3/H SERIES

Heavy duty modular gear units

Bonfiglioli

1. SYMBOLS AND UNITS OF MEASUREMENT

Symbol	Unit of measure-ment	Description
$An_{1,2}$	[kN]	Permissible axial force
f_S	-	Service factor
i	-	Gear ratio
I	-	Cyclic duration factor
J	[Kgm_2]	Moment of inertia
$M_{1.2}$	[Nm]	Torque
$Mc_{1,2}$	[Nm]	Calculated torque
$Mn_{1.2}$	[Nm]	Rated torque
$Mr_{1,2}$	[Nm]	Torque demand
$Mn_{2\ max}$	[Nm]	Maximum transmissible torque
$M_{2\ max}$	[Nm]	Maximum static torque
Mfs	[Nm]	Static bending moment

Symbol	Unit of measure-ment	Description
$n_{1.2}$	[min^{-1}]	Speed
$P_{1.2}$	[kW]	Power
PTB	[kW]	Base thermal power
PT_{FAN}	[kW]	Thermal power with FAN
$Pn_{1.2}$	[kW]	Rated power
$Pr_{1,2}$	[kW]	Power demand
P_T	[kW]	Thermal power
$Rc_{1,2}$	[kN]	Calculated radial force
$Rn_{1,2}$	[kN]	Permissible overhung load
t_a	[°C]	Ambient temperature
t_s	[°C]	Surface temperature
t_o	[°C]	Oil temperature
η	-	Efficiency

$_1$ value referring to the input shaft

$_2$ value referring to the output shaft

2. GENERAL DESIGN FEATURES

The 3/H solution combines the technological, performance and efficiency advantages of the planetary gear unit series with the robustness, quality and reliability of the helical bevel gear unit series.
The combined planetary/helical bevel gear units combine the advantages of the high torque transmission achievable with the 300 series with the optimal power transmission achievable with the HDO series, allowing them to be used in applications requiring high power density and medium to low output speeds.
The product range has a transmission capacity (Mn2) of up to 1,200 kNm, available in 15 sizes included in the catalogue, with customised combinations available on request.
The wide range of ratios and, above all, the availability of several intermediate sizes make the 3/H solution the most complete for the different requirements of the reference applications.
Compared to traditional technologies, the flexibility and synergy of the 3/H combined gear units mainly offer the following benefits:

- Torque extension
- Thermal power
- Compactness
- Low noise
- Versatile solutions and available accessories.

3. INSTALLATION

It is very important to respect the following rules when installing the gear unit:

- Ensure that the gear unit is securely fastened to prevent any vibration. Install hydraulic couplings, clutches, torque limiters, etc. (if impacts, prolonged overloads or possible blockages are expected).
- Before paint coating, protect the machined surfaces and the outer edge of the oil seals to prevent the paint from drying out the rubber, which could compromise the seal.
- We recommend machining the parts to be fitted on the gear unit output shafts with ISO H7 tolerance to avoid overly tight couplings which, during assembly, could irreparably damage the gear unit itself.

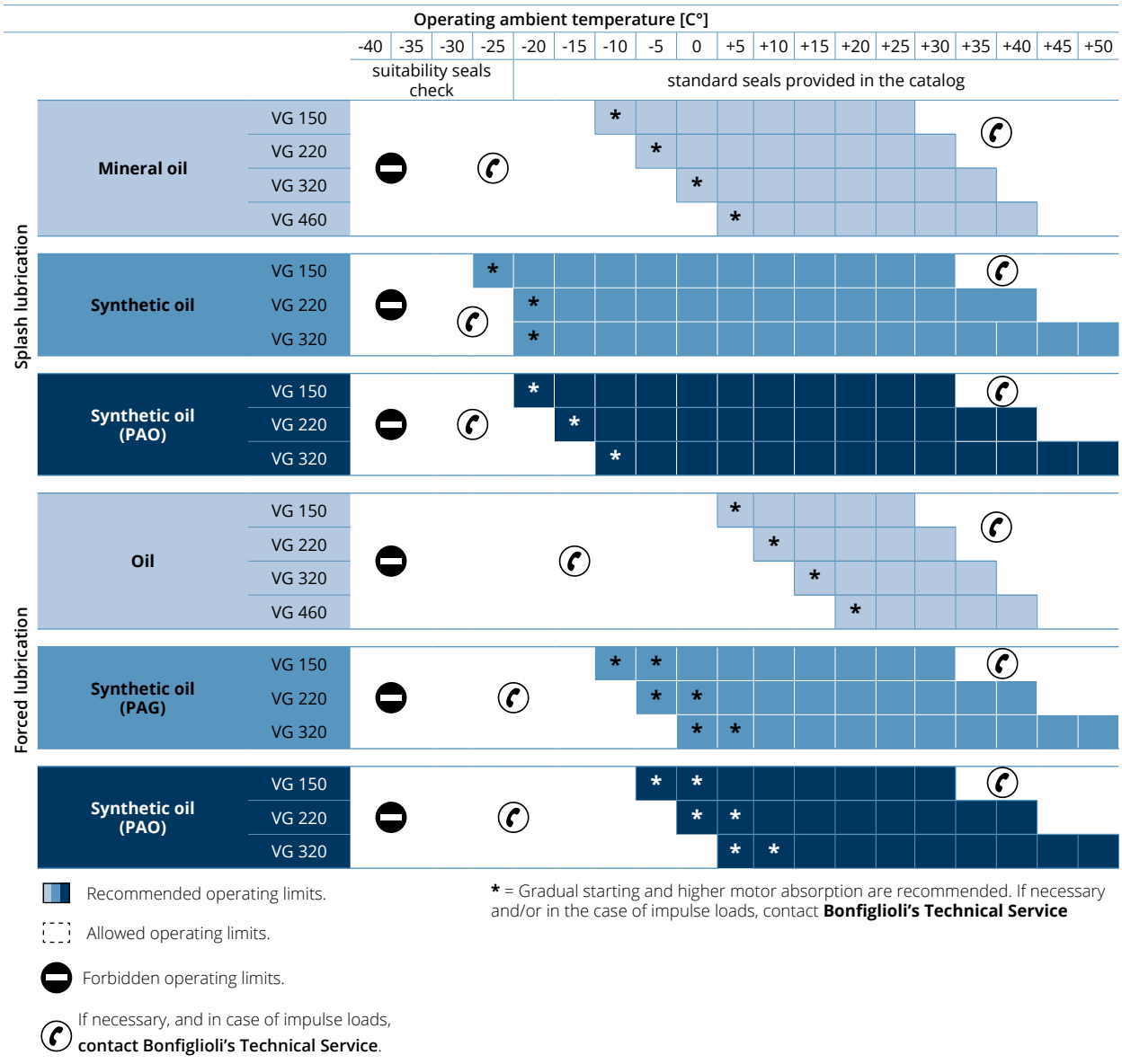
The customer is responsible for checking the coupling on the output shaft, defining suitable tolerances according to the torque to be transmitted.

- The mating surfaces must be clean and treated with suitable protective agents before assembly to prevent oxidation and consequent jamming of the parts.
- Before putting the gear unit into service, make sure that the machine incorporating it complies with the provisions of Machinery Directive 2006/42/EC and subsequent updates.
- Before starting the machine, make sure that the lubricant level is correct for the gear unit mounting position and that the viscosity is suitable for the type of application.
- If installed outdoors, provide adequate protection and/or carter to prevent direct exposure to atmospheric agents and solar radiation.

4. LUBRICATION

Please refer to the User and Maintenance Manual available at www.bonfiglioli.com for instructions on periodic oil level checks and change.
Avoid mixing mineral-based oils with synthetic oils and/or different brands.
It is good practice to check the level once a month for intermittent operation, or more frequently for continuous operation, and add oil if necessary.

4.1. SELECTION OF THE OPTIMAL OIL VISCOSITY (DATA REFERS TO SHELL OILS)



8. SERVICE FACTOR

This is a factor that associates a numerical value with the heaviness of the application. The parameter takes into account, with some unavoidable approximations, the variability of the load under which the gear unit operates, the type of service and the duration of operation. The table provides an indication for determining the required service factor depending on the application.
Application rating in UMH (uniform, medium and high)

Required service factor f_s depending on application						
Type of load	No. of start-ups / hour Z	Total operating time (h)				
		≤ 5000	10000	15000	25000	50000
		Type of load				
		h < 4	4 < h < 8	8 < h < 12	12 < h < 16	16 < h < 24
Uniform	Z < 10	0.90	1.00	1.15	1.30	1.60
	10 < Z < 30	0.95	1.15	1.30	1.50	1.80
	30 < Z < 100	1.00	1.25	1.45	1.60	2.00
Variable with moderate shocks	Z < 10	1.00	1.25	1.45	1.60	2.00
	10 < Z < 30	1.10	1.40	1.60	1.80	2.20
	30 < Z < 100	1.20	1.50	1.70	2.00	2.40
Variable with strong shocks	Z < 10	1.20	1.50	1.70	2.00	2.40
	10 < Z < 30	1.30	1.60	1.80	2.10	2.60
	30 < Z < 100	1.40	1.75	2.00	2.30	2.80

9. SIZING

1. Determine the gear ratio:

$$i = \frac{n1}{n2}$$

2. Calculate the power demand P_{r1} at the gear unit's input shaft:

$$P_{r1} = \frac{M_{r2} \times n_2}{9550 \times \eta}$$

η
0.90

3. Determine the required service factor f_s (see paragraph 8)

$$P_{n1} \geq P_{r1} \times f_s$$

4. By referring to the technical data tables, select the gear unit with the closest gear ratio to the calculated one and characterised by a rated power P_{n1} such that:

the sizing method is valid for applications using an electric motor.
If the gear unit is to be driven by other types of motor, contact **Bonfiglioli's Technical Service**.

10. VERIFICATION

10.1 MOTOR AVAILABILITY

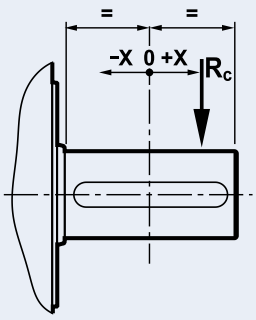
For the selected gear unit, check the availability of the relevant coupling flange in section 15.
The typical standardisation of electric motors may lead to selecting a motor with a power rating even much higher than the rated power Pn1 of the gear unit you have sized. Check that the maximum power that can be delivered by the electric motor is not reached under any conditions during the work cycle. In the event of uncertain calculation data or doubts about the actual load diagram of the application, it is advisable to install a torque limiting device.

10.2 BACKSTOP DEVICE

If the gear unit is provided with a backstop device, check its load capacity in the relevant sections 16.3 of this catalogue and ensure that the maximum input torque value of the M1MAX gear unit is never exceeded during its operation.

10.3 RADIAL LOAD BEARING CAPACITY CHECK

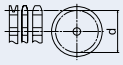
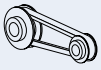
Transmission components keyed onto the gear unit input shafts generate forces, the resultant of which acts radially on the shaft itself.
The magnitude of these loads must be compatible with the bearing capacity of the shaft-bearing system of the gear unit. In particular, the absolute value of the applied load (Rc for the input shaft) must be lower than the nominal value (Rx for the input shaft) shown in the technical data tables.



$R_x = R_n \times K$

$R_c \leq R_x$

$$R_c = \frac{2000 \times M \times K_r}{d}$$

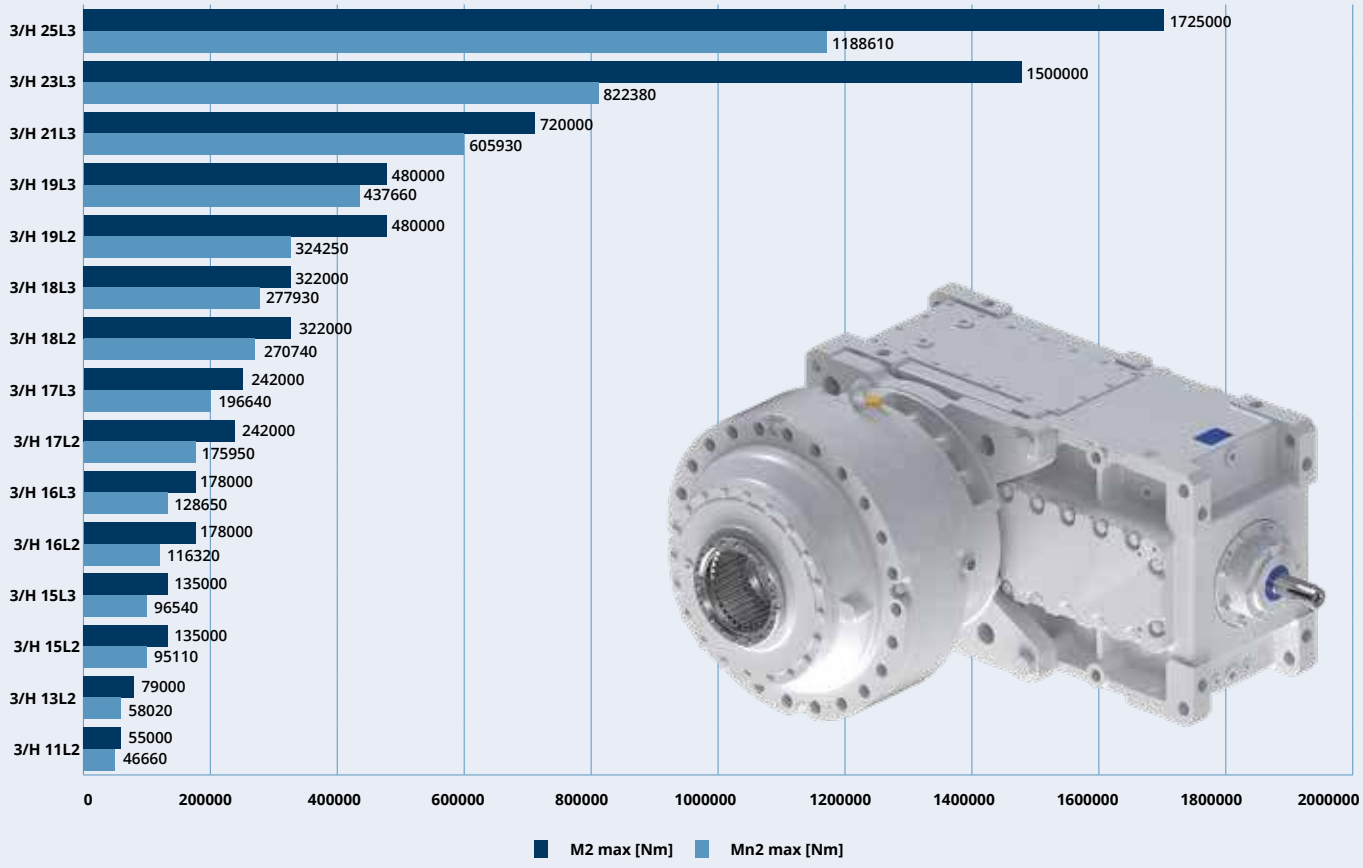
$K_r = 1$		M [Nm]	
$K_r = 1.25$		d [mm]	
$K_r = 1.5 - 2.0$			

The Rn_{max} values provided in this table are the maximum admissible radial loads; they may be subject to limitations depending on the application conditions.
For a precise calculation please contact **Bonfiglioli's Technical Service**.

11. DESIGN FEATURES

The main design features of the 3/H series are:

- 10 sizes: 11, 13, 15, 16, 17, 18, 19, 21, 23, 25
- Rated torque values with favourable distribution over the entire ratio range.
- Alloy steel bevel and cylindrical gears, case-hardened, hardened and ground, with profile correction to:
  - reduce noise and promote smooth transmission of fast gears;
  - maximise transmissible torque of final drives.
- Generally case-hardened and ground input shafts.
- Input shaft ends according to UNI/ISO 77588. Motor adapter by means of connection bell and flexible coupling.
- Several possibilities for customising the gear unit via options on request, including:
  - backstop device;
  - seals and gaskets of different types and materials;
  - sensors;
  - fixing elements;
  - auxiliary thermal cooling/heating devices;
  - forced lubrication systems.



M_{n2max} = maximum continuously transmissible torque
M_{n2max} = torque that can be borne by the gear unit under static or quasi-static conditions. The value may vary depending on the output configuration

12. PRODUCT CONFIGURATIONS

12.1 BASIC VARIANTS

3/H	11L2	0	30.3	FP	L	1	VP	160	AB3

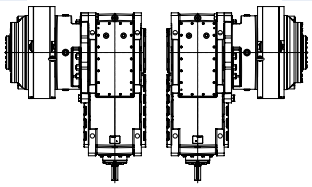
MOUNTING POS.
AB3 AB6

MOTOR SIZES
IEC (112 ... 315)
NEMA (180TC ... 440TC)

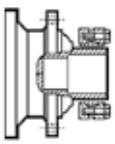
INPUT VERSION
VP G NG

VERSION
1 2

OUTPUT SIDE
L R



OUTPUT VERSION



FFP: Female shaft for friction coupling

FZP: Axial locking device splined female shaft

RATIOS
(30.6 ... 1160)

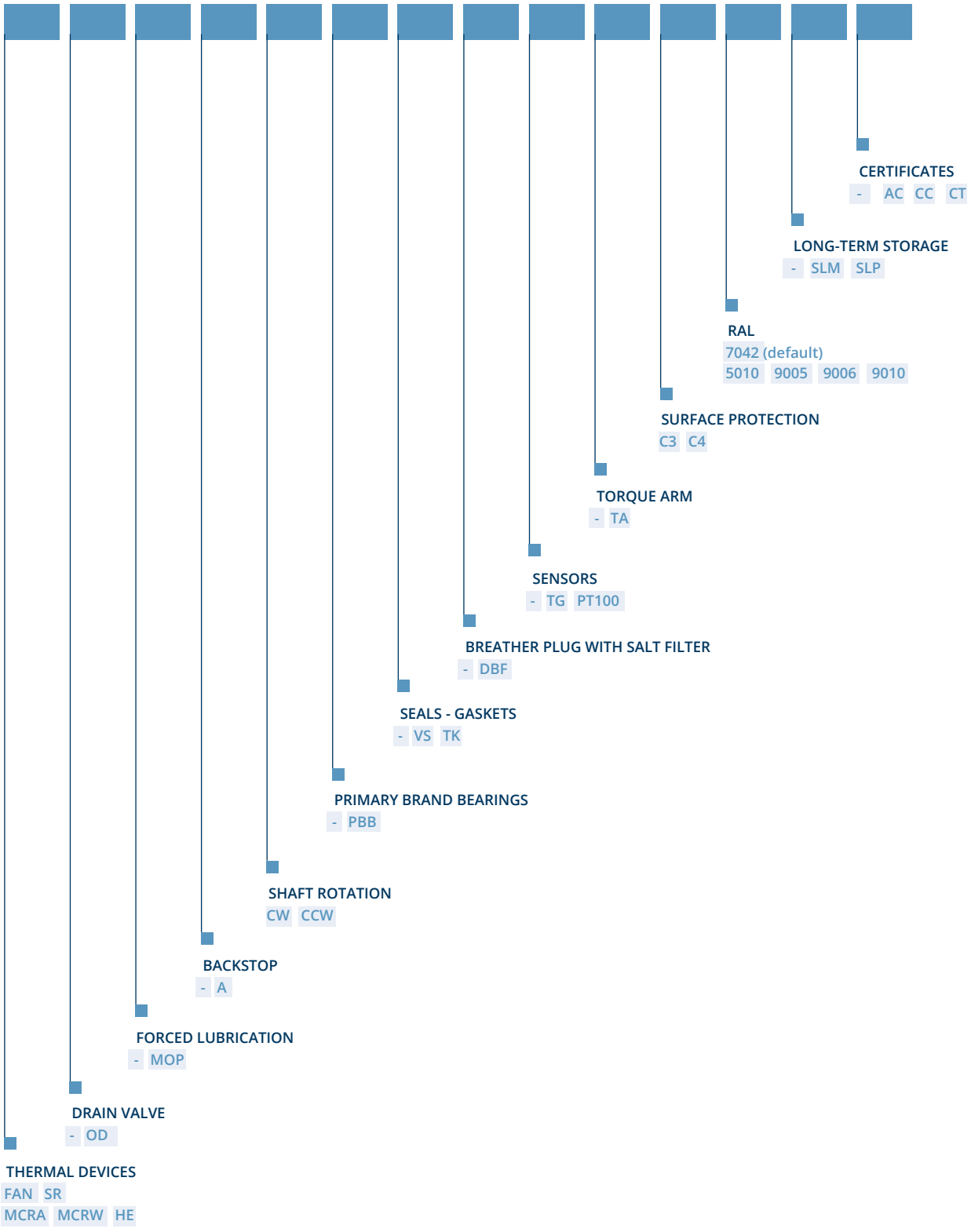
HD SERIES
O

GEAR UNIT TYPE

11L2	15L3	17L2	18L3	21L3
13L2	16L2	17L3	19L2	23L3
15L2	16L3	18L2	19L3	25L3

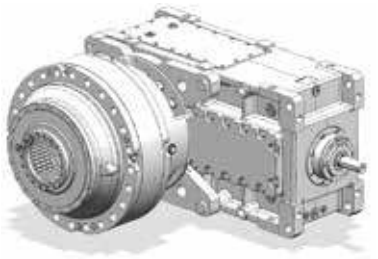
GEAR UNIT TYPE
3/H

12.2 OPTIONAL VARIANTS



NOTE: The combined selection of certain variants may lead to technical or dimensional conflicts. Contact **Bonfiglioli's Technical Service.**

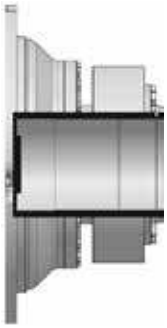
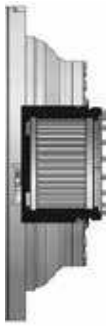
12.3 MOUNTING POSITION

AB3	AB6
	

NOTE: Gear units in AB6 mounting position are always supplied with forced lubrication system (MOP, MCRW, MCRA).
For overall dimensions refer to paragraph 16.1.

13. INPUT AND OUTPUT CONFIGURATION

13.1 OUTPUT SHAFT CONFIGURATION

FP	FZP
	

FP: Female shaft with friction joint always supplied
FZP: Axial locking device splined female shaft

13.2 INPUT SHAFT CONFIGURATION

Possible input configurations are:
- Cylindrical shaft with VP variant
- IEC motor flange with G variant
- NEMA motor flange with NG variant

G and NG variants include provision of the flexible coupling

VP	G / NG
	

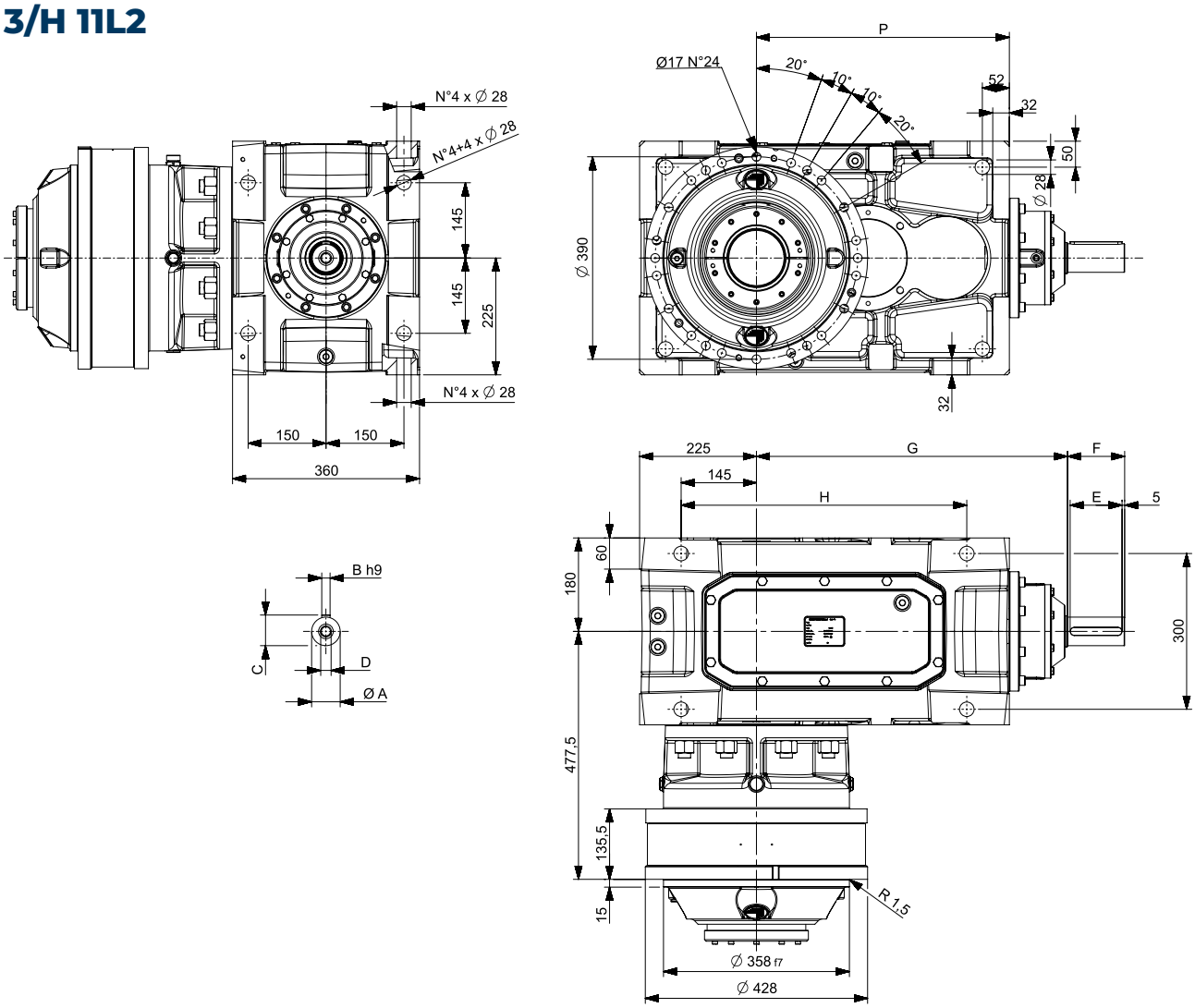
17. PERFORMANCE AND THERMAL POWER

3/H 11L2					n1 = 1800 min^{-1}				
					T_{amb} = 20°C	T_{amb} = 400°C	T_{amb} = 20°C	T_{amb} = 400°C	
	i	n2 [min$_{-1}$]	Mn_2 [Nm]	Pn_1 [kW]	P_{TB} [kW]		P_{TFAN} [kW]		M_2 Max [Nm]
3/H 11L2	30.3	59.5	29500	202	80	36	167	100	
3/H 11L2	33.9	53.0	30540	186	82	37	167	99	
3/H 11L2	36.8	48.9	31290	176	74	34	156	94	
3/H 11L2	42.1	42.7	32580	160	82	41	160	99	
3/H 11L2	47.0	38.3	33680	148	82	41	157	96	
3/H 11L2	51.1	35.2	34530	140	74	38	147	91	
3/H 11L2	59.7	30.1	36180	126	75	39	143	89	
3/H 11L2	65.0	27.7	37110	118	68	36	133	84	
3/H 11L2	76.0	23.7	38890	106	59	34	144	74	
3/H 11L2	84.6	21.3	40170	98	59	34	113	74	
3/H 11L2	92.1	19.5	41200	93	54	31	107	70	
3/H 11L2	98.6	18.3	41190	87	56	33	108	71	
3/H 11L2	119.0	15.1	41120	72	52	31	102	68	
3/H 11L2	125.2	14.4	41100	68	53	32	102	68	
3/H 11L2	150.9	11.9	41030	56	49	30	96	64	
3/H 11L2	164.4	10.9	41010	52	46	28	92	62	
3/H 11L2	175.5	10.3	41040	48	47	29	92	62	55000
3/H 11L2	212.7	8.5	41410	40	46	29	88	60	
3/H 11L2	222.9	8.1	41730	39	46	29	87	59	
3/H 11L2	248.3	7.3	42470	37	46	29	85	58	
3/H 11L2	270.3	6.7	43090	33	43	27	81	55	
3/H 11L2	335.4	5.4	44680	28	46	31	76	53	
3/H 11L2	373.4	4.8	45500	25	46	31	75	53	
3/H 11L2	389.8	4.6	46630	24	47	32	76	53	
3/H 11L2	483.0	3.7	46650	20	44	30	73	51	
3/H 11L2	525.6	3.4	46640	18	41	28	69	49	
3/H 11L2	560.7	3.2	46650	17	39	27	67	48	
3/H 11L2	651.5	2.8	46660	15	38	26	66	46	
3/H 11L2	725.6	2.5	46660	13	38	26	65	46	
3/H 11L2	828.2	2.2	46660	12	36	25	63	45	
3/H 11L2	921.9	2.0	46660	10	36	25	62	44	
3/H 11L2	1048	1.7	46660	9	33	23	59	42	
3/H 11L2	1099	1.6	46660	9	33	23	58	42	

3/H 11L2					n1 = 1500 min^{-1}				
					T_{amb} = 20°C	T_{amb} = 400°C	T_{amb} = 20°C	T_{amb} = 400°C	
	i	n2 [min$_{-1}$]	Mn_2 [Nm]	Pn_1 [kW]	P_{TB} [kW]		P_{TFAN} [kW]		M_2 Max [Nm]
3/H 11L2	30.3	49.6	31160	178	102	56	179	112	
3/H 11L2	33.9	44.2	32260	164	103	56	177	111	
3/H 11L2	36.8	40.7	33050	155	91	51	163	104	
3/H 11L2	42.1	35.6	34410	141	99	57	168	108	
3/H 11L2	47.0	31.9	35570	131	98	57	164	105	
3/H 11L2	51.1	29.3	36470	123	87	51	151	98	
3/H 11L2	59.7	25.1	38210	110	88	52	147	96	
3/H 11L2	65.0	23.1	39200	104	79	47	136	89	
3/H 11L2	76.0	19.7	41080	93	67	42	115	77	
3/H 11L2	84.6	17.7	41250	84	67	41	114	76	
3/H 11L2	92.1	16.3	41220	77	61	38	107	72	
3/H 11L2	98.6	15.2	41190	72	63	40	109	74	
3/H 11L2	119.0	12.6	41120	60	57	36	101	68	
3/H 11L2	125.2	12.0	41100	57	58	38	101	70	
3/H 11L2	150.9	9.9	41030	47	55	35	96	65	
3/H 11L2	164.4	9.1	41010	43	51	33	91	62	
3/H 11L2	175.5	8.5	41040	40	52	33	91	62	55000
3/H 11L2	212.7	7.1	41410	34	49	33	86	60	
3/H 11L2	222.9	6.7	41730	32	50	33	86	59	
3/H 11L2	248.3	6.0	42470	30	50	33	84	58	
3/H 11L2	270.3	5.5	43090	28	46	31	79	55	
3/H 11L2	335.4	4.5	44680	23	47	33	73	52	
3/H 11L2	373.4	4.0	45500	21	47	33	73	52	
3/H 11L2	389.8	3.8	45830	20	48	33	74	52	
3/H 11L2	483.0	3.1	46650	17	45	31	70	49	
3/H 11L2	525.6	2.9	46640	15	42	30	67	48	
3/H 11L2	560.7	2.7	46650	14	40	28	65	46	
3/H 11L2	651.5	2.3	46660	12	39	28	63	46	
3/H 11L2	725.6	2.1	46660	11	39	27	63	45	
3/H 11L2	828.2	1.8	46660	10	37	26	60	43	
3/H 11L2	921.9	1.6	46660	9	37	26	60	43	
3/H 11L2	1048	1.4	46660	8	34	24	56	41	
3/H 11L2	1099	1.3	46660	7	34	24	56	40	

19. DIMENSIONS AND WEIGHTS

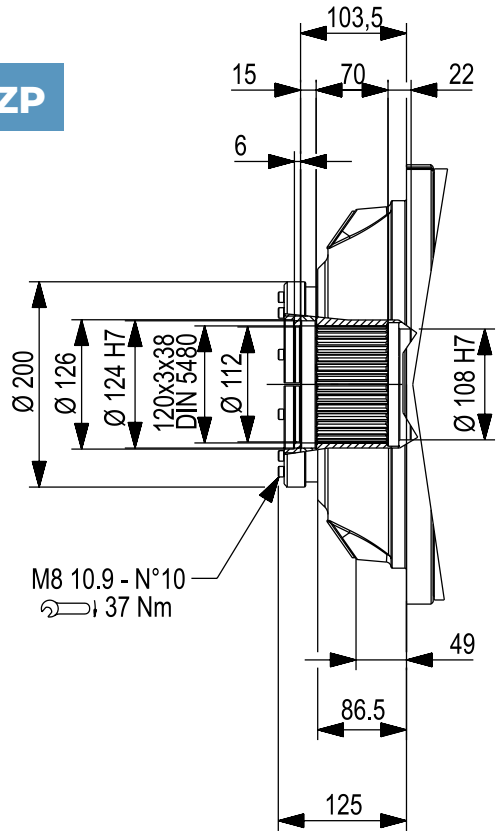
3/H 11L2



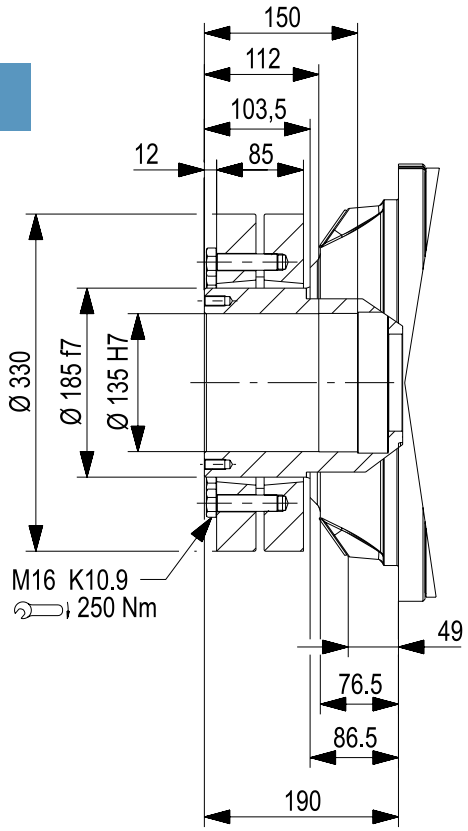
VP	i =	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	F [mm]	G [mm]	H [mm]	P [mm]	FP [KG]
3/H 11L2	30.3 65.0	55 m6	16	59	M20x42	100	110	599	405	487	665
3/H 11L2	76.0 270.3	45 k6	14	48.5	M16x36	100	110	706	525	605	726
3/H 11L2	335.4 1099	32 k6	10	35	M12x28	70	80	711	525	605	731

3/H 11L2

FZP



FP



M_{2max} = 55000 Nm