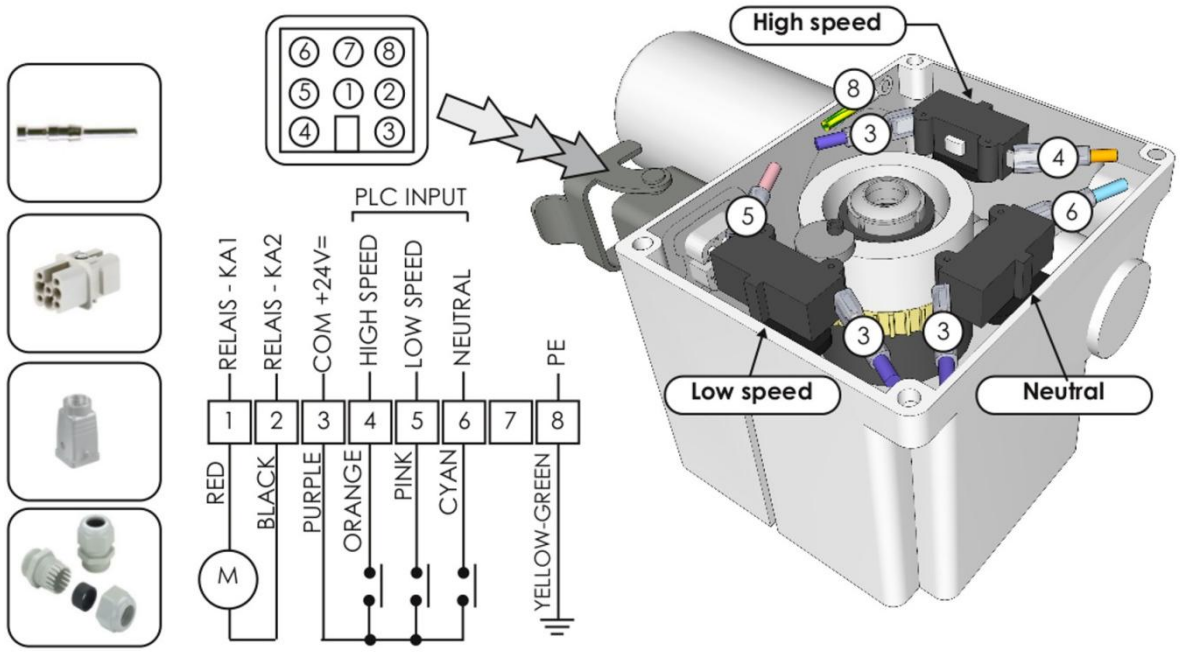
Vertical upward **Verticale verso l'alto**	Oil inlet Entrata olio	Oil return by fall down Uscita olio a caduta (Pipe inner ø min. 20mm)	Oil return by suction Uscita olio aspirazione	Vent valve Valvola di sfiato	Oil level indicator Spia livello olio	Sensor on request Sensore a richiesta
Forced lubrication Lubrificazione forzata	**K** **K** M12x1,5 2,50 l/min	**F or G** **F** M48x2 **G** M48x2	**H** **H** M20x1,5	**S1** **S1** 3/8"G	X	X

5 ELECTRICAL SECTION

5.1 ACTUATOR

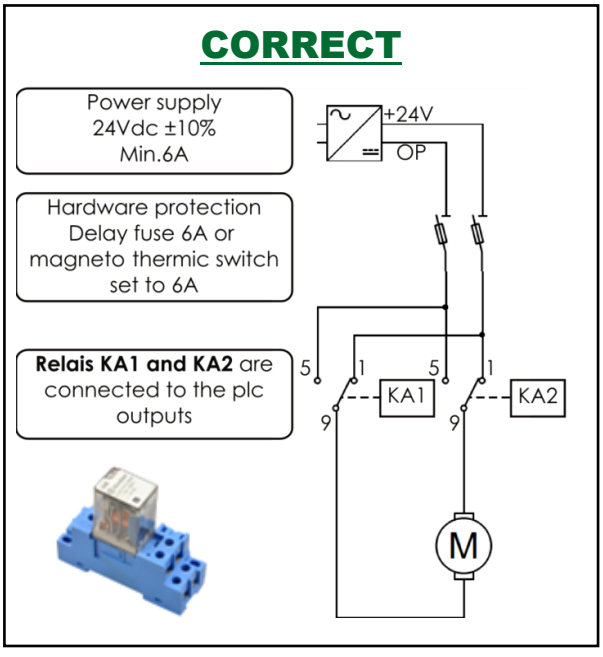
The gearbox actuator (02) is an electro-mechanical shifting unit used to switch between the low speed/high speed/neutral positions.
The unit is designed according to the easiest and most durable solutions for the speed change.

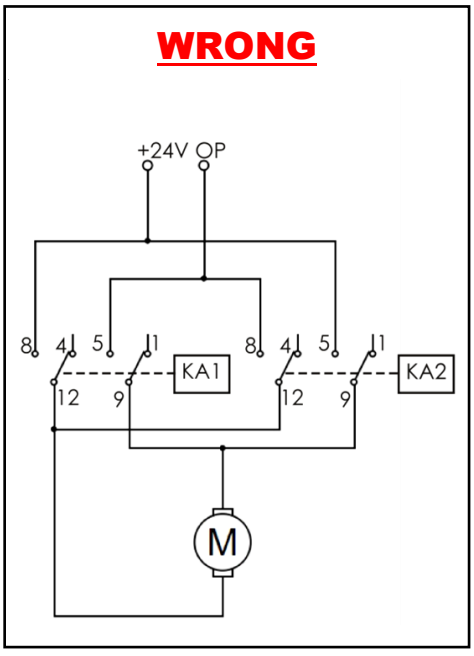
Cable Pin Out (a) | **Actuator (02)**



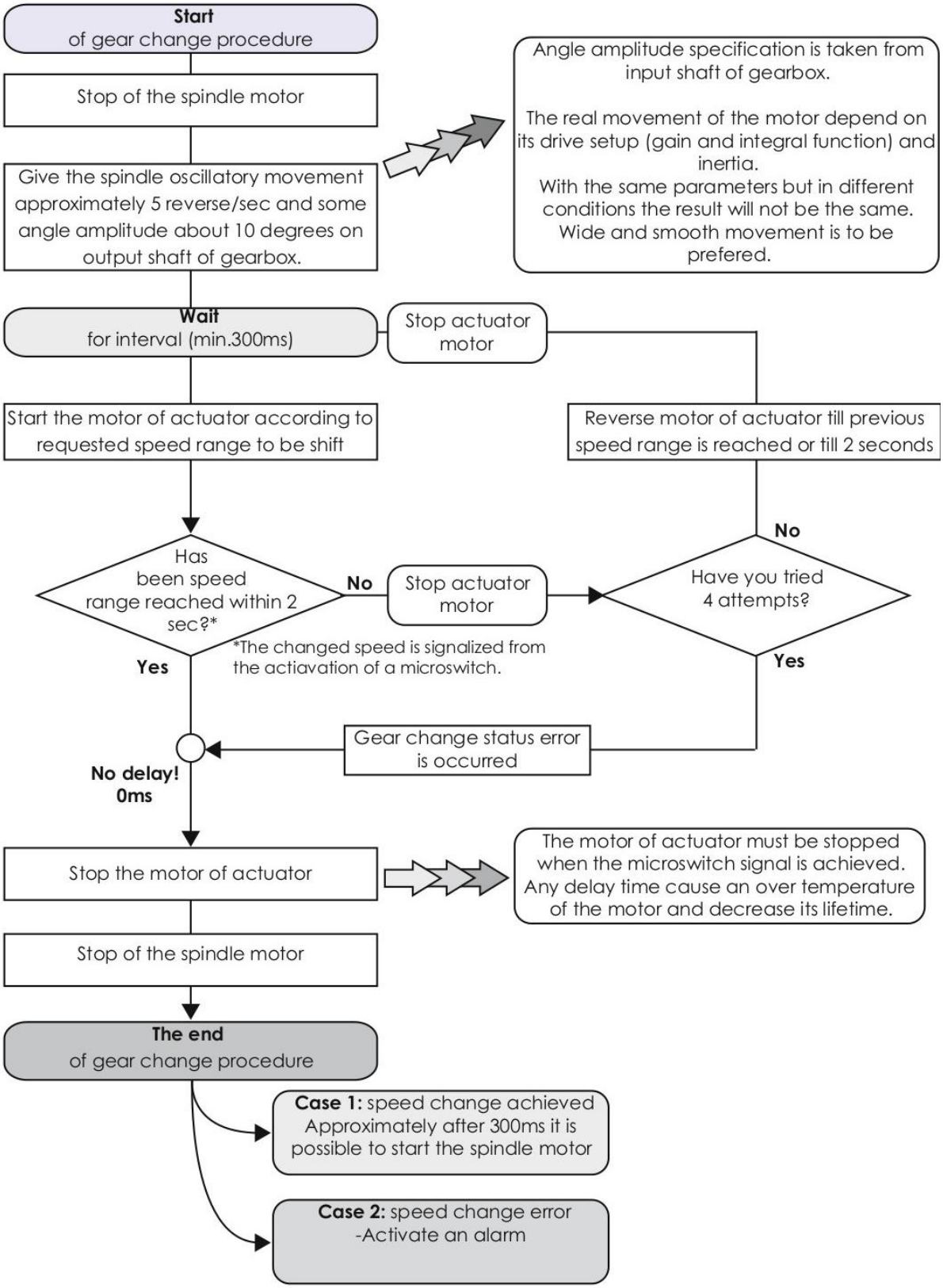
5.2 CIRCUIT DIAGRAM

The following circuit is the best solution in order to **preserve the motor and to avoid the delays** due to the actuator motor inertia.
The power supply unit must be able to supply at least 6A, in order to allow clutch slipping and to be able to overcome static friction torque.





5.3 FLOW CHART & ISO PROGRAM EXAMPLE



This program * shows a customer implementation of speed change sequence.

ISO PROGR. EXAMPLE

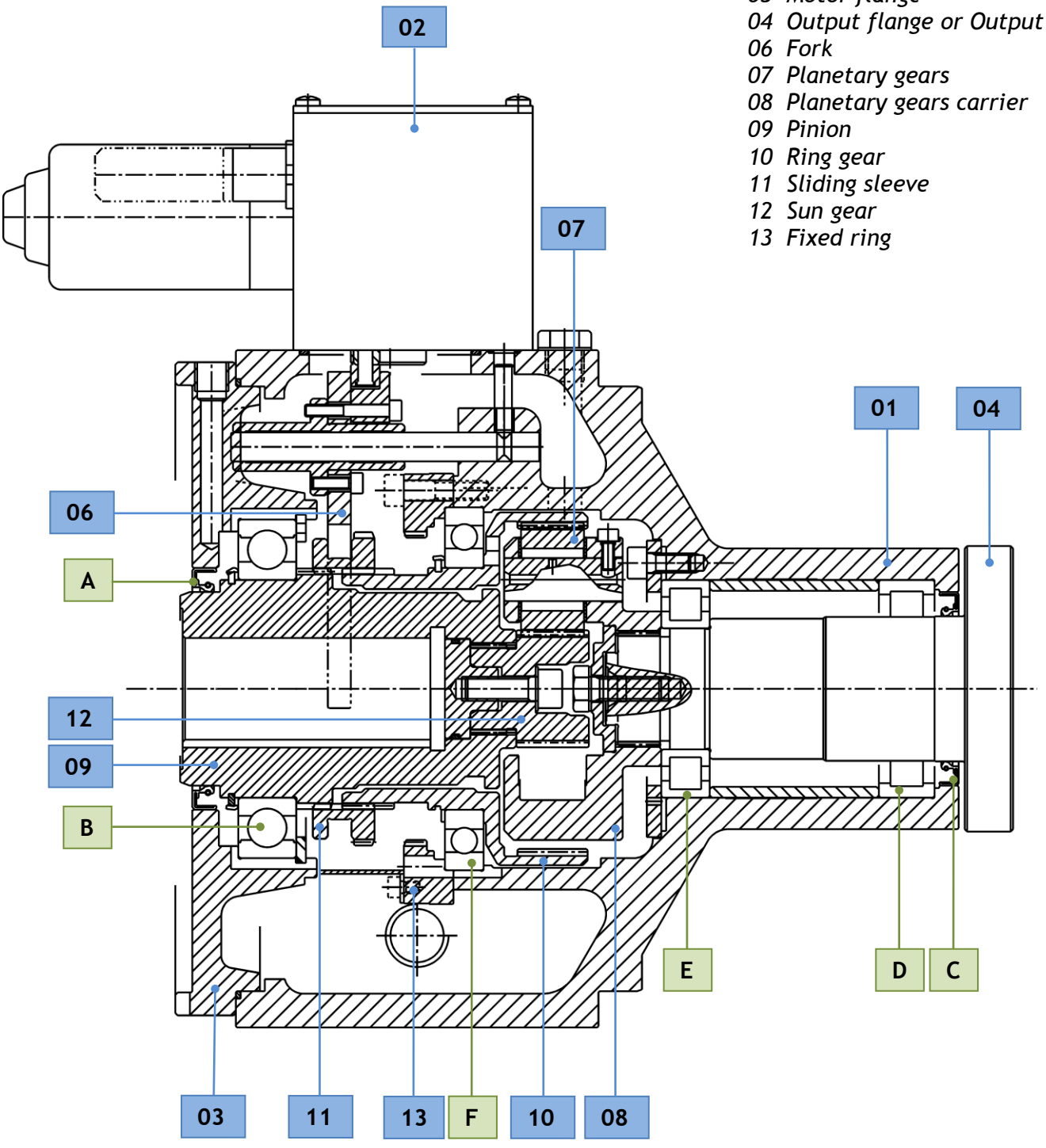
```
IF M42 is „on“ (request of second gear step from CNC side) THEN
   Attempt=0
   Spindle stop command
   IF   spindle is stopped THEN
     WHILE number of attempt <= 4 THEN
      Spindle oscillation command
        Gear shift forward command
        IF  M41 switch =1 more then 2 sec THEN
            Attempt=9
        Gear shift stop command
        Spindle stop oscillation command
      ELSE
           IF M42 switch = 0 more then 2 sec THEN
              Gear shift stop command
              Wait for 0.3 sec
              Gear shift reverse command
                 IF M41 switch = 1 THEN
                  Gear shift stop command
   Wait for 0.3 sec
                     Attempt=Attempt+1
                ENDIF
         ELSE
              IF M42 switch=1 THEN
              Gear shift stop command oscillation
                  Attempt=10
               ENDIF
            ENDIF
         ENDIF
      ENDWHILE
   ENDIF
ENDIF

IF M42 request is „on“ THEN
      IF Attempt = 9 THEN
          Error „Gearshift doesn’t move “
       ENDIF
       IF Attempt = 5 THEN
           Error „ Too much attempts “
        ENDIF
ENDIF
```

** The program has written for Heidenhain MP620 control unit*

6 GEARBOX LAYOUT VIEWS

6.1 GEARBOX TYPE CE 11 - 13 - 16 - 18 - 20

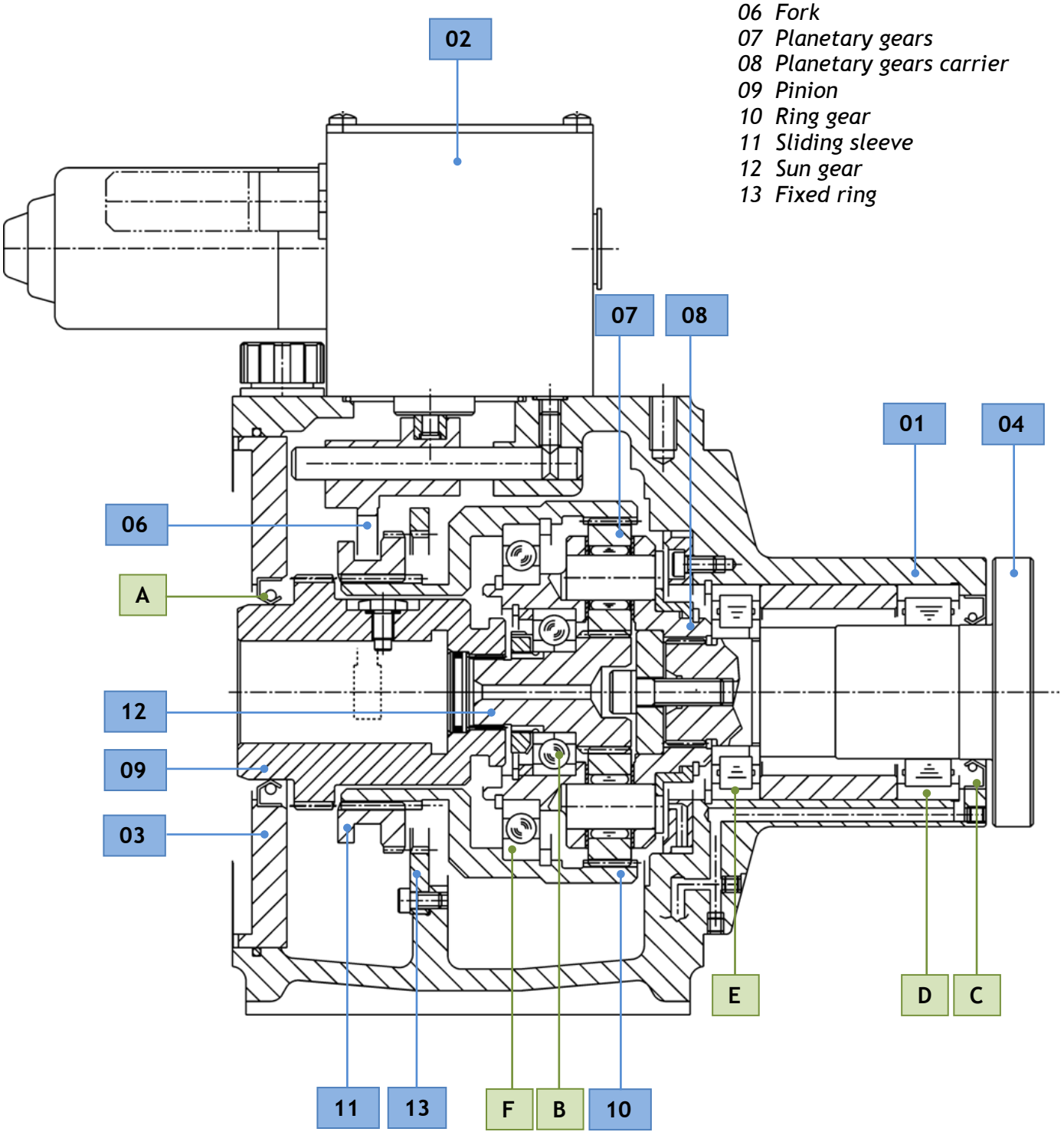
01 Housing
02 Actuator
03 Motor flange
04 Output flange or Output shaft
06 Fork
07 Planetary gears
08 Planetary gears carrier
09 Pinion
10 Ring gear
11 Sliding sleeve
12 Sun gear
13 Fixed ring



A Rotary Shaft Seal (pinion)
B Pinion Bearing
C Rotary Shaft Seal (output)
D Output Shaft Bearing (outer)
E Output Shaft Bearing (inner)
F Ring Gear Bearing

6.2 GEARBOX TYPE CE 12 - 14

01 Housing
02 Actuator
03 Motor flange
04 Output flange or Output shaft
06 Fork
07 Planetary gears
08 Planetary gears carrier
09 Pinion
10 Ring gear
11 Sliding sleeve
12 Sun gear
13 Fixed ring



A Rotary Shaft Seal (pinion)
B Pinion Bearing
C Rotary Shaft Seal (output)
D Output Shaft Bearing (outer)
E Output Shaft Bearing (inner)
F Ring Gear Bearing