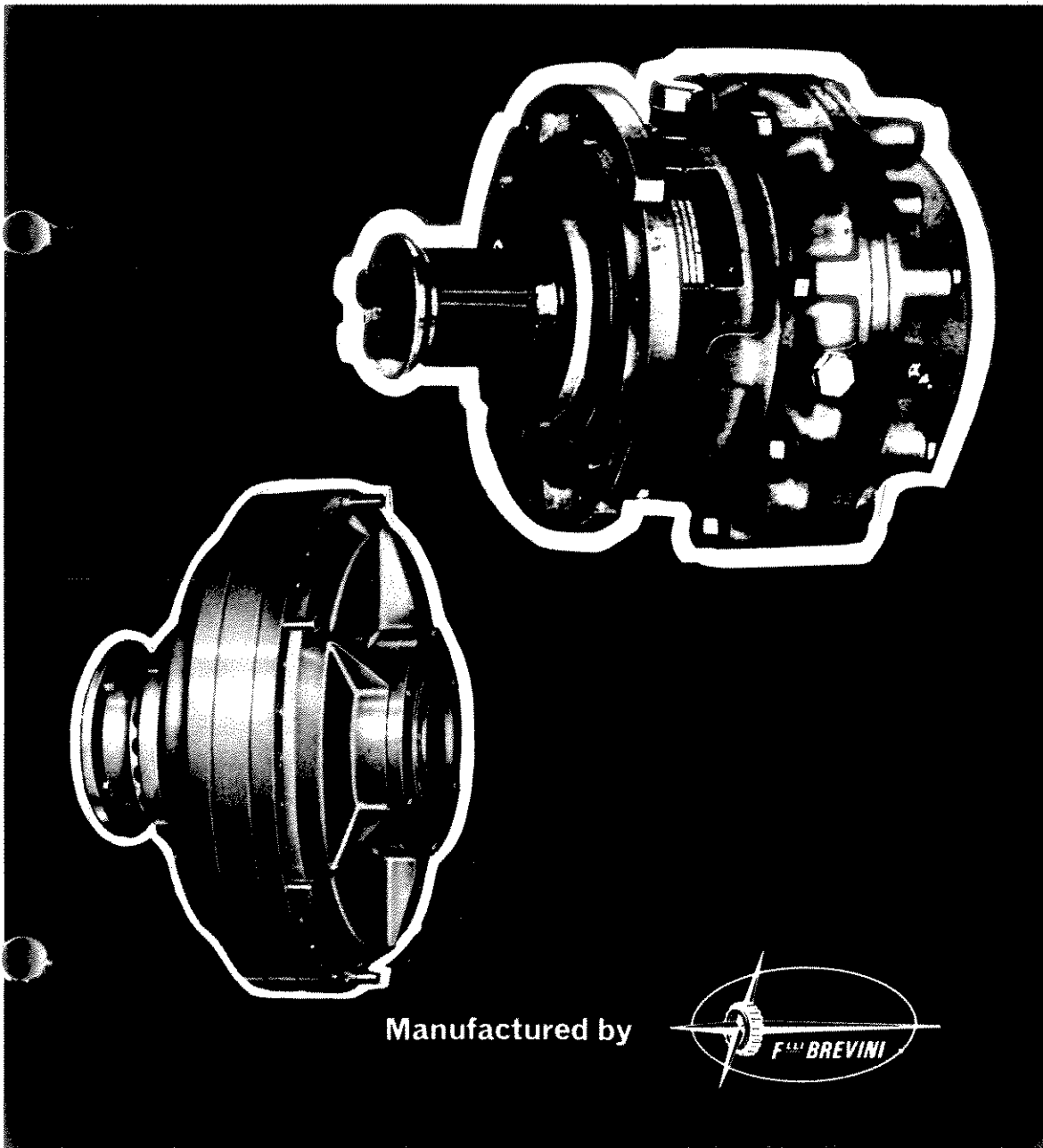




Hydrostatic Transmission Systems



Manufactured by



FOREWARD

Because of its versatility and efficiency, hydrostatic transmission has been, and is largely and increasingly used in many applications, and has successfully solved transmission problems, superseding any other existing transmission system.

In an application where high output torque and very low output speed are needed, a combination of the motor plus a reducer would be the best suitable solution. For this purpose we have made possible the availability of a great variety of reducers.

These reducers, maximizing the concept of planetary gears, have very high efficiency, compactness, linear and right angle axis for input and output shafts and, best of all, they can be connected with any kind of motor in the market.

For all these reasons, our planetary gear reducers can rationally solve any problems, insofar as hydrostatic transmission is concerned. As a matter of fact, thanks to their versatility, one can choose male or female shafts, ratios ranging from 1:3,37 TO 1:2,500, output torque ranging from 948 lb. ft. to 326,000 lb. ft., input speed up to 4,000 rpm, axial and radial loads up to customer's requirement. They can also be mounted of a positive-action hydraulic disc brake, negative-action hydraulic multi-disc brake, mechanical shoe brake, and various types of flanges for any possible application.

You can be sure that all our experience is at your disposal for a valid solution to any hydrostatic transmission problem you may encounter.

WAY OF MOUNTING

The units can be mounted:

1. Horizontally
2. Vertically -- Shaft-up
3. Vertically -- Shaft-down

Please advise the way the unit will be mounted, so that the unit can be provided with proper breather.

Lubrication

Before turning the hydraulic system on, make sure the reducer is filled with the appropriate type and quantity of lubricant.

Oil quantity varies with the type of reducer and its installment position.

Since the life of the gears and the good performance of the entire unit depend much on the right lubrication, it is recommended:

- to use SAE 80-90 EP oil
- to fill the reducer with the appropriate amount of oil stated on the reference charts
- to change the oil soon after the first 10 working hours and every 500/1000 hours afterwards
- to wash the gear system, when the oil change occurs, with oil solvent.

DELIVERY

- Units up to 72,500 lb. ft.: 8-9 weeks from date of receipt of order.
- Units from 72,500 lb. ft. to 130,000 lb. ft.: 13-14 weeks from date of receipt of order
- Units from 130,000 lb. ft. to 325,000 lb. ft.: 20-21 weeks from date of receipt of order

Units' Efficiency

Stages

- 1 efficiency 95-97%
- 2 efficiency 91-93%
- 3 efficiency 87-89%
- 4 efficiency 83-85%

Symbols

1. M Optional Male — Available upon request. Delivery and price may change.
2. MR Reinforced Male — Available upon request. Delivery and price may change.
3. F Optional Female — Available upon request. Delivery and price may change.
4. * Special Ratio — Available upon request. Delivery and price may change.

General Notes:

- maximum working temperature 70°C (158°F)
- ratios have \pm 3% tolerance

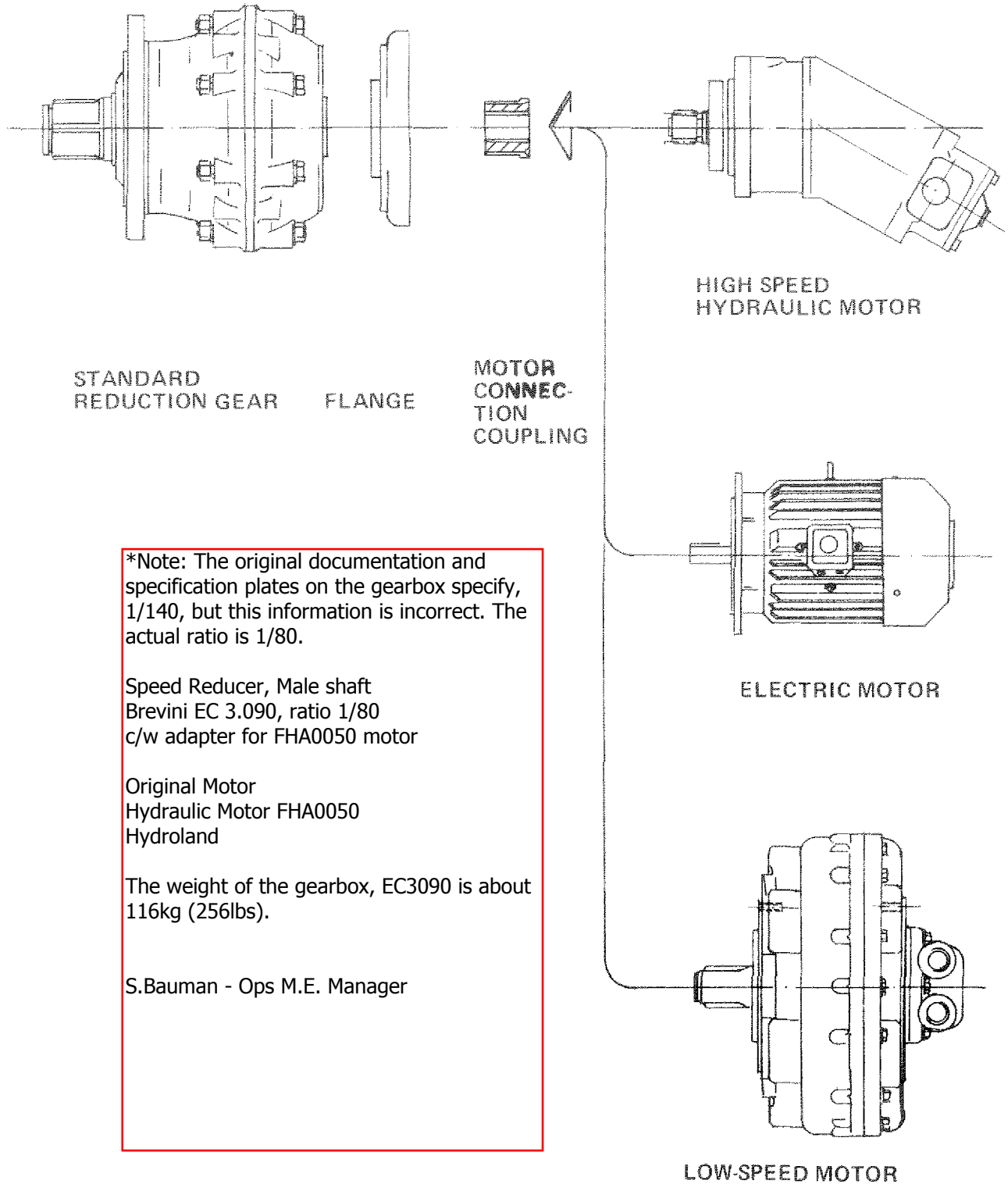
Important

Data contained in this catalogue supersedes any other previous data related to the same items.

MOTOR REDUCER COMBINATIONS

Our standard line of gear reducers **will fit any type of motor** existing in today's market. This is made possible by using the appropriate standard flanges and couplings available upon request.

The following example shows a standard gear reducer and its flanges – available to meet your needs



*Note: The original documentation and specification plates on the gearbox specify, 1/140, but this information is incorrect. The actual ratio is 1/80.

Speed Reducer, Male shaft
 Brevini EC 3.090, ratio 1/80
 c/w adapter for FHA0050 motor

Original Motor
 Hydraulic Motor FHA0050
 Hydroland

The weight of the gearbox, EC3090 is about 116kg (256lbs).

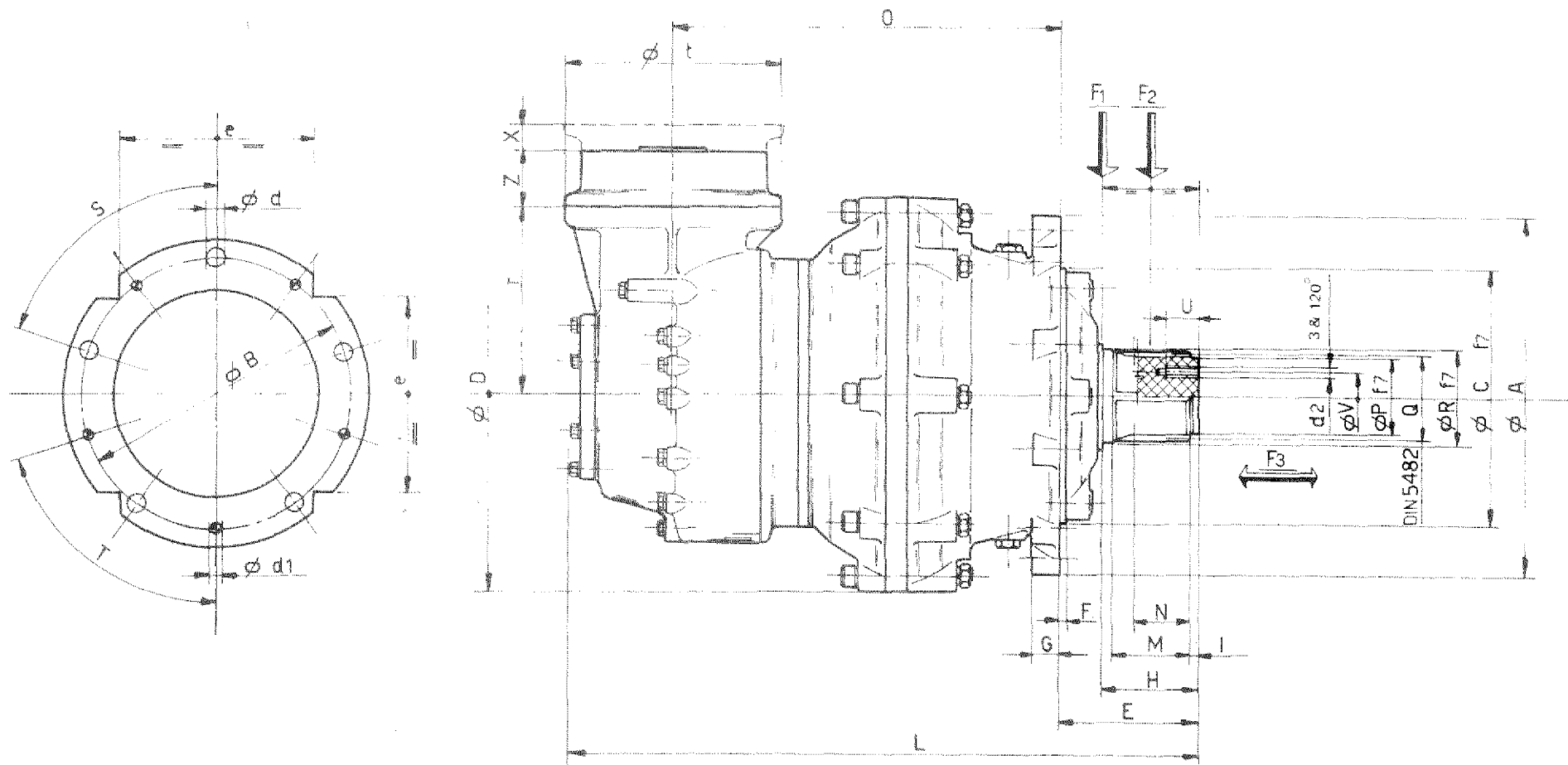
S.Bauman - Ops M.E. Manager

RIGHT-ANGLE REDUCERS — STANDARD MALE VERSION

UP TO 13,043 Lb., Ft., OUTPUT TORQUE

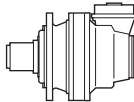
3 STAGES

TYPE	RATIO 1:.....	OUTPUT TORQUE			MAX. INPUT R.P.M.	RADIAL-AXIAL LOADS			WEIGHT Lb.
		Continuous Lb. Ft.	Intermittent Lb. Ft.	Peak Lb. Ft.		F ₁ Lb.	F ₂ Lb.	F ₃ Lb.	
EC 3045	*45 117	3,260	3,985	4,891	3,800	2,646	1,764	441	187
	50 125								
	56 140								
	71 *160								
	80 180								
	*85 200								
	100 *250								
EC 3045-MR	*45 117	3,260	3,985	4,891	3,800	6,614	4,409	3,307	190
	50 125								
	56 140								
	71 *160								
	80 180								
	*85 200								
	100 *250								
EC 3046	*45 117	3,260	4,348	5,336	3,800	12,566	9,259	2,205	201
	50 125								
	56 140								
	71 *160								
	80 180								
	*85 200								
	100 *250								
EC 3090	*56 125	6,522	8,696	13,043	3,800	12,566	9,259	6,834	304
	66 140								
	*71 160								
	80 170								
	*94 *200								
	100 225								
	112								
EC 3090-MR	*56 125	6,522	8,696	13,043	3,800	22,046	16,535	8,818	311
	66 140								
	*71 160								
	80 170								
	*94 *200								
	100 225								
112 225									



x : Flange-Motor Thickness

	A	B	C	D	E	F	G	H	I	L	M	N	O	P	Q	R	S	T	U	V	Z	d	d1	d2	e	r	t
EC 3.045	8.861	7.677	5.905	9.449	3.267	0.197	0.629	2.677	0.315	10.917	1.968	1.496	12.027	1.968	58 x 53	2.362	5 HOLES AT 72°	5 HOLES AT 72°	0.787	1.260	1.957	0.492	0.383	M10	5.512	6.693	7.677
EC 3.046	10.708	9.645	6.890	9.449	4.685	0.383	0.787	3.149	0.315	21.024	2.560	1.968	12.717	1.958	58 x 53	2.362	10 HOLES AT 36°		0.709	1.260	1.957	0.492		M10	6.889	6.693	7.677
EC 3.050	12.795	11.614	9.055	13.976	4.960	0.197	0.984	3.543	0.383	22.548	2.756	1.968	13.878	2.756	80 x 74	3.346	10 HOLES AT 36°		1.181	1.772	1.957	0.571		M10		6.693	7.677



i_{eff}	1500			1000			500			T_{2max} [Nm]	P_T [kW]
	n_2 [rpm]	T_2 [Nm]	P_2 [kW]	n_2 [rpm]	T_2 [Nm]	P_2 [kW]	n_2 [rpm]	T_2 [Nm]	P_2 [kW]		
EC 2090 - PDA 2090											
12.24	123	2760	35.4	82	3117	26.7	40.8	3838	16.4	15000	18
15.15	99	3416	35.4	66	3858	26.7	33.0	4750	16.4	15000	
17.43	86	3931	35.4	57	4439	26.7	28.7	5465	16.4	15000	
20.76	72	4514	34.2	48.2	4753	24.0	24.1	5107	12.9	15000	
23.33	64	2283	15.4	42.9	2578	11.6	21.4	3174	7.1	15000	
26.84	56	2627	15.4	37.3	2966	11.6	18.6	3652	7.1	15000	
31.97	46.9	3129	15.4	31.3	3533	11.6	15.6	4350	7.1	15000	
40.19	37.3	3582	14.0	24.9	3753	9.8	12.4	4045	5.3	15000	
EC 3090 - PDA 3090											
42.84	35.0	5945	21.8	23.3	6714	16.4	11.7	8266	10.1	15000	15
50.55	29.7	6248	19.4	19.8	7056	14.6	9.9	8687	9.0	15000	
53.03	28.3	6184	18.3	18.9	6983	13.8	9.4	8194	8.1	15000	
65.97	22.7	6457	15.4	15.2	7292	11.6	7.6	8977	7.1	15000	
73.44	20.4	6989	14.9	13.6	7893	11.3	6.8	9717	6.9	15000	
77.85	19.3	7112	14.4	12.8	8032	10.8	6.4	9888	6.7	15000	
90.90	16.5	7269	12.6	11.0	8085	9.3	5.5	8813	5.1	15000	
97.45	15.4	7608	12.3	10.3	8592	9.2	5.1	10578	5.7	15000	
113.1	13.3	7955	11.1	8.8	8984	8.3	4.4	10501	4.9	15000	
120.6	12.4	7913	10.3	8.3	8286	7.2	4.1	9334	4.1	15000	
140.0	10.7	8104	9.1	7.1	8393	6.3	3.6	9617	3.6	15000	
161.1	9.3	7216	7.0	6.2	7474	4.9	3.1	8537	2.8	15000	
169.1	8.9	8238	7.7	5.9	8684	5.4	3.0	9985	3.1	15000	
194.6	7.7	7336	5.9	5.1	7704	4.1	2.6	8867	2.4	15000	
231.8	6.5	5772	3.9	4.3	6047	2.7	2.2	6990	1.6	15000	
EC 4090 - PDA 4090											
285.8	5.2	8898	4.9	3.5	9657	3.5	1.7	11063	2.0	15000	10
321.5	4.7	10884	5.3	3.1	12248	4.0	1.6	13220	2.2	15000	
341.1	4.4	11078	5.1	2.9	12149	3.7	1.5	13144	2.0	15000	
395.8	3.8	11585	4.6	2.5	12747	3.4	1.3	13603	1.8	15000	
467.1	3.2	12173	4.1	2.1	12996	2.9	1.1	13913	1.6	15000	
503.8	3.0	12131	3.8	2.0	12602	2.6	0.99	14058	1.5	15000	
564.4	2.7	12624	3.5	1.8	13056	2.4	0.89	14276	1.3	15000	
623.6	2.4	10399	2.6	1.6	11250	1.9	0.80	12829	1.1	15000	
706.5	2.1	12523	2.8	1.4	13246	2.0	0.71	14717	1.1	15000	
820.0	1.8	11431	2.2	1.2	12043	1.5	0.61	14005	0.89	15000	
874.5	1.7	11105	2.0	1.1	12000	1.4	0.57	13661	0.82	15000	
1015	1.5	11427	1.8	0.99	12342	1.3	0.49	14042	0.72	15000	
1168	1.3	10154	1.4	0.86	10972	0.98	0.43	12491	0.56	15000	
1226	1.2	11847	1.5	0.82	12789	1.1	0.41	14537	0.62	15000	
1411	1.1	10530	1.2	0.71	11371	0.84	0.35	12934	0.48	15000	
1680	0.89	8340	0.78	0.60	9023	0.56	0.30	10291	0.32	15000	
1748	0.86	6325	0.57	0.57	6890	0.41	0.29	7939	0.24	15000	
2113	0.71	6585	0.49	0.47	7165	0.36	0.24	8245	0.20	15000	

Tutti i rapporti evidenziati (es. 12.24) hanno dimensioni particolari della coppia conica in certe versioni; vedere tavole dimensionali.

All ratios grey highlighted (ex. 12.24) have specific dimensions of the bevel gear set in some versions; see dimensional tables.

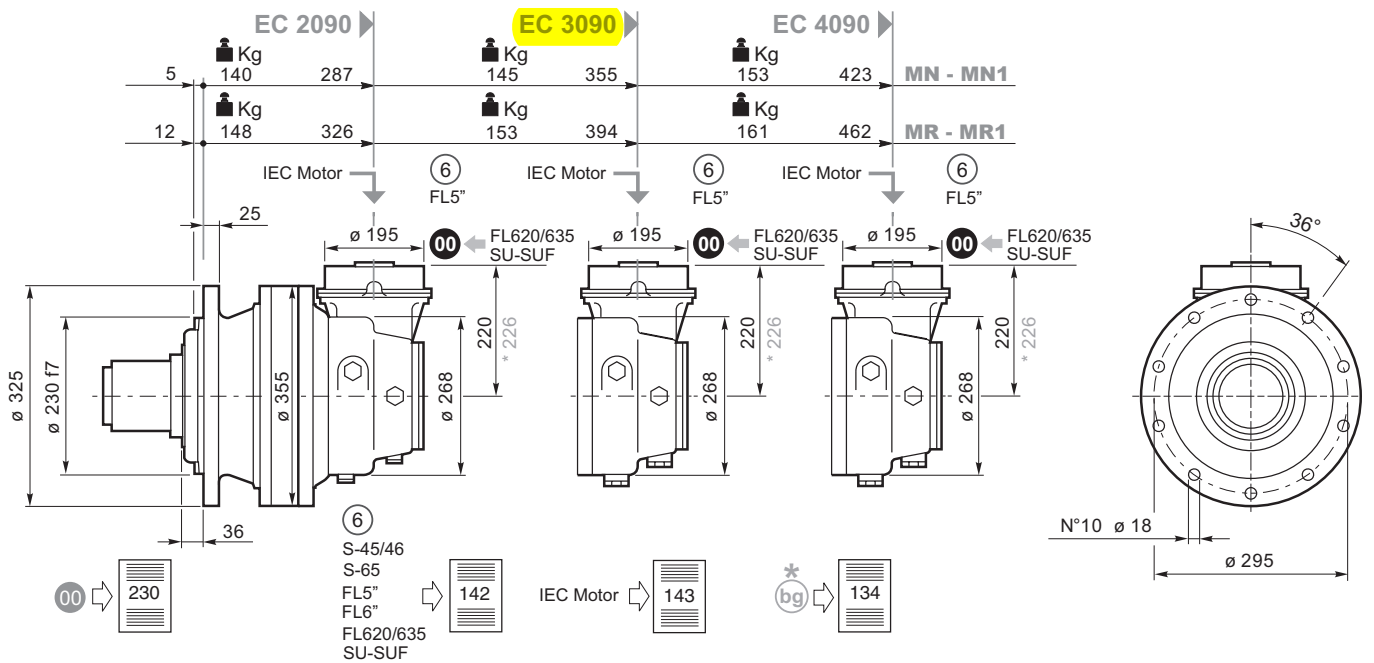
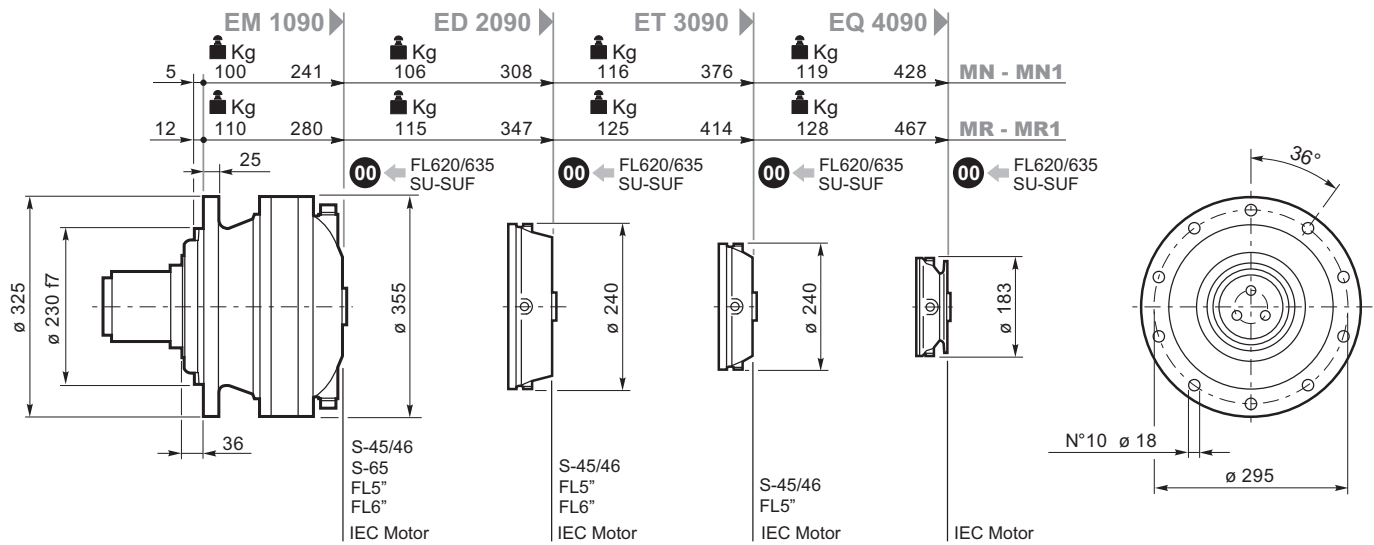
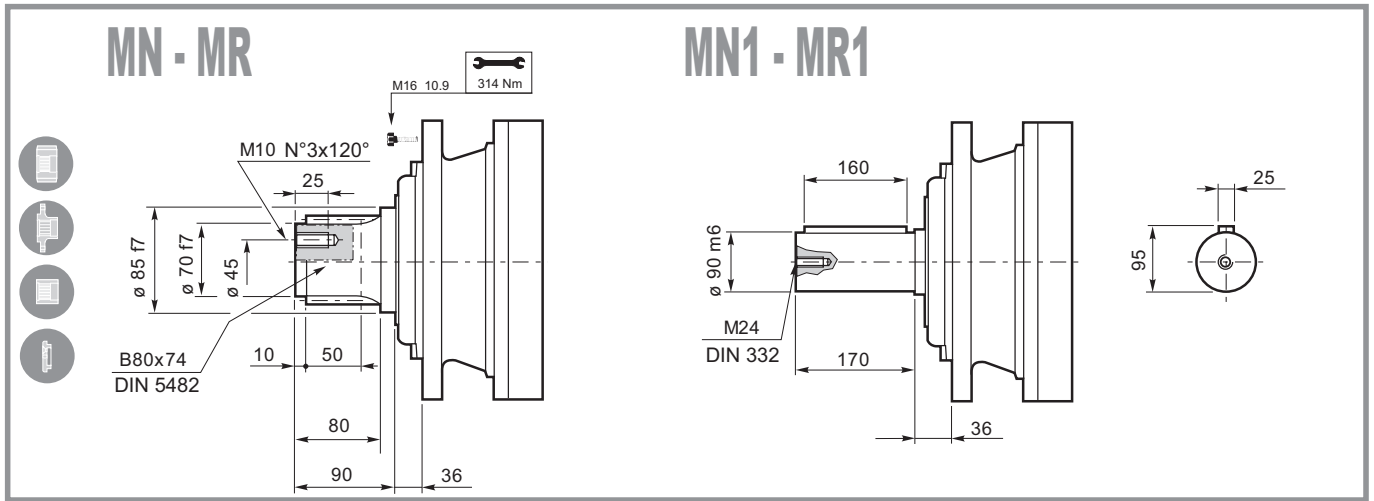
Alle mit (es. 12.24) gekennzeichneten Übersetzungen haben in bestimmten Versionen besondere Dimensionen des Kegelradtriebs. Siehe auch Dimensionstabellen.

Les rapports repérés par (es. 12.24) ont des dimensions de couple conique particulières. Voir les tableaux dimensionnels.

Todas las relaciones indicadas con (es. 12.24) tienen dimensiones particulares del par cónico según las versiones; ver las tablas de dimensión.

As relações marcadas com (es. 12.24) têm dimensões particulares da engrenagem cônica em certas versões; vide tabelas dimensionais.



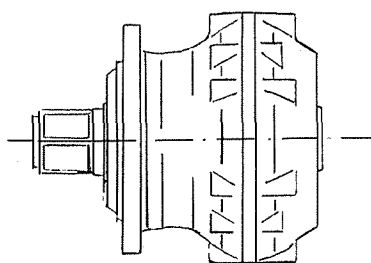


MALE VERSION							FEMALE VERSION								
TYPE	OIL QUANTITY GLS.			TYPE	OIL QUANTITY GLS.			TYPE	OIL QUANTITY GLS.			TYPE	OIL QUANTITY GLS.		
	POS. 1	POS. 2	POS. 3		POS. 1	POS. 2	POS. 3		POS. 1	POS. 2	POS. 3		POS. 1	POS. 2	POS. 3
EMI 12/G	.05	.13	.09	EC 2020	.55	1.11	.92	EMI 12/G-F	.05	.18	.09	EC 2020-F	.53	1.06	.87
EMI 14/S	.29	.53	.48	EC 2020-MR	.55	1.11	.92	EMI 14/S-F	.24	.45	.42	EC 2045-F	.50	1.00	.85
EMI 14/S-MR	.29	.53	.48	EC 2045	.53	1.06	.90	EMI 14/G-F	.21	.42	.4	EC 2090-F	1.03	1.85	1.40
EMI 14/G	.24	.48	.42	EC 2045-MR	.53	1.06	.90	* DK 11/G-F	.45	.82	.74	EC 2150	.77	1.58	1.19
EMI 14/G-MR	.24	.48	.42	EC 2046	.58	1.16	.95	* EP 16/M	.48	.87	.74	EC 3045-F	.69	1.37	1.08
EMI 15	.32	.58	.53	EC 2090	1.03	2.11	1.40	* EP 16/R	.69	1.27	.92	EC 3090-F	1.16	2.32	1.58
* DK 11/G	.45	.85	.74	EC 2090-MR	1.08	2.19	1.45	* EP 16/S	.79	1.45	1.00	EC 3150	.90	1.80	1.29
* DK 11/G-MR	.50	.98	.82	EC 2150-M	.82	1.69	1.32	* EP 17	1.85	3.43	2.24	EC 3250	1.08	2.17	1.58
* EP 16/M-M	.53	1.00	.92	EC 2150-MR	.95	1.95	1.48	ED 2010-F	.08	.16	.13	EC 3400	1.45	2.91	1.98
* EP 16/M-MR	.66	1.27	1.14	EC 3045	.71	1.43	1.11	ED 2020-F	.21	.45	.42	EC 3600	2.91	5.28	3.30
ED 2010	.08	.16	.13	EC 3045-MR	.71	1.43	1.11	ED 2045-F	.29	.53	.50	EC 4090-F	1.27	2.48	1.72
ED 2020	.29	.53	.53	EC 3046	.74	1.48	1.16	ED 2090-F	.63	1.14	.95	EC 4150	1.06	2.03	1.48
ED 2020-MR	.29	.53	.53	EC 3090-MR	1.21	2.43	1.64	ED 2150	.58	1.06	.85	EC 4250	1.21	2.48	1.72
ED 2045	.32	.58	.53	EC 3150-M	.95	1.90	1.48	ED 2250	.79	1.45	1.03	EC 4400	1.58	3.17	2.17
ED 2045-MR	.32	.58	.53	EC 3150-MR	1.08	2.17	1.64	* ED 2400	.92	1.72	1.16	EC 4600	3.17	5.81	3.57
ED 2046	.45	.85	.63	EC 3150-MR	1.08	2.17	1.64	* ED 2600	2.38	4.23	2.91				
ED 2090	.63	1.11	.95	EC 3250-M	1.16	2.32	1.77	ET 3020-F	.24	.53	.48				
ED 2090-MR	.66	1.16	1.03	EC 4090	1.27	2.54	1.72	ET 3045-F	.34	.61	.55				
ED 2150-M	.66	1.21	1.11	EC 4090-MR	1.32	2.64	1.80	ET 3090-F	.77	1.19	1.11				
ED 2150-MR	.79	1.43	1.19	EC 4150-M	1.11	2.22	1.66	ET 3150	.74	1.32	1.06				
ED 2250-M	.87	1.58	1.27	EC 4150-MR	1.24	2.48	1.85	ET 3250	.92	1.72	1.19				
ET 3020	.32	.58	.58	EC 4250-M	1.29	2.59	1.93	ET 3400	.95	1.72	1.21				
ET 3020-MR	.32	.58	.58					ET 3600	2.64	4.75	3.25				
ET 3045	.37	.66	.63					EQ 4045-F	.37	.66	.61				
ET 3045-MR	.37	.66	.63					EQ 4090-F	.85	1.53	1.19				
ET 3046	.50	.92	.74					EQ 4150	.82	1.48	1.16				
ET 3090	.77	1.40	1.11					EQ 4250	1.00	1.85	1.32				
ET 3090-MR	.82	1.48	1.19					EQ 4400	1.06	1.90	1.37				
ET 3150-M	.79	1.45	1.27					EQ 4600	2.75	4.89	3.43				
ET 3150-MR	.92	1.69	1.37												
ET 3250-M	1.00	1.85	1.45												
EQ 4045	.40	.74	.66												
EQ 4045-MR	.40	.74	.66												
EQ 4046	.58	1.11	.82												
EQ 4090	.85	1.58	1.19												
EQ 4090-MR	.90	1.64	1.27												
EQ 4150-M	.87	1.58	1.37												
EQ 4150-MR	1.00	1.85	1.48												
EQ 4250-M	1.08	2.06	1.58												

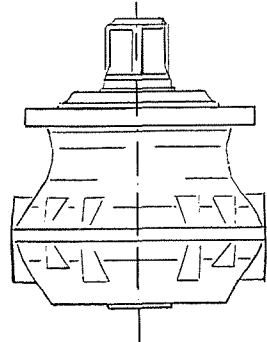
* The oil quantity depends on the type of motor connection flange.

** The oil quantity is stated approximately.

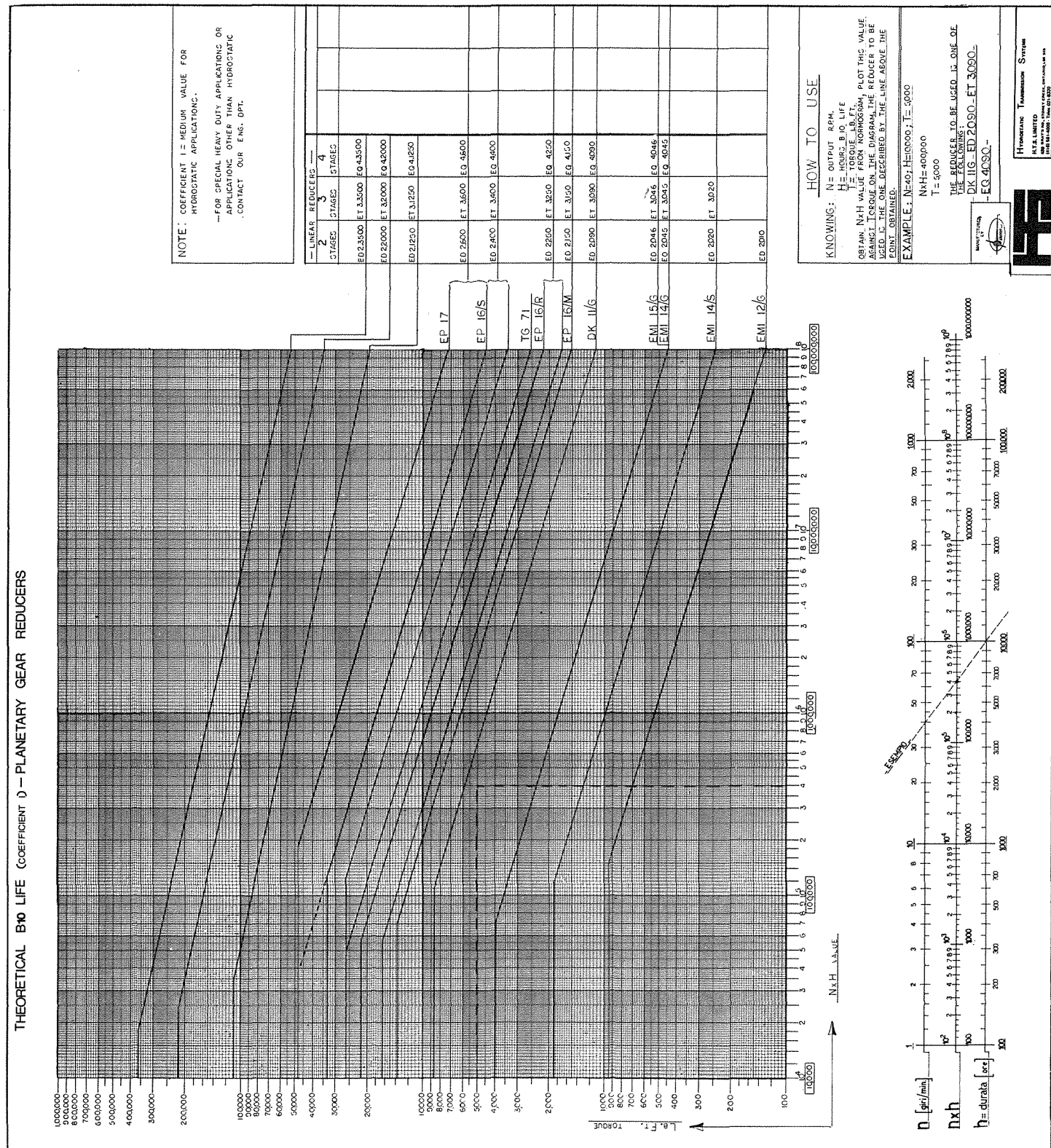
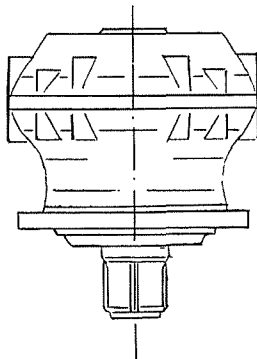
Horizontal Position 1

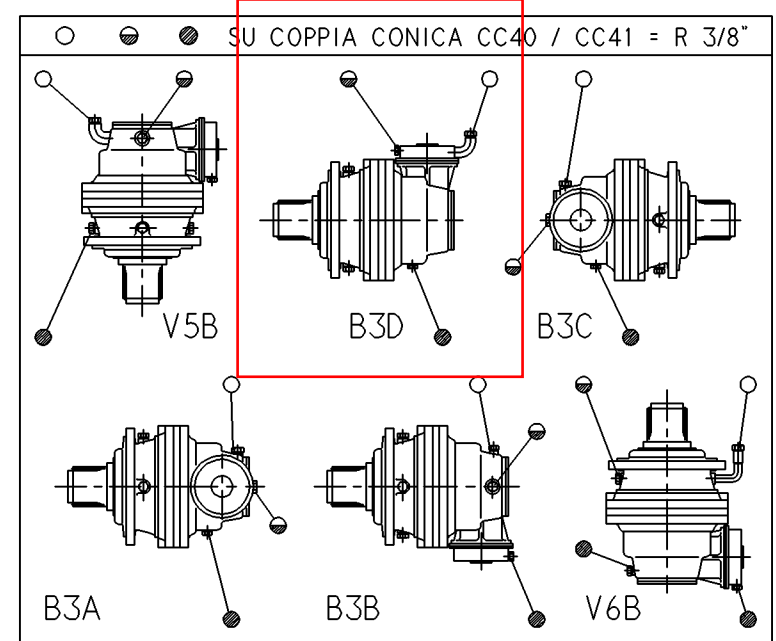
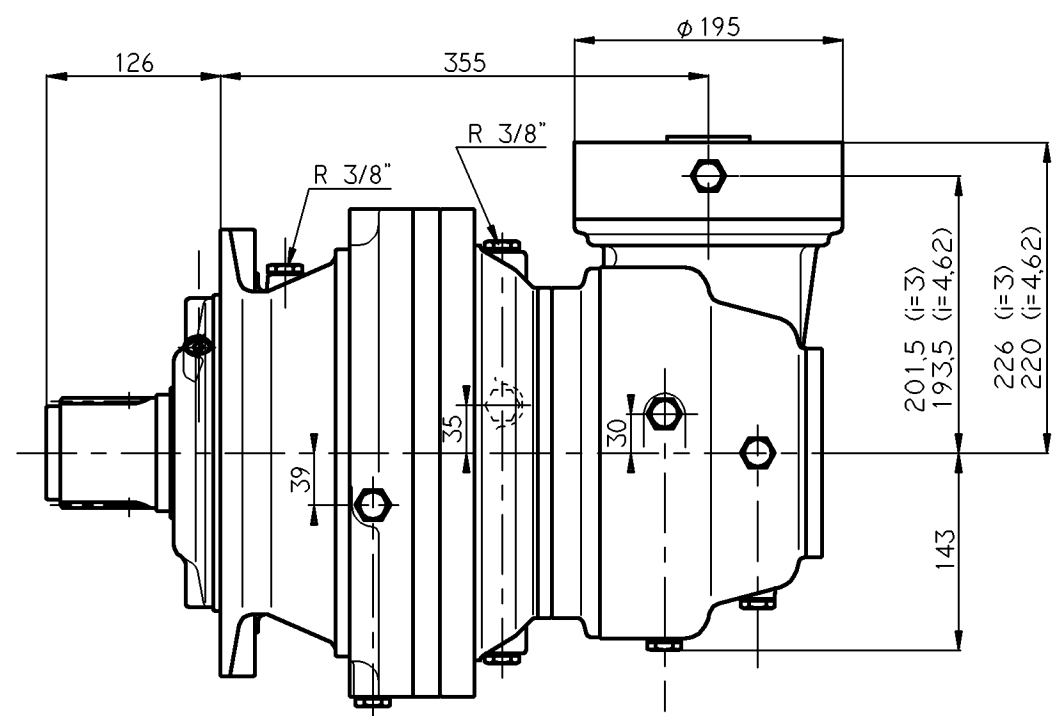


Vertical Position 2

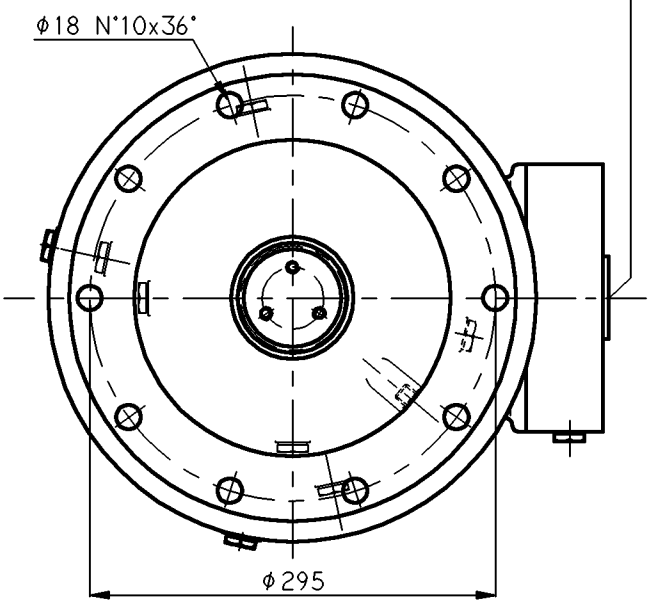
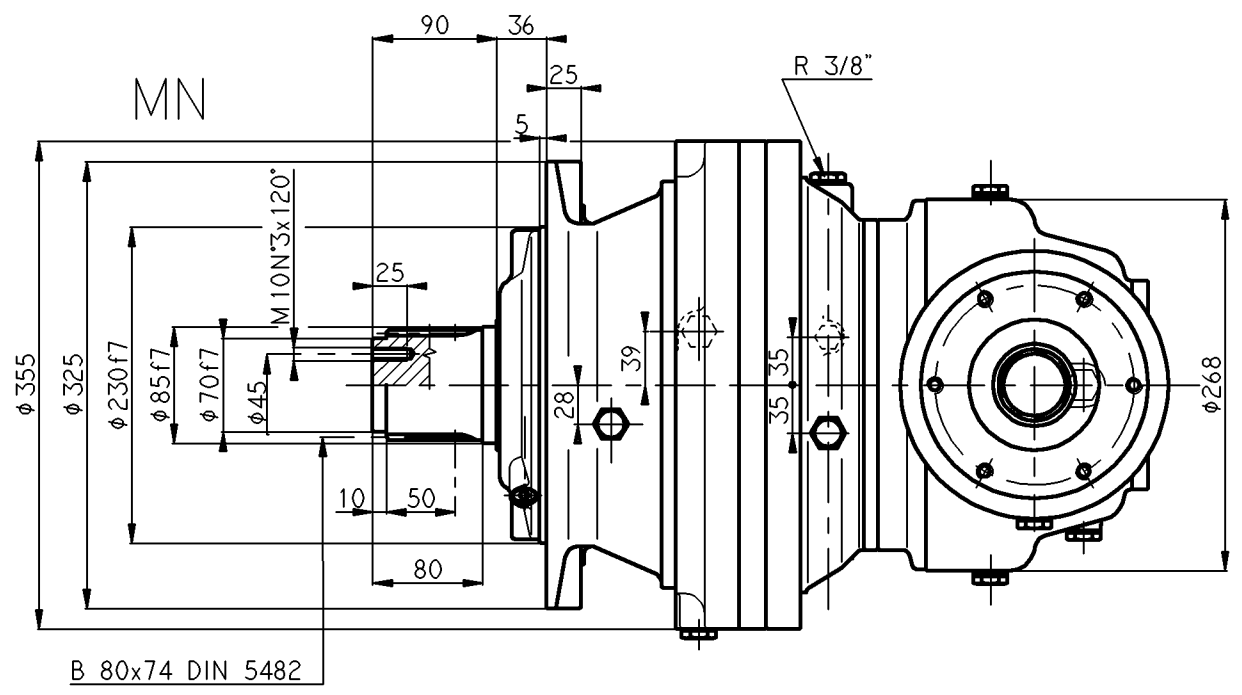


Vertical Position 3





ENTRATA UNIVERSALE
Universal input:
SF611000001A003



IND.	MODIFICA	DATA	FIRMA	CONTR.

- TAPPI OLIO OIL PLUGS**
- TAPPO CARICO E SFIATO FILLING AND BREATHER PLUG
 - TAPPO LIVELLO OIL LEVEL PLUG
 - TAPPO MAGNETICO E SCARICO MAGNETIC AND DRAIN PLUG
 - ▽ INGRASSATORE GREASING
 - ATTACCO COMANDO APERTURA FRENO BRAKE RELEASING PLUG
 - TAPPO CARICO E SFIATO OLIO FRENO BRAKE BREATHER PLUG
 - TAPPO LIVELLO OLIO FRENO BRAKE OIL LEVEL PLUG
 - TAPPO SCARICO OLIO FRENO BRAKE DRAIN PLUG

DENOMINAZIONE
EC3090 / MN / 00

DISEGNATO
Neroni

SCALA
1:5.5

CONTROLLATO
V.Montanari

DATA
21 OTT.98

SOSTITUISCE IL SD-900/3022.1

SOSTITUITO DA

SCHEMA N°
SI012C80101A003



DISEGNO ESEGUITO CON SISTEMA CAD
NON MODIFICARE A MANO

FOGLIO
A3
Indice

Questo disegno e le informazioni in esso contenute e'proprietà della Brevini Riduttori S.p.A.: non deve pertanto essere riprodotto (interamente o parzialmente) o usato per la costruzione o in qualsiasi altro modo rivelato senza previo consenso scritto della Brevini Riduttori S.p.A. This drawing and the information thereon is the property of Brevini Riduttori S.p.A and should not be reproduced (in whole or in part) or used for manufacture or otherwise disclosed without the prior written consent of Brevini Riduttori S.p.A.



17. LUBRIFICAZIONE

I riduttori Brevini vengono forniti privi di lubrificante; l'utilizzatore è tenuto ad effettuare il corretto riempimento prima della messa in moto della macchina.

Caratteristiche fondamentali degli oli

I parametri importanti da considerare quando si sceglie il tipo di olio sono:

- la viscosità alle condizioni nominali di funzionamento
- gli additivi

Lo stesso olio, deve lubrificare sia i cuscinetti che gli ingranaggi e tutti questi componenti convivono all'interno della stessa scatola, in condizioni di funzionamento diverse. Consideriamo i singoli parametri.

Viscosità

La viscosità nominale è riferita ad una temperatura di 40 °C, ma diminuisce velocemente all'aumentare della temperatura. Se la temperatura di funzionamento è compresa tra 50 °C e 70 °C, si può scegliere una viscosità nominale secondo la seguente tabella indicativa, scegliendo la viscosità più elevata quando si prevede la temperatura più alta.

n_2 [rpm]	50° C	70° C
$n_2 > 20$	VG 150	VG 220
$20 > n_2 > 5$	VG 220	VG 320
$n_2 > 5$	VG 320	VG 460

Particolare attenzione bisogna fare agli stadi in uscita molto caricati e con velocità molto basse (<1 giro/min). In questi casi bisogna ricorrere sempre ad oli con viscosità elevata e con una buona carica di additivazione Extreme Pressure (EP).

Additivi

Oltre ai normali additivi antischiuma ed antiossidanti, è importante utilizzare oli lubrificanti con additivi in grado di conferire proprietà EP (extremepressure) ed anti-usura, secondo ISO 6743-6 L-CKC o DIN 51517-3 CLP. Chiaramente quindi occorre ricercare prodotti con caratteristiche EP tanto più forti (tipo MOBILGEAR SHC) quanto più lenta è la velocità del riduttore. È opportuno ricordare che, i composti chimici sostitutivi della lubrificazione idrodinamica, si formano a scapito della carica EP originale. Quindi, in presenza di velocità molto basse e carichi elevati, è importante rispettare gli intervalli di manutenzione per non deprimere eccessivamente le caratteristiche lubrificanti dell'olio.

17. LUBRICATION

Brevini gear units are supplied without lubricant; therefore the user must carry out correct filling before starting the machine.

Fundamental characteristics of the oils

The important parameters to consider when choosing the type of oil are:

- viscosity at nominal operating conditions
- additives

The oil must lubricate the bearings and the gears and all these components work inside the same box, in different operating conditions. We will consider the individual parameters.

Viscosity

Nominal viscosity is referred to a temperature of 40 °C, but rapidly decreases with an increase in temperature. If the operating temperature is between 50 °C and 70 °C, a nominal viscosity can be chosen according to the following guide table, choosing the highest viscosity if the highest temperature is foreseen.

17. SCHMIERUNG

Die Brevini - Getriebe werden ohne Schmieröl geliefert; der Benutzer muss dieselben vor der Inbetriebnahme der Maschine mit der vorschrittmaßigen Schmierölmenge füllen.

Grundlegende schmieröleigenschaften

Bei der Schmierölauswahl sind die folgenden wichtige Parameter zu berücksichtigen:

- Viskosität bei Nennbetriebsbedingungen
- Additive

Dasselbe Öl muss sowohl Lager wie auch Zahnräder schmieren und diese Bauteile funktionieren zusammen in demselben Gehäuse unter unterschiedlichen Betriebsbedingungen. Nachfolgend werden die einzelnen Parameter kurz beschrieben.

Viskosität

Die Nennviskosität bezieht sich auf eine Temperatur von 40 °C und nimmt mit der Zunahme der Temperatur rasch ab. Liegt die Betriebstemperatur zwischen 50 °C und 70 °C, kann eine Nennviskosität laut folgender Tabelle gewählt werden, wobei bei sehr hoher Temperatur die höchste Viskosität zu wählen ist.

Special attention must be paid to very loaded output stages and with very low speeds (<1 rpm). In such cases, always use high viscosity oils and with a good amount of Extreme Pressure (EP) additive.

Additives

In addition to the normal antifoaming and antioxidant additives, it is important to use lubricating oils with additives that provide EP (extremepressure) and antiwear properties, according to ISO 6743-6 L-CKC or DIN 51517-3 CLP. Therefore it will be necessary to find products with EP characteristics all the stronger (type MOBILGEAR SHC) the slower the gear unit speed. It should be remembered that the chemical compounds replacing hydrodynamic lubrication are formed to the detriment of the original EP load.

Therefore, with very low speeds and high loads it is important to respect the maintenance periods so as not to excessively diminish the lubricating characteristics of the oil.

Besonders vorsichtig muss man bei Abtriebsstufen unter hohen Lasten und mit niedriger Drehzahl (<1 U/min) sein. In diesen Fällen muss immer Schmieröl mit hoher Viskosität und einer ausreichenden Menge an E.P. Additiven eingesetzt werden.

Additive

Neben den normalen Entschäumern und Oxidationshemmern müssen Schmieröle E.P. Additive (Extrem-Pressure) und verschleißhemmende Wirkstoffe laut ISO 6743-6 L-CKC oder DIN 51517-3 CLP enthalten. Es ist offensichtlich, dass dabei Produkte mit E.P. Eigenschaften (Typ MOBILGEAR SHC) zu wählen sind, die um so ausgeprägter sein müssen, je langsamer die Getriebedrehzahl ist. Es wird daran erinnert, dass sich die chemischen Substitutionsverbindungen der hydrodynamischen Schmierung zu Lasten des ursprünglichen EP-Gehalts bilden. Es ist daher bei sehr niedrigen Drehzahlen und hohen Belastungen sehr wichtig, dass die Wartungszeiträume zur Vermeidung einer übermäßigen Verschlechterung der Schmieröleigenschaften genau eingehalten werden.



Tipi di oli

Gli oli disponibili appartengono generalmente a tre grandi famiglie.

- 1) Oli minerali
- 2) Oli sintetici Poli-Alfa-Olefine
- 3) Oli sintetici Poli-Glicole

La scelta più appropriata è generalmente legata alle condizioni di impiego.

I riduttori non particolarmente caricati e con un ciclo di impiego discontinuo senza escursioni termiche importanti, possono certamente essere lubrificati con olio minerale.

Nei casi di impiego gravoso, quando i riduttori saranno prevedibilmente caricati molto ed in modo continuativo, con conseguente prevedibile innalzamento della temperatura, è bene utilizzare lubrificanti sintetici tipo polialfaolefine (PAO).

Gli oli di tipo poliglicole (PG) sono da utilizzare strettamente nel caso di applicazioni con forti strisciamenti fra i contatti, ad esempio nelle viti senza fine. Debbono essere impiegati con grande attenzione poiché non sono compatibili con gli altri oli e sono invece completamente miscibili con l'acqua. Questo fenomeno è particolarmente pericoloso poiché non si nota, ma deprime velocemente le caratteristiche lubrificanti dell'olio.

Oltre a questi già menzionati, ricordiamo che esistono gli oli idraulici e gli oli per l'industria alimentare.

I primi vengono usati per il comando dei freni negativi. Per una maggiore tutela dell'ambiente sottolineiamo l'esistenza di alcuni tipi biodegradabili.

I secondi trovano specifico impiego nell'industria alimentare in quanto sono prodotti speciali non nocivi alla salute.

Vari produttori forniscono oli appartenenti a tutte le famiglie con caratteristiche molto simili. Più avanti proponiamo una tabella comparativa tra le marche più note.

Types of oils

The oils available generally belong to three big families.

- 1) Mineral oils
- 2) Poly-Alpha-Olefin synthetic oils
- 3) Poly-Glycol synthetic oils

The most suitable choice is generally tied to the conditions of use.

Gear units that are **not particularly loaded** and with a **discontinuous operating cycle**, without **considerable temperature ranges**, can certainly be lubricated with **mineral oil**.

In cases of **heavy use**, when the gear units are **very loaded** and in a **continuous way**, with resultant **temperature increase**, it is best to use **polyalphaolefin synthetic lubricants (PAO)**.

Polyglycol oils (PG) are to be used strictly in the case of **applications with heavy sliding between contacts**, e.g. in **worms**. They must be employed with great care since they are not compatible with the other oils but are completely mixable with water. This phenomenon is particularly dangerous, since it is not noticed, but rapidly diminishes the lubricating characteristics of the oil.

In addition to the above, there are also hydraulic oils and oils for the food industry.

The former are used for the command of negative brakes. For better environmental protection there are several biodegradable types.

The latter have a specific use in the food industry since they are special products that are not harmful to the health.

Various producers supply oils belonging to all the families with very similar characteristics. A comparison table of the best known brands is given later on.

Schmierölsorten

Die verfügbaren Ölsorten gehören allgemein zu drei großen Familien

- 1) Mineralöle
- 2) Synthetische Poly-Alpha-Olefin-Öle
- 3) Synthetische Polyglykolöle

Die Auswahl hängt im Allgemeinen von den Einsatzbedingungen ab.

Getriebe, die nicht im Dauerbetrieb laufen und keinen großen Belastungen und großen Temperaturschwankungen ausgesetzt sind, können problemlos mit Mineralölen geschmiert werden.

Bei Einsatz unter erschwerten Bedingungen, bei denen die Getriebe voraussichtlich hohen Lasten im Dauerbetrieb mit der entsprechenden voraussehbaren Temperaturerhöhung ausgesetzt sind, ist es angebracht, synthetische Poly-Alpha-Olefin-Öle (PAO) zu verwenden.

Die Poly-Glykolöle (PG) werden in Anwendungen benutzt, in denen starke Gleitreibungen zwischen den Kontaktflächen auftreten, wie z. B. in Schnecken. Bei ihrer Anwendung ist sehr sorgfältig vorzugehen, da sie mit anderen Schmierölen unverträglich, aber voll mit Wasser vermischbar sind. Das ist besonders gefährlich, weil es unbemerkt erfolgt und sehr schnell die Schmiereigenschaften des Öls verschlechtert.

Neben den erwähnten Ölen gibt es noch Hydrauliköl und Öle für die Lebensmittelindustrie.

Die ersteren werden auf Negativbremsen eingesetzt. Zum Umweltschutz weisen wir auf einige biologisch abbaubare Ölsorten hin.

Die zweiten werden von der Lebensmittelindustrie verwendet, da sie nicht gesundheitsschädlich sind.

Einige Hersteller liefern Schmieröle, die allen Familien mit sehr ähnlichen Merkmalen angehören. An anderer Stelle finden Sie eine Vergleichstabelle der bekanntesten Ölmarken.



Contaminazione

Durante il normale funzionamento, a causa del rodaggio delle superfici, è inevitabile che si trasferiscano nell'olio delle microparticelle metalliche. Questa contaminazione, può accorciare la vita dei cuscinetti, mandando in avaria prematura il riduttore. Per limitare e controllare il fenomeno, senza ricorrere a frequenti e costosi cambi d'olio, occorre prevedere l'impiego di un opportuno sistema ausiliario di circolazione dell'olio.

Con questo sistema, si ottiene il doppio vantaggio di controllare il livello di contaminazione con l'impiego di appositi filtri e di stabilizzare la temperatura di funzionamento al livello più adeguato per garantire la viscosità voluta. Infatti, può succedere che la capacità termica specifica del riduttore è insufficiente a garantire un livello di temperatura di funzionamento corretto e stabile. Vedremo più avanti i sistemi ausiliari disponibili presso la Brevini Riduttori.

Per problemi di lubrificazione di riduttori destinati a impieghi particolari sia per la tipologia costruttiva, sia per i parametri di funzionamento, è consigliabile contattare il servizio Tecnico-Commerciale Brevini.

A questo proposito ricordiamo che la Brevini Riduttori si avvale di un accordo tecnico con la Exxon Mobil in base al quale si può avere sia una consulenza preventiva mirata all'applicazione, sia il monitoraggio di applicazioni lubrificate con prodotti MOBIL.

Contamination

During **normal operation**, due to running-in of the surfaces, metallic microparticles will inevitably form in the oil. This contamination can shorten the life of the bearings, resulting in early breakdown of the gear unit. To limit and control this phenomenon, without resorting to frequent and costly oil changes, a suitable auxiliary oil circulating system must be provided.

This system offers the dual advantage of controlling the level of contamination with the use of special filters and stabilizing the operating temperature at a level more suitable for guaranteeing the required viscosity. In fact, the specific thermal capacity of the gear unit is sometimes insufficient to ensure a correct and stable operating temperature level. The auxiliary systems available from Brevini Riduttori will be described later on.

For lubrication problems with gear units intended for particular uses, for construction type and operating parameters, it is advisable to contact the Brevini Technical Commercial service.

In this respect, Brevini Riduttori has a technical agreement with Exxon Mobil for having preventive advice for the specific application, and the monitoring of applications lubricated with MOBIL products.

Verschmutzung

Während des normalen Betriebs entstehen durch den Abrieb der Oberflächen Mikrometallpartikel im Öl. Diese Verschmutzung kann die Lebensdauer der Lager verkürzen und zu einem Ausfall des Getriebes führen. Zur Einschränkung dieser Erscheinung ohne häufigen und kostspieligen Ölwechsel ist der Einbau einer zusätzlichen Filteranlage des Schmieröls empfehlenswert.

Diese Anlage bietet den doppelten Vorteil, einerseits den Grad der Ölverschmutzung zu reduzieren und andererseits die Betriebstemperatur auf einer für die gewünschte Viskosität geeigneten Temperaturstufe zu stabilisieren. Es kann mitunter der Fall eintreten, dass die spezifische Wärmeleistung des Getriebes nicht ausreicht, eine korrekte und stabile Stufe der Betriebstemperatur zu gewährleisten. An anderer Stelle werden die bei Brevini Riduttori verfügbaren Hilfssysteme beschrieben.

Wenden Sie sich bei Schmierproblemen von Getrieben, die sowohl bauseitig wie auch aufgrund der Betriebsparameter für besondere Anwendungen vorgesehen sind, direkt an die technische Verkaufssberatung Brevini.

In diesem Zusammenhang dürfen wir erwähnen, dass Brevini Riduttori eine technische Vereinbarung mit Exxon Mobil abgeschlossen hat, die Ihnen eine gezielte Anwendungsberatung wie auch die Überwachung von Schmieranwendungen mit Produkten MOBIL ermöglicht.


**Tabella oli lubrificanti
per uso generale**
**Table of lubricant oils
for general use**
**Tabelle der allaemein
verwendeten Schmierole**
**Tableau des lubrifiants
pour emoloi general**
**Tabla de aceites lubricantes
para todos los usos**
**Tabela de óleos lubrificantes
para uso geral**

Produttore Manufacturer Hersteller Marque Fabricante Produtor	Oli Minerali Mineral oils Mineralöle Huiles minérales Aceites minerales Óleos minerais			Oli Sintetici Polialfaolefine (PAO) Poly-Alpha-Olefin synthetic oils (PAO) Synthetische Poly-Alpha-Olefin-Öle (PAO) Huiles synthétiques polialphaoléfinas (PAO) Aceites sintéticos polialfaolefinas (PAO) Óleos sintéticos polialfaolefinas (PAO)			Oli Sintetici Poliglicicoli (PG) Polyglycol synthetic oils (PG) Synthetische Polyglykölöle (PG) Huiles synthétiques polyglycoles (PG) Aceites sintéticos poliglicólicos (PG) Óleos sintéticos poliglicólicos (PAO)		
	ISO VG 150	ISO VG 220	ISO VG 320	ISO VG 150	ISO VG 220	ISO VG 320	ISO VG 150	ISO VG 220	ISO VG 320
ADDINOL	Transmission Oil CLP 150	Transmission Oil CLP 220	Transmission Oil CLP 320	Eco Gear 150 S	Eco Gear 220 S	Eco Gear 320 S	Luboil RS 150	Luboil RS 220	-
AGIP	Blasia 150	Blasia 220	Blasia 320	-	Blasia SX 220	Blasia SX 320	Blasia S 150	Blasia S 220	Blasia S 320
ARAL	Degol BG 150 Plus	Degol BG 220 Plus	Degol BG 320 Plus	Degol PAS 150	Degol PAS 220	Degol PAS 320	Degol GS 150	Degol GS 220	Degol GS 320
BP	Energol GR-XP 150	Energol GR-XP 220	Energol GR-XP 320	Energol EPX 150	Energol EPX 220	Energol EPX 320	Energol SG 150	Energol SG-XP 220	Energol SG-XP 320
CASTROL	Alpha SP 150	Alpha SP 220	Alpha SP 320	Alphasyn EP 150	Alphasyn EP 220	Alphasyn EP 320	Alphasyn PG 150	Alphasyn PG 220	Alphasyn PG 320
CEPSA	Engranajes HP 150	Engranajes HP 220	Engranajes HP 320	Engranajes HPX 150	Engranajes HPX 220	Engranajes HPX 320	Engranajes HPS 150	Engranajes HPS 220	Engranajes HPS 320
CHEVRON	Ultra Gear 150	Ultra Gear 220	Ultra Gear 320	Tegra Synthetic Gear 150	Tegra Synthetic Gear 220	Tegra Synthetic Gear 320	HiPerSYN 150	HiPerSYN 220	HiPerSYN 320
DEA	Falcon 150	Falcon 220	Falcon 320	Intor 150	Intor 220	Intor 20	Polydea 150	Polydea 220	Polydea 320
ERG	Roxin S EP 150	Roxin S EP 220	Roxin S EP 320	-	-	-	-	-	-
ESSO	Spartan EP 150	Spartan EP 220	Spartan EP 320	Spartan S EP 150	Spartan S EP 220	Spartan S EP 320	Glycolube 150	Glycolube 220	Glycolube 320
FUCHS	Renolin CKC 150	Renolin CKC 220	Renolin CKC 320	Renolin Unisyn CKC 150	Renolin Unisyn CKC 220	Renolin Unisyn CKC 320	Renolin PG 150	Renolin PG 220	Renolin PG 320
LUBRITECH	Gearmaster CLP 150	Gearmaster CLP 220	Gearmaster CLP 320	Gearmaster SYN 150	Gearmaster SYN 220	Gearmaster SYN 320	Gearmaster PGP 150	Gearmaster PGP 220	Gearmaster PGP 320
KLÜBER	Klüberoil GEM 1-150	Klüberoil GEM 1-220	Klüberoil GEM 1-320	Klübersynth EG 4-150	Klübersynth EG 4-220	Klübersynth EG 4-320	Klübersynth GH 6-150	Klübersynth GH 6-220	Klübersynth GH 6-320
LUBMARINE	Epona Z 150	Epona Z 220	Epona Z 320	-	Epona SA 320	Epona SA 320	-	-	-
MOBIL	Mobilgear XMP 150	Mobilgear XMP 220	Mobilgear XMP 320	Mobilgear SHC XMP 150	Mobilgear SHC XMP 220	Mobilgear SHC XMP 320	Glygoyle 22	Glygoyle 30	Glygoyle HE320
MOLIKOTE	L-0115	L-0122	L-0132	L-1115	L-1122	L-1132	-	-	-
NILS	Ripress EP 150	Ripress EP 220	Ripress EP 320	Arcol Synt 150	Arcol Synt 220	Arcol Synt 320	Ripress Synt 150	Ripress Synt 220	Ripress Synt 320
OMV	Gear HST 150	Gear HST 220	Gear HST 320	-	Gear SHG 220	Gear SHG 320	Gear PG 150	Gear PG 220	Gear PG 320
OPTIMOL	Optigear BM 150	Optigear BM 220	Optigear BM 320	Optigear Synthetic A 150	Optigear Synthetic A 220	Optigear Synthetic A 320	Optiflex A 150	Optiflex A 220	Optiflex A 320
PAKELO	Erolube EP-C ISO 150	Erolube EP-C ISO 220	Erolube EP-C ISO 320	Gearsint EP ISO 150	Gearsint EP ISO 220	Gearsint EP ISO 320	Allsint EP-C ISO 150	Allsint EP-C ISO 220	Allsint EP-C ISO 320
PENNZOIL	Super Maxol EP 150	Super Maxol EP 220	Super Maxol EP 320	-	-	-	-	-	-
Q8	Goya 150	Goya 220	Goya 320	El Greco 150	El Greco 220	El Greco 320	Gade 150	Gade 220	Gade 320
ROLOIL	EP/150	EP/220	EP/320	-	-	-	Sincat 150	Sincat 220	Sincat 320
ROYAL PURPLE	-	-	-	Synergy 150	Synergy 220	Synergy 320	-	-	-
SHELL	Omala 150	Omala 220	Omala 320	Omala HD 150	Omala HD 220	Omala HD 320	Tivela S 150	Tivela S 220	Tivela S 320
SINCLAIR	Warrior EP/ NL 150	Warrior EP/ NL 220	Warrior EP/ NL 320	-	-	-	-	-	-
SUNOCO	Sun EP 150	Sun EP 220	Sun EP 320	Duragear 150	Duragear 220	Duragear 320	-	-	-
TAMOIL	Carter EP Lubricant 150	Carter EP Lubricant 220	Carter Ep Lubricant 320	-	-	-	-	-	-
TEXACO	Meropa 150	Meropa 220	Meropa 320	Pinnacle EP 150	Pinnacle EP 220	Pinnacle EP 320	-	Synlube CLP 220	Synlube CLP 320
TOTAL	Carter EP 150	Carter EP 220	Carter EP 320	Carter SH 150	Carter SH 220	Carter SH 320	Carter SY 150	Carter SY 220	Carter SY 320
TRIBOL	1100/150	1100/220	1100/320	1510/150	1510/220	1510/320	800/150	800/220	800/320



Vaso di espansione

Nel caso di montaggio verticale e, comunque, ogni volta si renda necessario riempire completamente il riduttore, occorre rispettare alcune regole.

All'atto del riempimento, nella parte superiore, in corrispondenza della tenuta rotante dell'albero di uscita, si può formare una bolla d'aria, che deve essere eliminata per evitare l'insufficiente lubrificazione della tenuta stessa. Inoltre sapendo che il volume dell'olio aumenta con la temperatura, occorre predisporre un serbatoio ausiliario che consenta all'olio di espandersi senza creare pericolose pressioni interne al riduttore.

The Brevini gearbox requires 6.6 liters (1.74 gallons) of fluid per the manufactures literature.

**S.Bauman
Operations M.E. Manager**

Expansion tank

Several rules must be followed with vertical mounting, and in any case whenever the gear unit has to be completely filled. During filling, an air bubble can form in the upper part, at the output shaft revolving seal, and which must be eliminated in order to avoid insufficient lubrication of the seal. Also, since the volume of oil increases with the temperature, an auxiliary tank must be provided to allow the oil to expand without creating dangerous pressures inside the gear unit.

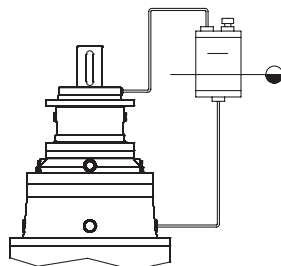


Fig. 10

Expansionsgefäß

Bei vertikalem Einbau und in allen Fällen, in denen das Getriebe vollständig gefüllt werden muss, sind einige wichtige Regeln einzuhalten.

Während des Füllens kann sich im oberen Teil in Höhe der Wellendichtung eine Luftblase bilden, die zur Vermeidung ungenügender Schmierung beseitigt werden muss. Da sich das Ölvolumen mit steigender Temperatur erhöht, muss ein Hilfsbehälter eingebaut werden, der die Ausdehnung des Öls ausgleicht und gefährliche Drücke im Inneren des Getriebes verhindert.

Per il dimensionamento occorre determinare il volume (V_e) di espansione dell'olio alla temperatura di funzionamento:

For dimensioning, the oil expansion volume (V_e) at operating temperature must be determined:

Für die Bemessung des Behälters muss das Ausdehnungsvolumen (V_e) des Öls bei Betriebstemperatur berechnet werden:

$$V_e = V_t \times \Delta T / 1000$$

V_t = volume totale dell'olio
 ΔT = differenza tra temperatura di funzionamento e temperatura ambiente

V_t = total volume of oil
 ΔT = difference between operating temperature and ambient temperature

V_t = Gesamte Ölmenge
 ΔT = Unterschied zwischen Betriebs- und Umgebungstemperatur

La capacità (V_s) del vaso di espansione è:

The capacity (V_s) of the expansion tank is:

Das Aufnahmevermögen (V_s) des Expansionsbehälters ist:

$$V_s = 2 \times V_e$$

Per eliminare l'eventuale aria residua, devono essere collegati il foro presente nella zona più alta del riduttore e la parte superiore del vaso di espansione; quest'ultimo deve essere posto ad una altezza tale da garantire il pieno riempimento del riduttore al livello minimo. Si consiglia di realizzare il tubo di spurgo o lo stesso vaso di espansione con materiale trasparente, per poter verificare con facilità l'esatta posizione del livello del lubrificante.

To remove any residual air, the holes in the top part of the gear unit and the upper part of the expansion tank must be connected; the latter must be located at a height guaranteeing complete filling of the gear unit up to the minimum level. It is advisable to make the bleeding tube or the expansion tank with transparent material, to be able to easily check the exact position of the lubricant level.

Zur Entlüftung der Restluft ist die Bohrung im höchsten Teil des Getriebes mit dem Oberteil des Expansionsgefäßes zu verbinden; letzteres muss auf einer Höhe angeordnet werden, die gewährleistet, dass das Getriebe immer bis zum Mindeststand gefüllt ist. Es ist angebracht, einen Entlüftungsschlauch und ein Expansionsgefäß aus durchsichtigem Material zu verwenden, um jederzeit auf leichte Weise den Schmierölstand kontrollieren zu können.



Montaggio verticale in linea e versioni ortogonali

I riduttori debbono essere completamente pieni, quindi occorre montare il vaso di espansione. Come detto in precedenza, è molto importante collegare lo sfiato superiore del riduttore al vaso di espansione per consentire all'olio di risalire fino all'anello di tenuta rotante dell'albero superiore del riduttore.

Volendo montare uno strumento che consenta la verifica visiva (o tramite apposito segnale elettrico), lo strumento sarà collocato sul fianco del serbatoio.

Vertical mounting in-line and right-angle versions

The gear units must be completely full, then the expansion tank must be fitted. As already stated, it is very important to connect the top breather to the expansion tank in order to allow the oil to rise up to the rotating seal ring of the gear unit upper shaft.

To fit an instrument for visual checking (or by means of a special electric signal), the instrument must be placed on the side of the tank.

Vertikaleinbau von In-Line- und Winkelgetrieben

Die Getriebe müssen vollständig gefüllt sein; daher ist immer ein Expansionsbehälter erforderlich. Wie bereits ausgeführt wurde, ist es sehr wichtig, dass die obere Entlüftung des Getriebes an das Expansionsgefäß angeschlossen wird, damit das Schmieröl die Wellendichtung der oberen Getriebewelle erreichen kann.

Falls eine Sichtkontrolle des Ölstands (oder eine Kontrolle mittels eines elektrischen Signals) gewünscht wird, muss das Gerät auf der Seite des Behälters angeordnet werden.

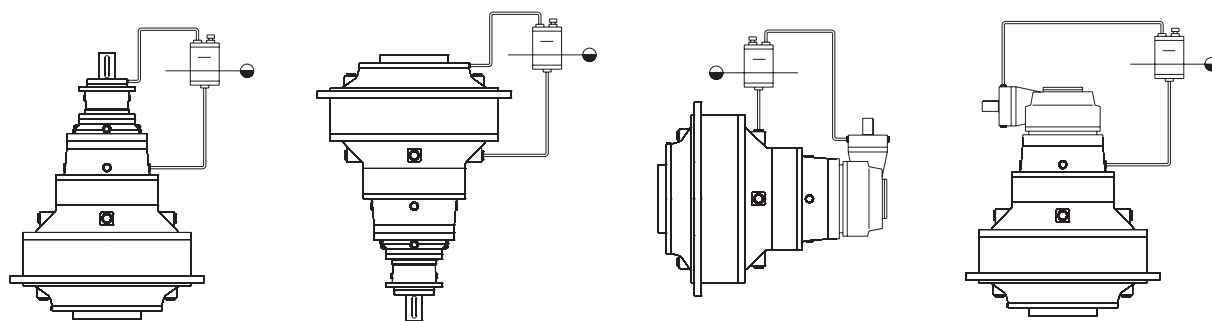


Fig. 11

Sistemi ausiliari di raffreddamento e filtrazione

Nel caso la potenza trasmessa sia superiore alla potenza termica dissipabile dal riduttore, è necessario l'impiego di un sistema ausiliario di raffreddamento, in grado di smaltire la potenza termica in eccedenza e di mantenere anche un buon livello di pulizia dell'olio lubrificante, attraverso la filtrazione continua.

Per assolvere questa funzione, la Brevini Riduttori propone tre unità di raffreddamento in grado di dissipare rispettivamente 5, 10, 20 kW.

Auxiliary cooling and filtering systems

If the power transmitted is higher than the thermal power that can be dissipated by the gear unit, an auxiliary cooling system able to dissipate the excess thermal power and also maintain a good level of cleaning of the lubricating oil through constant filtering, must be used.

To carry out this function, Brevini Riduttori proposes three cooling units able to dissipate 5, 10, 20 kW respectively.

Zusätzliche kühl- und filteranlage

Falls die übertragene Leistung höher ist als die vom Getriebe abführbare Wärmeleistung muss ein zusätzliches Kühlsystem installiert werden, das in der Lage ist, die überschüssige Wärmeleistung abzuführen und durch Dauerfiltration das Schmieröl auf einem ausreichend sauberen Niveau zu halten.

Brevini Riduttori bietet zu diesem Zweck drei Kühleinheiten mit einer Wärmedissipation von jeweils 5, 10, 20 kW an.

Type	1	2	3	4
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065
067

EM 1065	MN	1,6	3,2		
	FE	1,8	3,6		
	FS	1,6	3,2		
	FP				

ED 2065	MN	2,4	4,8		
	FE	2,6	5,2		
	FS	2,4	4,8		
	FP				

EC 2065	MN	2,7	5,4		
	FE	2,9	5,8		
	FS	2,7	5,4		
	FP				

ET 3065	MN	2,3	4,6		
	FE	2,5	5		
	FS	2,3	4,6		
	FP				

EC 3065	MN	3,7	7,4		
	FE	3,8	7,6		
	FS	3,7	7,4		
	FP				

EQ 4065	MN	2,5	5		
	FE	2,8	5,6		
	FS	2,5	5		
	FP				

EC 4065	MN				
	FE				
	FS				
	FP				

PD 1065	MR1	5	9		
PD 2065	MR1	5,8	10,5		
PD 3065	MR1	6	11		
PD 4065	MR1	6,4	11,8		

PDA 2065	MR1	6	11,4	12	6,5
PDA 3065	MR1	7	13,8	14	7,5
PDA 4065	MR1				

090
091

EM 1090	MN	2,2	4,4		
	MR	3	6		
	FE	2,2	4,4		
	FS	2,2	4,4		
FP					

ED 2090	MN	2,2	4,4		
	MR	3,5	7		
	FE	3,2	6,4		
	FS	2,2	4,4		
FP					

EC 2090	MN	5	10		
	MR	6	12		
	FE	5,2	10,4		
	FS	5	10		
FP					

ET 3090	MN	3,3	6,6		
	MR	3,2	6,4		
	FE	3,2	6,4		
	FS	3,3	6,6		
FP					

Type	1	2	3	4
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090
091

EC 3090	MN	5,2	10,4		
	MR	6,2	12,4		
	FE	5,5	11		
	FS	5,2	10,4		
	FP				

EQ 4090	MN	4	8		
	MR	5	10		
	FE	3,8	7,6		
	FS	4	8		
FP					

EC 4090	MN	5,5	11		
	MR	6,5	13		
	FE	5,8	11,6		
	FS	5,5	11		
	FP				

PD 1090	MR1	5,2	9,5		
PD 2090	MR1	6	11		
PD 3090	MR1	6,3	11,6		
PD 4090	MR1	7	13		

PDA 2090	MR1	8,5	14,8	15	8
PDA 3090	MR1	9	15,4	15,5	8,5
PDA 4090	MR1	9,5	16	16	9

150
155

EM 1150	MN	2,5	5		
	MR	4,5	9		
	FE	1,8	3,6		
	FS	2,5	5		
	FP				

ED 2150	MN	3,2	6,4		
	MR	5	10		
	FE	2,5	5		
	FS	3,2	6,4		
FP					

EC 2150	MN	5	10		
	MR	7	14		
	FE	3	12		
	FS	5	10		
FP					

ET 3150	MN	3,5	7		
	MR	5,3	10,6		
	FE	3	6		
	FS	3,5	7		
FP					

EC 3150	MN	4,4	8,8		
	MR	6	12		
	FE	3,7	7,4		
	FS	4,4	8,8		
FP					

EQ 4150	MN	3,7	7,4		
	MR	5,5	11		
	FE	3,5	7		
	FS	3,7	7,4		
FP					

EC 4150	MN	5,5	11		
	MR	6	12		
	FE	3,5	7		
	FS	5,5	11		
FP					

Type	1	2	3	4
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150
155

PD 1150	MR1	5,5	10,2		
PD 2150	MR1	6,3	11,6		
PD 3150	MR1	6,5	12		
PD 4150	MR1	11	13,4		

PDA 2150	MR1	10	15,2	15,5	9
PDA 3150	MR1	9	15,7	16	9
PDA 4150	MR1	9	16,4	16,5	9,5

250
255

EM 1250	MN	3,8	7		
	FE	2,5	5		
	FS	3,8	7		
	FP				

ED 2250	MN	4,5	9		
	FE	3,5	7		
	FS	4,5	9		
	FP				

EC 2250	MN	6,5	13		
	FE	5	10		
	FS	6,5	13		
	FP				

ET 3250	MN	5	10		
	FE	4,5	9		
	FS	5	10		
	FP				

EC 3250	MN	5,7	11,4		
	FE	6	12		
	FS	5,7	11,4		
	FP				

EQ 4250	MN	5,2	10,4		
	FE	4,8	9,6		
	FS	5,2	10,4		
	FP				

EC 4250	MN	7	14		
	FE	5,7	11,4		
	FS	7	14		
	FP				

320

ED 2320	FE	3,5	7		
ET 3320	FE	4,5	9		

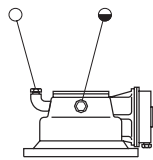
20.POSIZIONI DI MONTAGGIO

20.MOUNTING POSITIONS

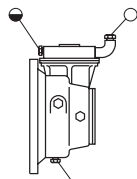
20.EINBAUPOSITION

		Posizione orizzontale / Horizontal position / Waagerechte Stellung Position Horizontale / Posición Horizontal / Posição Horizontal		Posizione verticale / vertical position / Senkrechte Stellung Position Verticale / Posición Vertical / Posição Vertical	
		010-091	150-320	010-091	150-320
INLINE	MN-MR-MN1-MR1				
	FE				
	FS				

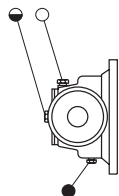
RIGHT ANGLE



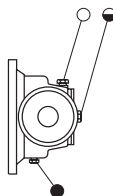
V5B



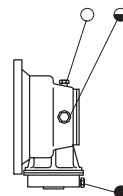
B3D



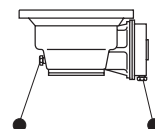
B3C



B3A



B3B



V6B

● Tappo scarico / Drain plug
Bouchon de vidange de l'huile
Ölablasstopfen
Tapón vaciado aceite / Bujão de dreno

● Tappo livello / Oil level plug
Bouchon de niveau de l'huile
Ölstandsstopfen
Tapón nivel aceite / Bujão de nível

○ Tappo carico e sfiato / Breather and filling plug
Bouchon de remplissage de l'huile et reniflard
Öleinfüll- und entlüftungsstopfen
Tapón llenado y presurizado
Bujão de preenchimento e válvula de alívio