General Information about NB300 Planetary Gearboxes

This section provides some general information for you to understand the symbles, technical characters and other information about the planetary gearboxes.

The use of planetary gear units in the field of power transmission is the modern answer to the demand for compactness constructive simplicity, high product reliability and efficiency.

Table of contents

1. Symbols, units of measure and description

Symbol	Unit	Description
A_{C1}	(N)	Calculated thrust load at gearbox input shaft
A_{C2}	(N)	Calculated thrust load at gearbox output shaft
A_{n1}	(N)	Rated thrust load at gearbox input shaft
A_{n2}	(N)	Rated thrust load at gearbox output shaft
F_h		Lifetime factor for gearbox calculation
F_{h1}, F_{h2}		Lifetime factor for bearing shafts calculation
f_{h1}, f_{h2}		Load corrective factor on shafts
f_m		Increase factor
fs		Service factor
ft		Thermal factor
ftp		Temperature factor
fv		Speed factor
h	(h)	Lifetime in hours
i		Gearbox ratio
M2’	(N.m)	Reference torque
M2	(N.m)	Torque delivered to output shaft
M_b	(N.m)	Rated brake torque
Mc2	(N.m)	Calculated torque at gearbox output
Mn2	(N.m)	Gearbox rated output torque
Mn2’	(N.m)	Gearbox rated output torque, life time=10000 hours
M_{2max}	(N.m)	Gearbox max. output torque
M_{r1}	(N.m)	Require torque at gearbox input
M_{r2}	(N.m)	Require torque at gearbox output
n1,n2	(min^{-1})	Angular speed at gearbox input, Angular speed at gearbox output
P	(bar)	Hydraulic oil pressure
P1	(KW)	Max. transmissible power at gearbox input
P1’	(KW)	Transmissible power at gearbox input
P2	(KW)	Transmissible power at gearbox output
Pn	(KW)	Gearbox rated power
Pr1	(KW)	Required input power
Pr2	(KW)	Output power at n2 max.
Pr2’	(KW)	Output power at n2 min.
Ps	(KW)	Excess power
Pt	(KW)	Gearbox thermal capacity
Q	(L/min)	Hydraulic flow rate
Rc1, Rc2	(N)	Calculated radial load of gearbox input shaft, Calculated radial load of gearbox output shaft
Rx1	(N)	Rated radial load at gearbox input re-calculated with respect to different load application points
Rx2	(N)	Rated radial load at gearbox output re-calculated with respect to different load application points
S		Safety factor
ta	(℃)	Ambient temperature
V	Cm^3	Hydraulic motor displacement
Vc	Cm^3	Theoretical hydraulic motor displacement
X	mm	Load application distance from shaft shoulder
ηd		Dynamic efficiency

2. TECHNICAL CHARACTERISTICS AND GENERAL INFORMATION

2.1.OUTPUT TORQUE

2.1.1.Reference torque M2’ (N.m)

This is an indicative output torque to easily establish the performance class for each gearbox basic size.

2.1.2.Gear motor delivered torque M2 (N.m)

This is the net torque delivered to the output shaft, with installed power Pn, safety factor S, which will yield a theoretical lifetime of 10000 hours. This torque value takes gearbox efficiency into consideration.

2.1.3.Nominal torque Mn2 (N.m)

Torque transmission at output at uniform continuous load, service factor fs=1 for different fixed values of the life factor (n2×h).

2.1.4. Rated output torque Mn2’ (N.m)

This is the torque output the gearbox can deliver safety, based on: uniform loading and safety factor S=1, 10000 hours theoretical lifetime.

2.1.5.Max. Torque M2max (N.m)

It is the output torque that the reduction unit can withstand in static or highly intermittent conditions. (It is considered as instantaneous load peak torque or starting torque under load).

2.1.6.Required torque Mr2 (N.m)

This is the torque corresponding to application requirements. It must always be equal or less than rated output torque Mn2 of the selected gearbox.

2.1.7.Calculated torque Mc2 (N.m)

Torque value to be used for selecting the gearbox, considering required torque Mr2 and service factor fs (table 3), and is obtained by formula:

$$M_{c2}=M_{r2}\times f_s<M_{n2} \qquad (F1)$$

Where Mn2 is the value for the specific application taking into consideration the life factor (n2×h)

2.2.POWER

2.2.1. Input rated power P1 (KW)

Power P1 indicated in the specification table for each gearbox size is either the intermittent or continuous power which can be transmitted at the gearbox input under the following conditions**:**

Input speed	n_1
Theoretical duration	1000 h
Service factor	fs=1

Check that the formula here below is always satisfied:

$$P_1'\times f_s < P_1 \qquad (F2)$$

2.2.2. Output power P2 (KW)

This value is the power transmitted at gearbox output. It can be calculated with the following formulas:

$$P_2=P_1\times \eta_d \qquad (F3)$$

$$P_2=(M_{r2}\times n_2)/9549 \qquad (F4)$$

2.3.THERMAL POWER Pt (KW)

This value indicates the gearbox’s thermal capacity (refer to the technical data concerning the gearboxes under consideration) and is the power that can be transmitted under continuous duty, at an input speed n_1 of 1500 min^{-1} at an ambient temperature of 20℃ without using a supplementary cooling device.

For a duty cycle with short operating periods and sufficiently long pauses to allow the unit to cool, thermal power

is not particularly important and therefore it does not need to be taken into consideration.
At an ambient temperature other than 20℃ under intermittent duty conditions and with an input speed n_1 other than 1500 min^{-1} it is possible to calculate the Pt value according to the thermal factor ft and the speed factor fv, shown in table (1).
Make sure that the following condition is always satisfied: $P_{r1} <= Pt \times f_t \times f_V$ (F5)
Table: 1

ta max. ( )	ft				
	Continuous duty	Intermittent duty Cyclic duration factor % (l) % (l)= t_f /(t_f + t_r) ×100% (t_f : operating time under load) (t_r : rest time)			
	100%	80%	60%	40%	20%
10	1.2	1.3	1.6	1.8	2.0
20	1.0	1.1	1.3	1.5	1.7
30	0.9	1.0	1.2	1.3	1.5
40	0.7	0.8	0.9	1.0	1.2
50	0.5	0.6	0.7	0.8	0.9

n1	fv
500	1.7
750	1.5
950	1.2
1500	1.0
1750	0.85
2000	0.7
2500	0.5
3000	0.4

2.4.DYNAMIC EFFICIENCY ηd

Obtained from the ratio of output power P_2 to input power P_1 according to the following equation:

$\eta_d = P_2/P_1$ (F6)

Its value is a function of the transmitted power, the speed, the reduction ratio and oil temperature and viscosity. The maximum efficiency values are shown in the table (2) below.

Table 2:

N° stage			
L1	L2, R2	L3, R3	L4, R4
0.97	0.94	0.91	0.88

2.5.REDUCTION RATIO i

This is the ratio of gearbox input speed to gearbox output speed.

$i = n_1/n_2$ (F7)

2.6.ANGULAR SPEED

2.6.1.Input speed n1 (min-1)

The n1 refers to the speed of motor if motor is directly connected to gearbox. In the case of an indirect drive, this value is the speed of the motor divided by the transmission ratio of the indirect drive accessory (belt, chain, etc.).
Input speed should exceed the values indicated in the tables on gearbox technical features.
As for continuous operation in industrial applications, we recommend that speed of 1750 min-1 be never exceeded.

2.6.2. Output speed n2 (min-1)

Calculated from input speed n_1 and transmission ratio i according to the following equation:

$n_2 = n_1/i$ (F8)

2.7. SERVICE FACTOR fs

This is a factor depending on the application type. This factor takes into consideration (with sufficient approximation) load variations which the gearbox may undergo for a specific type of duty. It also takes into consideration the selected type of the drive unit, electric or hydraulic motor and so on.

Table (3) gives indications for the service factor to be selected according to the application and operation type.

Table 3:

SERVICE FACTOR f_S						
		Number of starts (/hour)				
Type of	**Type of drvie unit**	**16**	**32**	**63**	**125**	**250**
Uniform load	Electric motor	1.00	1.10	1.15	1.25	1.4
	Hydraulic motor	1.00	1.00	1.10	1.15	1.20
	Endothermic engine	1.25	--	--	--	--
Moderate shock load	Electric motor	1.10	1.15	1.20	1.40	1.60
	Hydraulic motor	1.00	1.00	1.10	1.20	1.30
	Endothermic engine	1.50	--	--	--	--
Heavy shock load	Electric motor	1.20	1.30	1.40	1.60	1.80
	Hydraulic motor	1.10	1.20	1.25	1.35	1.50
	Endothermic engine	2.00	--	--	--‘	--

2.8. SAFETY FACTOR S

This is the relationship of the gear unit rated power to the power of the electric motor actually driving the unit

$$S=Pn1 / P1 \qquad (F9)$$

2.9. LIFE FACTOR Fh1, Fh2

Factor resulting by multiplying angular speed at input (n_1) or output (n_2) by actual operating working hours h, break time excluded.

$$F_{h1}=(n_1 \times h) \qquad (F10)$$

$$F_{h2}=(n_2 \times h) \qquad (F11)$$

Life factor is directly proportional to gearbox rpms during the whole duty time.

2.10. SELECTION

Some essential data are necessary for a proper gearbox of gear motor selection as indicated in table (4).

Fill in the table and send a copy to out technical service department which will select the most suitable gearbox for your application requirements.

2.11. GEARBOX SELECTION

a) Determine the following according to the required application:
   - Service factor fs (Table 3)
   - Required gearbox working life (h)
   - Required drive unit (hydraulic, electric or others)

b) Define the calculated torque with the required output torque M_{c2}

$$M_{c2}=Mr_2 \times fs \qquad (F12)$$

c) Calculate the life factor with required working life h and output speed n2:

$$F_{h2}= (n_2 \times h) \qquad (F13)$$

d) Calculate the required reduction ratio:

$$i=n_1/n_2 \qquad (F14)$$

e) Select gearbox size which, having a reduction ratio close to the calculated value, and see the following:

$M_{c2} <= M_{n2}$ (F15)

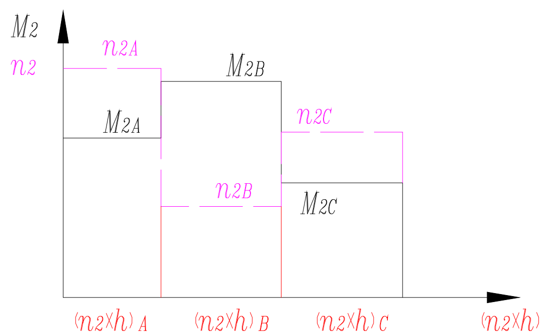
$F_{h2} <= (n_2 \times h)$ (F16)

Where the Mn_2 and F_{h2} are indicated in the tables on technical features for each gearbox size.

In case of applications in which the required M_{r2} and speed n_2 vary within a wide range, best selection could be an equivalent required torque given by:

$$M_{r2}=\{[(n2\times h)_A \times M_A^4+(n2\times h)_B \times M_B^4+(n2\times h)_C \times M_C^4+\ldots]/[(n2\times h)_A+(n2\times h)_B+(n2\times h)_C+\ldots]\}^{0.25}$$

Referred to:



And calculating the life factor F_h with:

$$F_{h\ calc} = (n2\times h)_A + (n2\times h)_B + (n2\times h)_C \ldots\ldots \quad (F17)$$

Then follow the same procedure as specified in d) and e).

Table (4): **DATA SHEET FOR SELECTING REDUCTION GEAR**

	Date application sheet for selecting reduction gear	
Name of client: Address: Date:		
Application description:		
Type of motor and drive unit: Electric / Hydraulic / Others		
Gearbox		**Electric motor**
P_{r2}	Required output power: (KW)	IEC or NEMA size:
M_{r2}	Required output torque: (N.m)	Rated power: (KW)
n_2	Output speed: (min^{-1})	Motor voltage: (V)
n_1	Input speed: (min^{-1})	Number of poles:
R_{c2}	Radial load on output shaft: (N)	Frequency: (Hz)
X_2	Load application distance: (mm)	Duty type to IEC norms: s / %
R_{c1}	Radial load on input shaft: (N)	Starting frequency: 1/h
X_1	Load application distance: (mm)	Motor protection degree: IP
A_{c2}	Thrust load on output shaft: (N)	Insulation class:
A_{c1}	Thrust load on input shaft: (N)	Brake in self-braking motor:
h	Required life lifetime: (h)	Brake voltage: (V) Brake torque Mb: (N.m)
ta	Ambient temperature: (℃)	**HYDRAULIC MOTOR**
Type: Liner / Right angle		Brand:
Output version:		Type:
Accessories:		Min./Max. displacement: (cm^3)
Mounting position:		Max. operating pressure: (bar)
Lubricants: mineral /synthetic		Max. operating flow rate: (l/min^{-1})
		Hydraulic brake: yes /no
		Brake torque Mb: (N.m)

NOTE:

The selection criteria and specifications reported in this catalogue are not valid for any applications, including those where the gearbox is to serve as a safety device preventing injury to persons or damage to objects, as is the case with hoisting equipment.

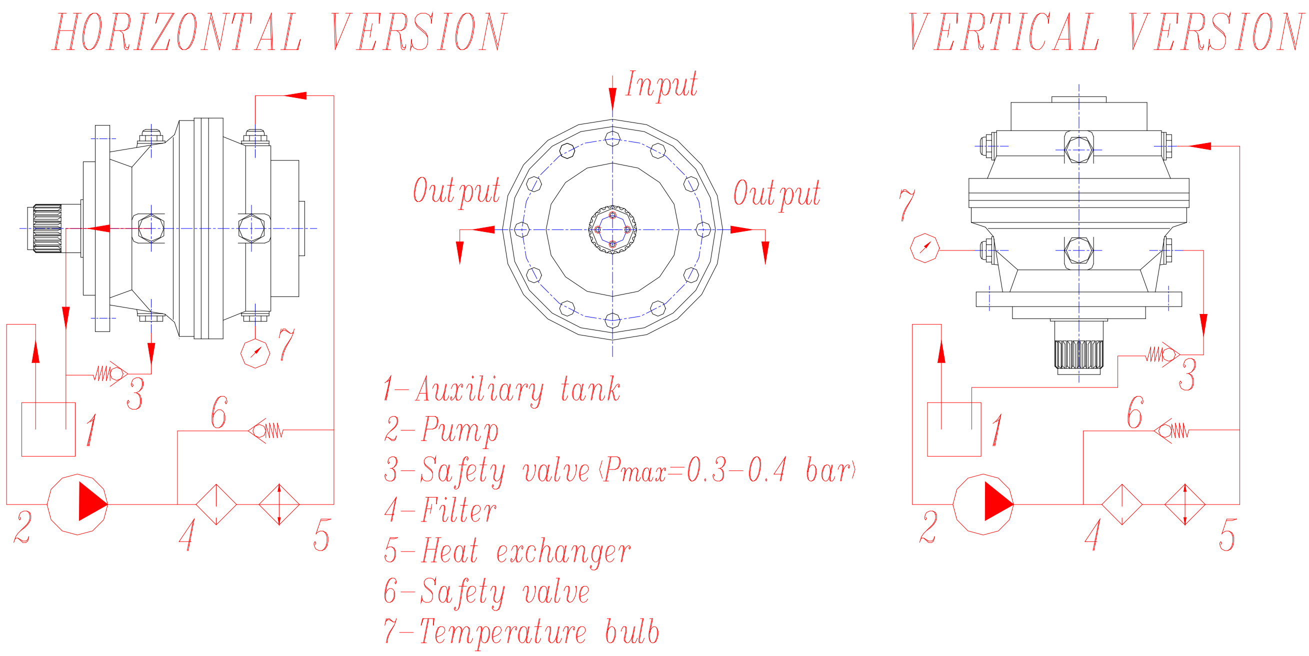
2.12. VERIFICATION

After selecting the drives units, please check the following:

a) Thermal power

Make sure that thermal power of the gearbox (shown in the tables in the chapters dealing with the gear unit series captioned) is equal to or greater than the power required by the application according to equation (F5). If this condition is not respected, select larger gearbox or apply a forced cooling system.

Example of oil re-circulation cooling system:



b) Maximum torque

Make sure that the maximum torque (considered as instantaneous load peak torque or starting torque under load) does not exceed the M_{2max} value that the gearbox can withstand. (Refer to the technical data tables concerning the gearboxes sizes.)

c) Radial loads

Check that radial loads exerted on input and output shafts are lower than or equal to values indicated in the tables on gearbox technical features or charts for each gearbox size. In case they are grater the indicated value, change either gearbox output version, gearbox size or system bearing arrangement.

To check proceed as follows:

Define radial loads Rc_1 at input and Rc2 at output.

$$Rc_1=2000\times Mc_1\times Kr_1/d_1 \quad (F18)$$

$$Rc_2=2000\times Mc_2\times Kr_2/d_2 \quad (F19)$$

In which:

Mc_1, Mc_2 ------ Input and output calculated torque (N.m)

d_1, d_2------------Diameter of the part fitted onto the shaft (mm), pulley, gear or chain crown.

Kr_1, Kr_2-------Stress factor for radial load with following values

Chain crown-------1.0

Gear ----------------1.25

Belt pulley-------------1.5-2.5

Define the trust load position X onto shaft. Check this value with the chart indicating the load Rx1 and Rx2 bearable by the gearbox. Check that the following is satisfied:

$Rc_1 <= Rx_1 \times f_{h1}$ (F20)

$Rc_2 <= Rx_2 \times f_{h2}$ (F21)

Where f_{h1} and f_{h2} the radial and thrust load corrective factor depending on the required life factor F_{h1} and F_{h2}.

d) Thrust loads

check the thrust load, when exerted onto the output shaft, as specified for the radial load. The following should be satisfied:

$\pm Ac2 <= \pm An2 \times f_{h2}$ (F22)

when a thrust load is combined with an axial load, contact us via email.

2.13. HOW TO SELECT THE MOTOR

Electric motor

a) n_2 and dynamic efficiency η_d are known, calculate input power based on torque M_{r2} as follows:

$P_{r1}=(M_{r2} \times n_2) / (9549 \times \eta_d)$ KW (F23)

Table (2) on page 6 reports the values of efficiency ηd related to the different reduction stages of the gearboxes.

b) Look up the motor selection charts and select a size with such rated power to satisfy this condition:

$P_{r1} <= P_n$ (F24)

4-pole motor and over should be preferred.

Unless otherwise specified, power P_n of motors indicated in the catalogue refers to continuous duty S1.

For motors used in conditions other than S1, the type of duty required by reference to CEI 2-3/IEC 34-1 Standards must be mentioned.

For duties from S2 to S8 in particular and for motor frame 132 or smaller, extra power can be obtained with respect to continuous duty power, consequently the following condition must be satisfied:

$P_{r1}/fm <= P_n$ (F25)

The increased power factor fm can be obtained from table (5).

Table 5:

fm	**Duty**						
	S2			**S3***			**S4-S8**
	Cycle duration (min^{-1})			**Cyclic duration factor % (I) % (I)= t_f /(t_f +t_r) ×100% (t_f : operating time under load) (t_r : rest time)**			**Please contact us (info@broadwaygear.com)**
	10	**30**	**60**	**25%**	**40%**	**60%**	
	1.35	1.15	60	1.25	1.15	1.1	

***Cycle duration, in any event, must be 10 minutes or less. If it is longer than 10 min., please contact us via info@broadwaygear.com.**

For duties other than S1 with considerable number of starts per hour, factor Z must be considered (it is ascertained by using the information in the motors chapter). Factor Z defines the maximum number of starts for the application under consideration.

c) For the output speed n2 or closest to, select the gear motor that yields a safety factor S meeting the following condition: S >= fs (F26)

Hydraulic motor

Determine hydraulic motor type according the application, choosing from the options given in guidance table (6).

Table 6:

Duty	Light		Medium		Heavy	
Pressure (bar)	<175		175-200		200-450	
Motor design	Orbital	Gear motor	Radial piston	Axial piston	Cam motor	Axial piston
Speed (rpm)	Mean <=700	High <=3000	Mean <=500	High <=4000	Low <=200	Mean <=4000
η_{mh}	0.80	0.85	0.95	0.93	0.93	0.93
η_v	0.90	0.87	0.95	0.95	0.95	0.95

Based on the specifications of gearbox input:

Input torque ---------Mr1 (N.m)

Input speed----------n1 (min^{-1})

And on allowed pressure P (bar) for the hydraulic circuit, calculate the displacement of the hydraulic motor by formula:

$$Vc= (20\times\pi\times Mr1) / (P\times\eta_{mh}) \quad cm^3 \quad (F27)$$

Where η_{mh} is the hydraulic mechanical efficiency of the motor (Table 6).

Select a motor size with displacement V that satisfies the following condition:

$$Vc <= V \quad (F28)$$

Calculate the flow required for the hydraulic motor

$$Q1=(V\times n1) / \eta_v\times 1000 \quad (l/min^{-1}) \quad (F29)$$

Where η_v is the volumetric efficiency of the motor (Table 6).

2.14. INSTALLATION

Observing a few rules for correct installation is essential to the reliable and proper operation of the gearbox or gear motor.

The rules set out here are intended as a preliminary guide to selecting gearbox or gear motor. For effective and proper installation, follow the instructions given in the installation, use the maintenances manual for the gearbox available from our sales department.

Following is a brief outline of installation rules:

a) Fastening:

Place gearbox on a surface providing adequate rigidity. Mating surfaces should be machined and flat.

Mating surfaces must be within definite geometric tolerances (see manual). This is especially true of flange-mounted gearboxes with splined hollow shafts.

In applications that involve high radial loads at the output end, flange mounting is recommended for some gearbox sizes as this mounting makes use of the double pilot diameters provided in these gearboxes.

Make sure the gearbox is suitable for the required mounting position.

Use screws of resistance class 8.8 and over to secure the gearbox. Torque up screws to the figures indicated in the relevant tables.

With transmitted output torque greater than or equal 70% of the indicated M_{2max} torque, and with frequent movement reversals, use screws with minimum resistance 10.9.

Some gearbox sizes can be fastened using either screws or pins. Of pin seated in the frame the gearboxes be at least 1.5 times pin diameter.

b) Connections

Secure the connection parts to gearbox input and output. Do not tap them with hammers or similar tools. To insert these parts, use the service screws and threaded holes provided on the shafts. Be sure to clean off any grease or protects from the shafts before fitting any connection parts.

Fitting hydraulic motors.

Be careful the O ring between motor flange and gearbox input flange when assembling. Install the hydraulic motor before filling lube oil into the gearbox.

Connecting the hydraulic brake.

The hydraulic circuit should be such to ensure that brake is released instants before gearbox starts and applied after gearbox has stopped. Check that pressure in the hydraulic line for brake release is at zero whenever gearbox is stopped.

Direction of rotation

Motors are connected to the suitable electric or hydraulic circuit according to their direction of rotation. When performing these connections, bear in mind that all gearboxes, whether in the in-line or right angle design, have the same direction of rotation both at input and output. For more details of the connection of electric and hydraulic motors, see relevant sections in this catalogue.

c) Painting

Painted with antioxidant water primer in the color red. Mating surfaces are not painted. Final coat is to be applied by the customer. Before painting, protect the seal rings installed on the shafts. Contact with paint may deteriorate the seals with subsequent oil leakage.

d) Lubrication

Before start-up, fill the gearbox with the recommended lube oil up to correct level. Level is checked through the suitable plug or sight glass provided on each gearbox depending on designated mounting position

2.15. MAINTENANCE

Gearboxes are virtually maintenance free under normal operating conditions. The only periodic operations required are checks on oil level and oil changes as follows:

Oil Changes

Change the oil first after 100-150 hours operation.

Subsequently, change the oil only every 2000-3000 hours operation depending on application.

Alternatively change oil once a year.

Check the oil level in the gearbox every month and top up as necessary.

2.16. STORAGE

Observe the following instructions to ensure correct storage of delivered products:

a) Do not store outdoors, in areas exposed to weather or with excessive humidity;
b) Always place boards in wood or other material between floor and products, to avoid direct contact with the floor;
c) For storage periods of over 60 days, all machined surfaces such as flanges, shafts and couplings must be protected with a suitable ant oxidation product (SHELL ENSIS FLUID SDC or equivalent product);

d) The following measures must be taken in respect of products for which the expected storage period exceeds 6 months:

d1) Cover outer machined parts and mating parts with grease to avoid oxidation;

d2) Position the gearboxes with the breather plug up and fill them with oil (this does not apply to life-lubed gearboxes). Before use, the gearboxes should be filled with the proper amount lubricant of the recommended type

2.17. SUPPLY CONDITIONS

Gearboxes are supplied as follows:

a) ready for installation in the mounting position specified on order;

b) dry; inner parts are protected by a film of the oil used for final testing;

c) Painted with antioxidant water primer in the color red, Mating surfaces are not painted and are covered with a film or protective oil. Final coatis to be applied by the Customer;

d) Tested to in-house specifications;

e) Suitably packed;

f) Complete with mounting nuts and bolts for IEC electric motors;

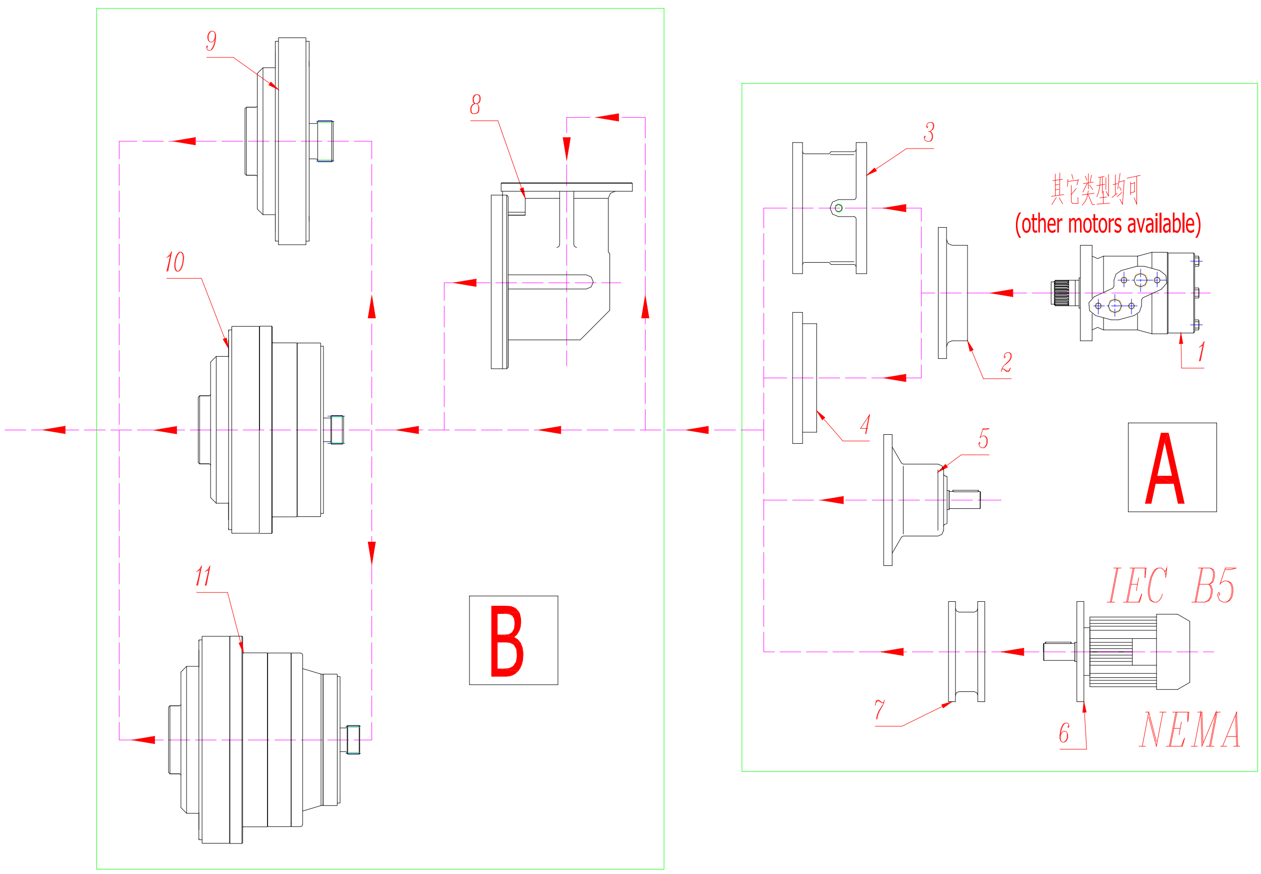
3. NB300 SERIES PLANETARY DRIVES

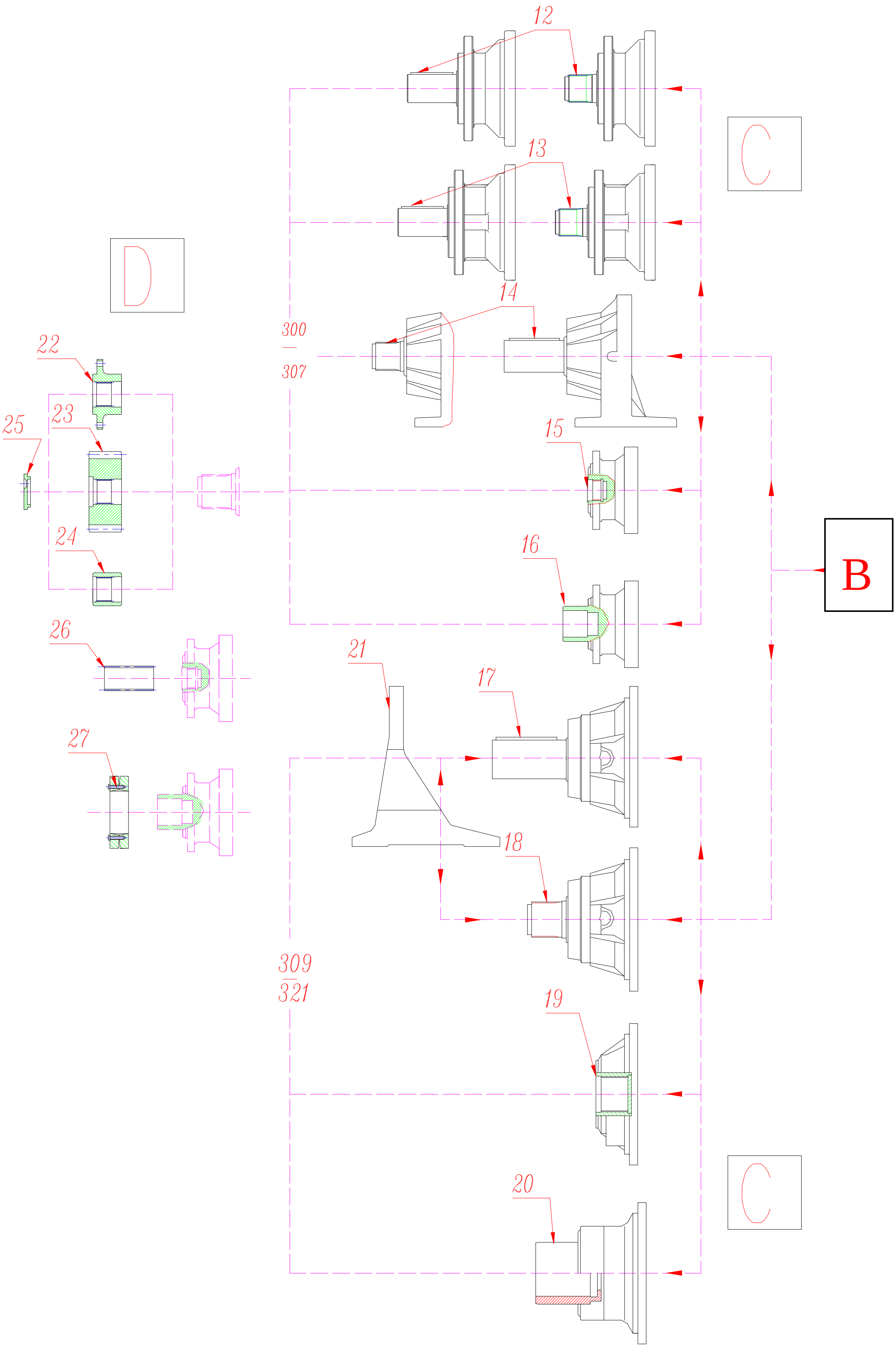
3.1. INTRODUCTION

The NB300 series consist of a range of multi-purpose planetary gearboxes that can be operated by either hydraulic or electric motors. Basic features are:

- 12 sizes
- Output torque up to 160 000 N.m
- Transmissible power up to 250 KW
- Ratios from 3.5:1 to 3 000:1
- 2 versions: in-line and right angle (first stage with bevel gear pair Gleason)
- Reduction stages ranging from 1 to 4
- With flange-mounted, foot-mounted and shaft-mounted output
- Output shafts with keyway, splined, splined hollow shafts, hollow shafts for shaft-mounting with shrink disc
- Input adaptors for: electric motors to IEC standards design B5 or NEMA standard, hydraulic motors by major manufactures and according to SAE J744C, negative hydraulic parking brakes for operation by hydraulic motors
- Output shaft accessories: flanges, pinions, splined bars, shrink discs
- High radial and axial load capacity of output shafts thanks to tapered roller bearings fitted on the HZ and PC versions
- High efficiency
- Housing made of spheroidal cast iron.

3.2. CONSTRUCTION VERSIONS




12
13
C
D
14
300
307
22
23
25
15
24
B
16
26
21
17
27
18
309
321
19
C
20

A: INPUT

1. Hydraulic motor
2. Hydraulic motor setting
3. Negative brake
4. Cover
5. Input shaft
6. Electric motor
7. Electric motor setting

B: REDUCTIONS

8. Right-angle reduction stage
9. Single planetary reduction stage
10. Two or more planetary reduction stages
11. Three or more planetary reduction stages

C: OUTPUT

12. Keyed or splined solid shaft output
13. Keyed or splined heavy solid shaft output
14. Output with support bracket and keyed or splined solid shaft
15. Splined hollow shaft output
16. Hollow shaft output for shrink disc
17. Keyed solid shaft output
18. Splined solid shaft output
19. Splinde hollow shaft output
20. Hollow shaft output for shrink disc
21. Support bracket

D: FITTINGS

22. Flange
23. Pinion
24. Sleeve coupling
25. Stop bottom plate
26. Splined bar
27. Shrink disc

3.3. MOUNTING POSITION

For a proper designation of the geared motor or gearbox, mounting position please refer to the table (7) to determine mounting position.

Table 7: (in - line)

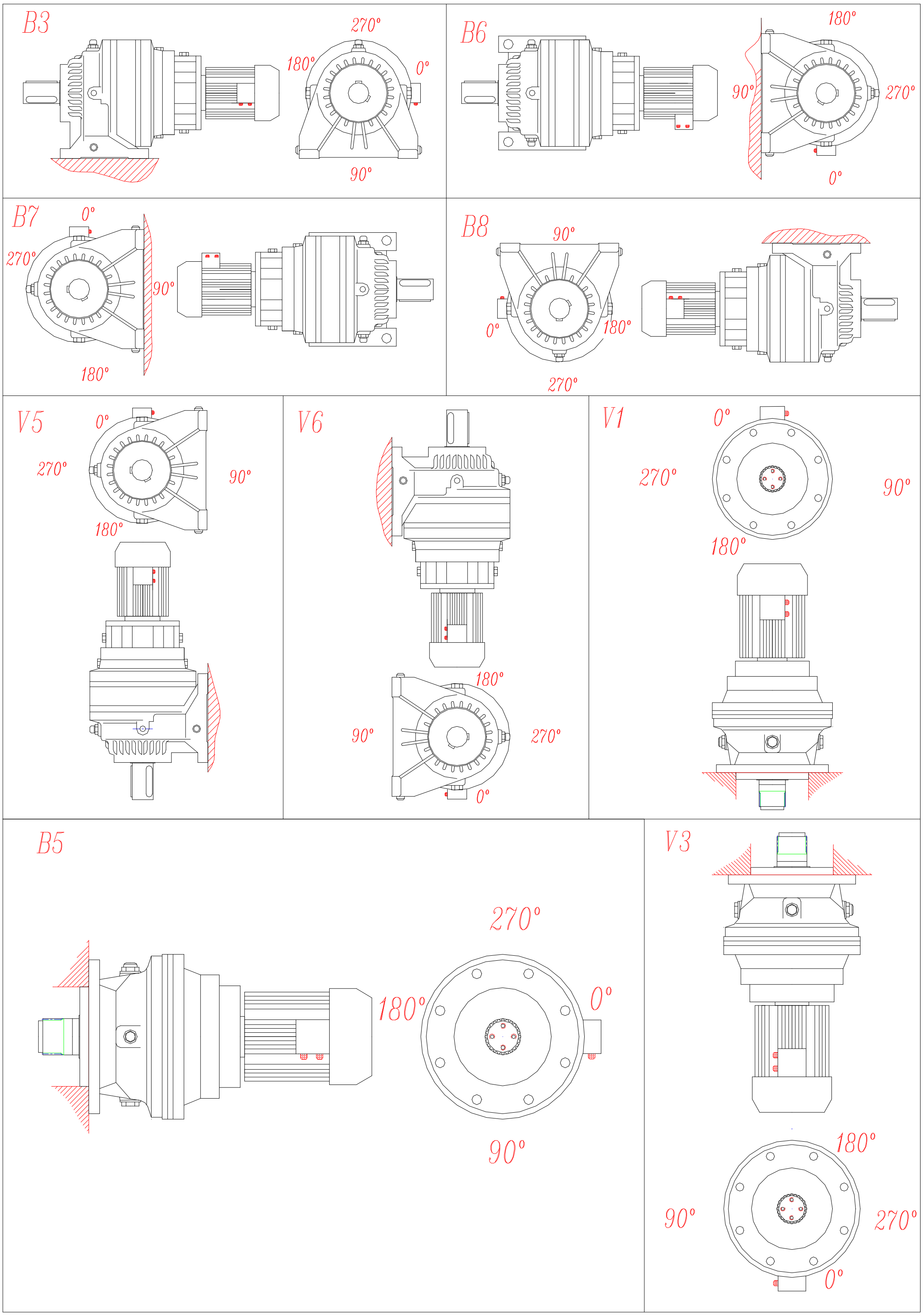
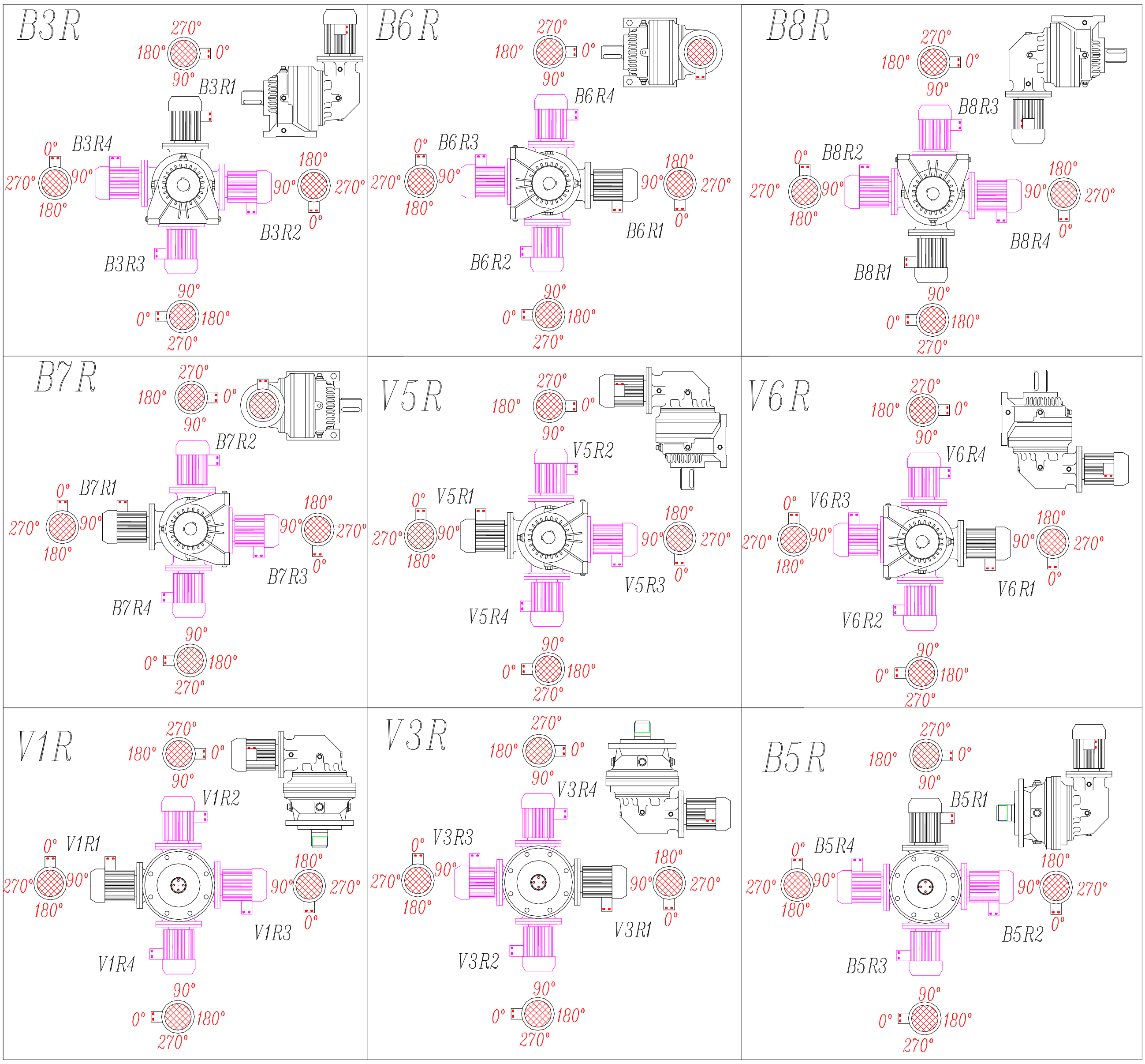


Table 7: (right angle)



3.4. LUBRICATION

(Prior to start-up)

Standard lubrication is oil bath. Respect the specifications given below for fixed and mobile machines:

1) Mobile machinery: SAE 80W/90 oil with API GL5 properties

2) Industrial machinery: ISO VG 150 oils with E.P. properties

The following table lists the most common brands of lubricant and the types recommended for normal applications.

Table 8:

	INDUSTRIAL PLANTS INDUSTRIEANGEN		MOBLE MACHINES	
	ISO standard…E.P. grade		SAE standard…APL GL grade	
Ambient	-10° C /+30° C	+20° C/+45° C	-10° C/+30° C	+20° C/+45° C
	ISO VG 150	ISO VG 220	SAE 80W/90	SAE 85W/140
AGIP	BLASIA 150	BLASIA 220	ROTRA MP	ROTRA MP
ARAL	DEGOL BG 150	DEGOL BG 220	GETRIEBEOL HYP	GETRIEBEOL HYP
BP - MACH	ENERGOL GR XP 150	ENERGOL GR XP 220	HYPOGEAR EP	HYPOGEAR EP
CASTROL	ALPHA SP 150	ALPHA SP 220	HYPOY	HYPOY
CHEVRON	EDWN.L. GEAR COMPOUND 150	N.L. GEAR COMPOUND 220	UNIVERSAL GEAR	UNIVERSAL GEAR
ELF	REDUCTELF SP 150	REDUCTELF SP 220	TRANSELF8	TRANSELF8
ESSO	SPARTAN EP 150	SPARTAN EP 220	GEAR OIL GX	GEAR OIL GX
FINA	GIRAN 150	GIRAN 220		
I.P.	MELLANA 150	MELLANA 220	PONTIAX HD	PONTIAX HD
KLüBER	LAMORA 150	LAMORA 220		
MOBIL	MOBIL GEAR 629	MOBIL GEAR 630	MOBILUBE HD	MOBILUBE HD
SHELL	OMALA EP 150	OMALA EP 220	SPIRAX HD	SPIRAX HD
TOTAL	CARTER EP 150	CARTER EP 220	TRANSMISSION TM	TRANSMISSION TM

Note:

1, For particular applications like: high temperature running conditions, non inflammable oil, etc. contact Ningbo planetary gearbox Co., LTD technical Departments.

2, Maximum operating oil temperature must never exceed 85° C.

BRAKES LUBRICATION

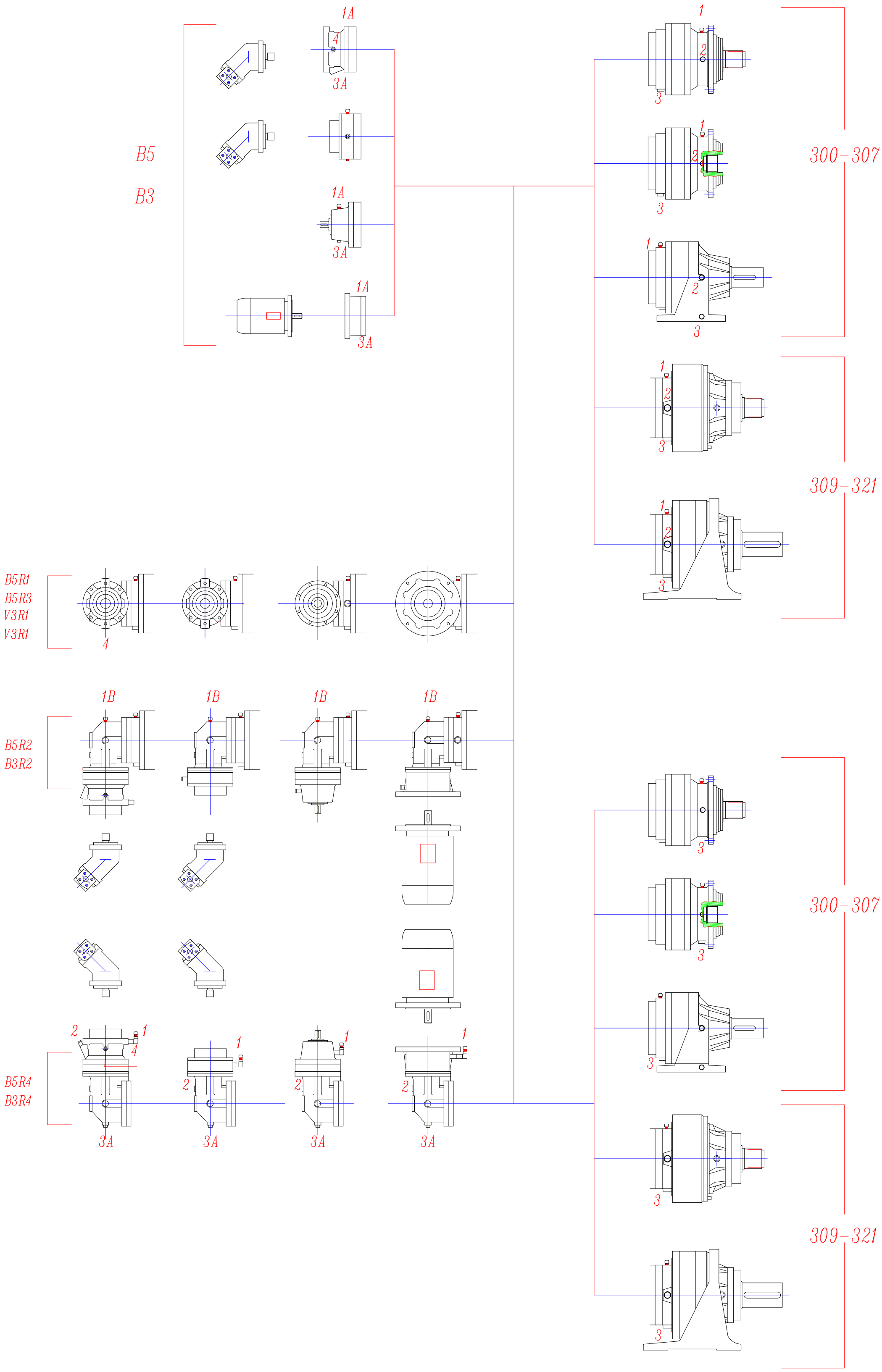
The hydraulically operated multi disc brakes are lubricated by the same oil as the gearbox.

FILLING

Gearboxes are supplied without oil. All gearboxes are equipped with filler, lever, breather, and drain plugs. To fill the gearbox secure it in its exact working position, unscrew the oil filler plug, and add oil until it is visible in the level window. The position of the window will obviously depend on whether the unit is mounted horizontally or vertically. To drain, remove the magnetic drain plug and drain off
oil. If possible, drain while the oil is hot and remove the filler plug from the top of the gearbox to give optimum oil flow.

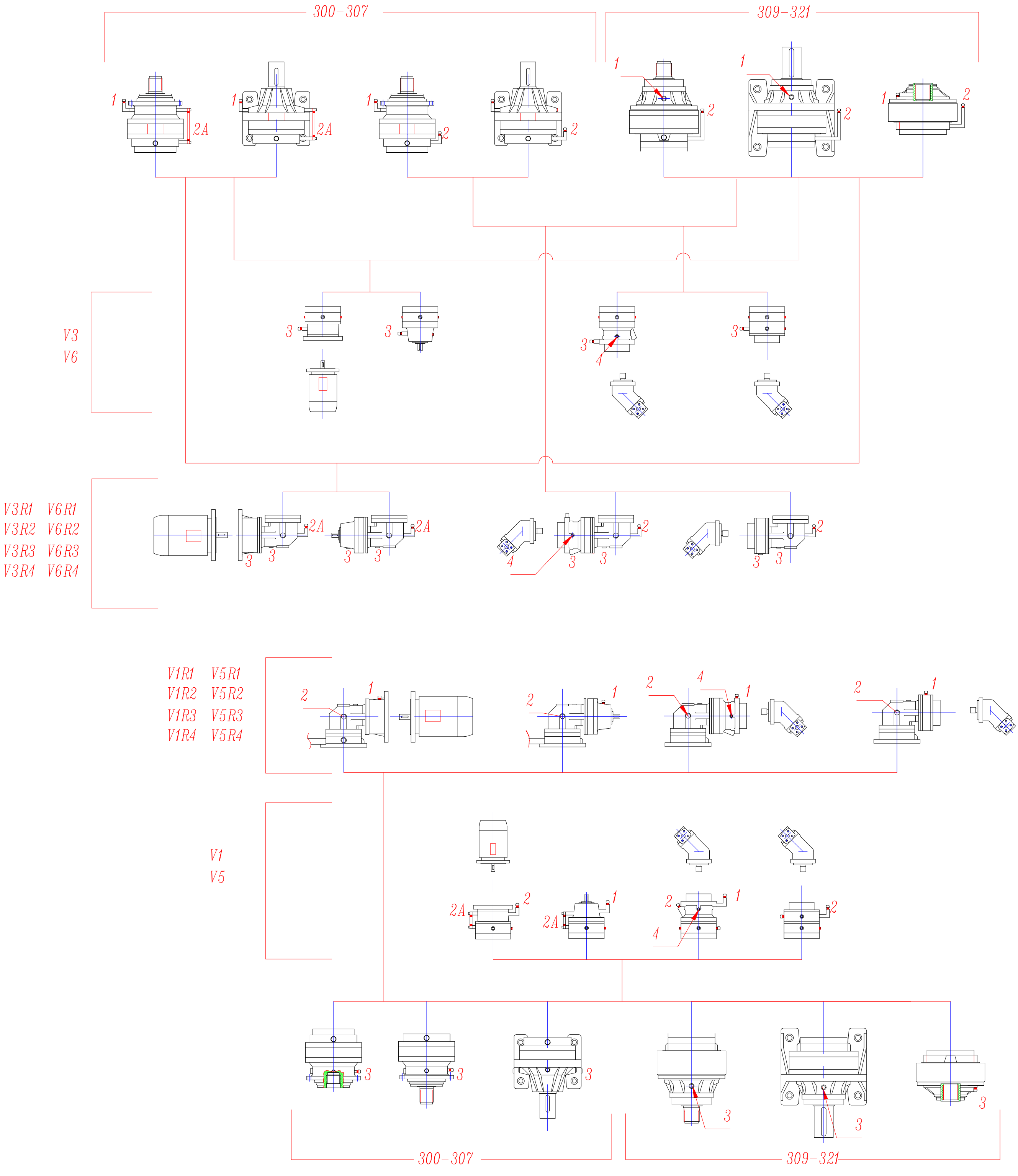
Note: In gearboxes with brakes, brake lubrication is provided by the gearbox lubricant.

3.5. PLUG POSITIONS:



1, 1A, 1B: Filling/breather oil plug
2, 2A: Oil level plug
3, 3A: Oil draining plug
4: Brake port

PLUG POSITIONS



1, 1A, 1B: Filling/breather oil plug

2, 2A: Oil level plug

3, 3A: Oil draining plug

4: Brake port

3.6. REFERENCE OIL QUANTITY:` (L)

Table 9:

TYPE		In – Line			TYPE		Right angle		
		Mounting position					Mounting position		
		B5,B3	V1,V5	V3,V6			B5R,B3R	V1R,V5R	V3R,V6R
300	L1	0.6	1.0	0.9	300	R2	1.2	1.7	1.5
	L2	0.9	1.3	1.2		R3	1.5	2.0	1.8
	L3	1.2	1.6	1.5		R4	1.8	2.3	2.1
	L4	1.5	1.9	1.8					
301	L1	0.8	1.2	1.1	301	R2	1.6	2.1	1.9
	L2	1.1	1.5	1.4		R3	1.9	2.4	2.2
	L3	1.4	1.8	1.7		R4	2.2	2.7	2.5
	L4	1.7	2.1	2.0					
303	L1	1.3	2.3	2.0	303	R2	2.2	2.8	2.6
	L2	1.6	2.6	2.3		R3	2.5	3.1	2.9
	L3	1.9	2.9	2.6		R4	2.8	3.4	3.2
	L4	2.2	3.2	2.9					
305	L1	1.6	2.6	2.4	305	R2	2.5	3.1	2.9
	L2	2.1	3.1	2.9		R3	3.0	3.6	3.4
	L3	2.4	3.4	3.2		R4	3.3	3.0	3.7
	L4	2.7	3.7	3.5					
306	L1	2.5	3.5	3.2	306	R2	4.0	5.0	4.8
	L2	3.3	4.3	4.0		R3	4.8	5.8	5.6
	L3	3.6	4.6	4.3		R4	5.1	6.1	5.9
	L4	3.9	4.9	4.6					
307	L1	3.5	5.0	4.5	307	R2	6.0	8.0	7.0
	L2	4.5	6.0	5.5		R3	7.0	9.0	8.0
	L3	5.0	6.5	6.0		R4	7.5	9.5	8.5
	L4	5.3	6.8	6.3					
309	L1	4.0	5.5	5.0	309	R2	6.5	8.5	7.5
	L2	5.0	6.5	6.0		R3	7.5	9.5	8.5
	L3	5.5	7.0	6.5		R4	8.0	10	9
	L4	5.8	7.3	6.8					
310	L1	5.0	6.5	6.0	310	R2	10	12	11
	L2	6.3	7.8	7.3		R3	11	13	12
	L3	7.1	8.6	8.1		R4	12	14	13
	L4	7.4	8.9	8.4					
311	L1	7.0	12	10	311	R2	14	19	17
	L2	9.0	14	12		R3	16	21	19
	L3	10	15	13		R4	17	22	20
	L4	10.5	15.5	13.5					
313	L1	9.0	14	12	313	R2	16	21	19
	L2	11.5	16.5	14.5		R3	19	24	22
	L3	12.5	17.5	15.5		R4	20	25	23
	L4	13	18	16					
315	L1	15	23	19	315				
	L2	19	27	23		R3	27	35	31
	L3	21	29	25		R4	30	38	34
	L4	22	30	26					
316	L1	18	26	22	316				
	L2	22	30	26		R3	30	38	34
	L3	24	32	28		R4	33	41	37
	L4	25	33	29					

3.7. NEGATIVE MULTI DISC BRAKE

DESCRIPTION:

Our fail-safe parking brake is an oil immersed multi disc unit on the input side of the gearbox.. The brake is operated when there is no hydraulic pressure and is released when the minimum release pressure is applied.

Use of parking brake is necessary whenever the driven system must be kept at standstill even under external forces and/or torques.

Applications:

---Winches

---Slewing drives

---Parking brake on mobile equipment

---General industrial applications

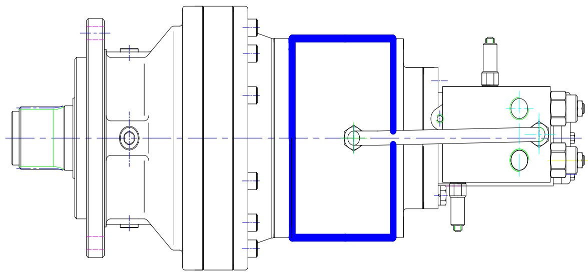


Table 10: BRAKE **TECHNICAL DATE**

		TYPE																	
		4						**5**						**6**					
		A	**B**	**D**	**F**	**H**	**K**	**L**	**B**	**C**	**E**	**G**	**K**	**B**	**C**	**E**	**G**	**K**	**L**
Static brake torque Mb	**Name**	50	100	160	260	330	400	440	400	500	630	800	1000	850	1100	1500	2100	2600	3200
Min. opening pressure	**Bar**	10	20	30	20	25	30	35	20	28	20	26	32	15	20	25	20	25	30
Max. Operating pressure	**Bar**	320																	
Oil volume for brake release	**Cm3**	8	8	8	8	8	8	15	15	15	15	15	15	40	40	40	40	40	40

3.8. PRODUCT IDENTIFICATION SCHEME

NB3 05 L 1 – 30 – HZ - 4F - OMP315A - B3 - P - R

1 2 3 4 5 6 7 8 9 10 11

1 **Produce series**: NB3—Planetary drives
NB4—Track drives
NB6—Wheel drives
NB7—Slewing drives

2 **Gearbox size**: 00, 01, 03, 05…16

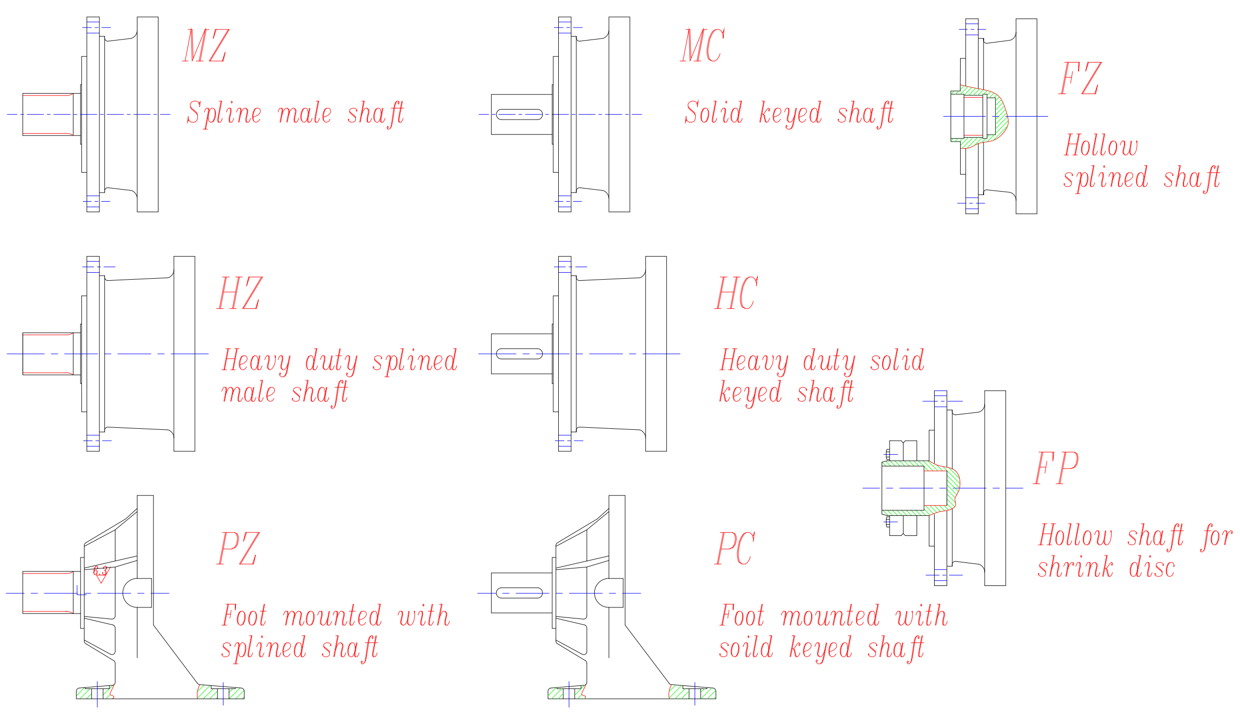
3 **Design: L**—Liner gearbox

R—Right angle

4 **No. Of reductions: 1,2,3,4**

5 **Reduction ratio:** Fill in the value of the trans. ratio (including point and decimals) reported in the selection charts

6 **Output version:**



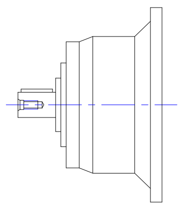
PRODUCT IDENTIFICATION SCHEME (continued)

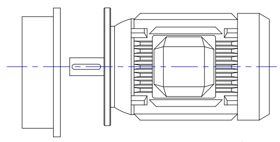
7 Hydraulic brake type (only with hydraulic motor adaptor):

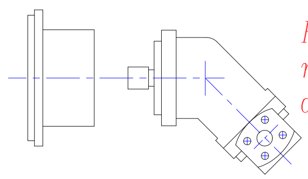
Standard negative multi disc brake: 4A, 4B…4L, 5B, 5C…5K, 6B, 6C…6L (see page 23)

Without hydraulic brake: WO

8 **Input:**

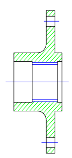


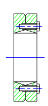


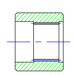


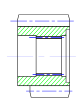
9 **Mounting position:** See page 18,19

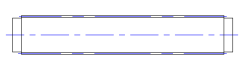
10 **Output fittings:**





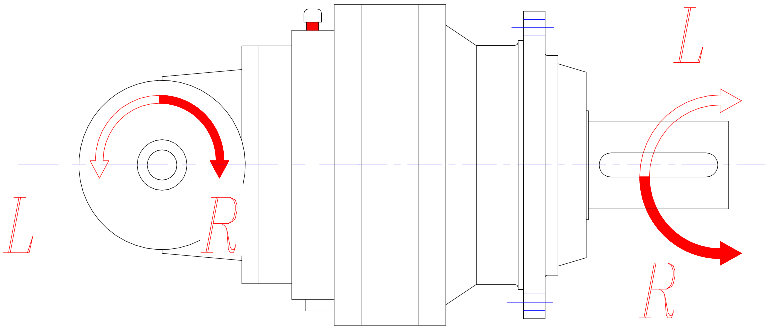






PRODUCT IDENTIFICATION SCHEME (continued)

11 **Rotate direction (only for right angle design):**



Option: Supplementary coolings system, etc