MTMC 60 P - 1110

TWIN DISC

TECHNODRIVE

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TMC 60 P

Manuale di Servizio
Service Manual
Manuel d'Utilisation

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MARINE GEAR TMC 60 P
INSTRUCTIONS FOR INSTALLATION, USE AND MAINTENANCE - SPARE PARTS.

INTRODUCTION

- Prior to starting read and follow the instruction provided in this manual. Failure to do so will make warranty void.
- Twin Disc shall not be responsible for any demages caused by faulty installation, wrong handling or deficient maintenance.
- It is the responsibility of users to provide and install guards and safety devices wich may be required by recognized safety standards on the respective country.

GENERAL INFORMATION

- TMC 60 P marine transmission is built with alloy steel, casehardened and hardened gears; the clutch-unit is a bronze double cone and the coupling device is mechanically servo controlled.
- The marine transmission unit may be coupled only to engines which turn anti-clockwise (as seen from the flywheel side).
- In forward speed, the output flange rotating direction is reversed with regard to the engine rotating direction.
- In ratios 2,00 and 2,45 the reverse-gear maintains the same ratio in both directions. In ratios 1,55 and 2,83 the reverse-gear does not have the same reduction in forward and reverse.

INSTALLATION

- The gearbox is supplied without oil. Therefore, prior to its starting, it must be filled up with ATF oil up to the maximum level marked by the dipstick.
- The connection between the engine and the reverse-gear unit must be carried out by means of a proper flexible coupling. Before carrying out the connection, protect the splined shaft by putting a layer of water-repellent grease on it.
- Carefully carry out the fitting between the reverse-gear output shaft and the propeller shaft avoiding misalignments.
- The reverse-gear unit may be installed with a maximum inclination of 15° with respect to the horizontal surface.
- The reverse-gear unit must be shifted by means of a single-lever flexible cable. During the installation of the control cable make sure that the cable neutral position corresponds to that of the reverse-gear unit lever and that the cable allows the reverse-gear control lever to complete the stroke both in forward and in reverse speed. The stroke of the lever between forward speed and reverse speed, must not be less than 60 mm (lever lower hole), 70 mm (upper hole).
- Make sure that the lever forward speed position corresponds to the acual advancement of the hull.

⚠ **Make certain that the control cable is easily movable.**

⚠ **Make sure that the control cable is able to perform the complete lever stroke both in forward and in reverse and that it is well positioned in neutral.**

USE AND MAINTENANCE

- Employ only ATF oil; perform the first replacement after 30 working hours, then replace the oil every 500 working hours but at least once a year.
- Check the oil level weekly by means of the oil dipstick with the engine off.
- During continuous operations oil temperature must not exceed 90° C.
- The shifting from one speed to the other must be performed by pausing in the neutral lever position with the engine running at idle speed. A direct shift from the forward speed to the reverse speed without stopping in the neutral position is allowed only in case of emergency.
- When the boat is sailing (engine stopped), the gear lever must be in neutral position. Never put the gear lever in the position corresponding to the direction of travel of the boat.
- The clutch-unit is self-adjusting and, therefore, needs no adjustment.
- If, after using the reverse-gear unit for a long time, shifting (from forward speed to neutral or from reverse speed to neutral) becomes particularly difficult, it is advisable first to check the status of the control cable and of its relevant box. Then, if necessary, unlock the nut ref. 59 (spanner 13) and mantein the screw ref. 31 in its position with an alien wrench (4 mm.). Than rotate clockwise the screw ref. 31 by a 1/4 of turn and lock the nut ref. 59.
- If one or both clutches slip, it is necessary to check if the control cable runs the whole stroke needed to couple the reverse-gear unit (minimum 30 mm on each side in the lower hole and 35 mm on each side in the upper hole of the control ever). It is also critical that the neutral position of the reverse-gear unit must correspond to the neutral position of the control cable. If the problem persists, it is necessary to disassemble the reverse-gear unit in order to check the status of clutch ref. 24. If the clutch shows signs of wear or burns on its cone-shaped surfaces or on the groove, it must be replaced. The cone-shaped surface on gears ref. 26 and 25 must also be checked; such surface must show no marks of burning or seizure end no material deposits coming from the clutch cone otherwise the gears must be replaced. In the case the clutch-unit alone is replaced, it is not necessary to disassemble adjusting shims ref. 5 and, therefore, bearings need not to be adjusted during assembly.

⚠ **The gearbox is supplied without oil. Before the first start-up it must be filled up to the maximum level marked on the dipstick. Use ATF oil.**

⚠ **Before to start the engine make sure that the gearbox is in neutral position.**

⚠ **The gearbox should only be shifted with the engine at idle speed so as to avoid that the gearbox or the coupling may be demaged.**

⚠ **Disassembly and assembly of the gearbox or of its parts is to be made by specialized technicians only.**

COOLING SYSTEM

- In heavy-duty conditions and especially when the reverse speed is regularly used as forward speed, it is advisable to use the reverse-gear unit cooling system (see Pag. 14). The approximate continuos power values above which the employment of the cooling system is advisable are:

  Forward speed: 40 KW
  Reverse speed: 30 KW

  The cooling water for the reverse-gear unit must be taken from the engine cooling system, after the pump and put back into the system before the engine exchanger. The diameter of the reverse-gear hose fittings is 20 mm (16 mm or 25 mm upon request). The cooling system is installed upon request directly in our factory; however, even reverse-gear units with no cooling systems are arranged for their installation wich must be carried out as follows: position “0” rings ref. 3 on fittings ref. 2. Fasten hose fittings ref. 1 on hose fittings ref. 2. Insert copper pipe ref. 4 into one of the fittings. Upon removing the oil from the reverse-gear unit, unscrew the two caps located on the lower part of the reverse-gear unit cover. Insert the copper pipe and tighten the fittings on the reverse-gear. All threaded connections must be assembled by means of Loctite type 542 or equivalent material.

⚠ **Disassembly and assembly of the gearbox or of its parts is to be made by specialized technicians only.**

GEARBOX DISASSEMBLY

⚠ **Disassembly and assembly of the gearbox or of its parts is to be made by specialized technicians only.**

In order to completely disassemble the reverse-gear unit, operate as follows:

- Remove the reverse-gear control unit by unscrewing M8 two nuts ref. 57 and extracting the whole unit (control lever ref. 17, cover ref. 2, shaft ref. 10, guide shoe ref. 23, screw ref. 31) carefully avoiding to drop guide shoe ref. 23 into the reverse-gear unit as it has no axial lock.
- Remove output flange ref. 28 from the reverse-gear unit by unscrewing nut ref. 18 and by extracting the flange from the shaft spline.
- Loosen fastening screws ref. 51, 52, 53 located between the box and the cover and, while holding the reverse-gear unit in a vertical position, gently, beat the head of output shaft ref. 12 with a copper hammer in order to separate the box from the cover.
- While the reverse-gear unit is open, remove input shaft ref. 13 together with bearing cones ref. 56 and the whole output shaft. Loosen screw ref. 58 which fastens the intermediate shaft to the reverse-gear cover and remove the whole intermediate shaft.
- In order to disassemble the clutch cone from the output shaft, extract all parts according to the following sequence: bearing ref. 56 located on the flange side, spacer ref. 7, gear ref. 26, pin housing cage ref. 40, bush ref. 32 spacer ref. 6 and clutch cone ref. 24.
- In order to complete the disassembly of the output shaft remove nut ref. 19 and extract, in the following order, bearing ref. 56, spacer ref. 7, gear ref. 25, pin housing cage ref. 40, bush ref. 32 and spacer ref. 6.
- Spacers ref. 5 are located between cover ref. 3 and bearing ref. 56; therefore, in order to remove them it is necessary to remove the cups of the taper roller bearings from their seats.
- Disassembly of intermediate gear ref. 27: straighten lock washer ref. 41 and unscrew ring nut ref. 30, extract gear ref. 27 towards the splined side of shaft ref. 11. Together with the gear also one of bearings ref. 55, distance ring ref. 4 and stop ring ref. 35 and the cup of the other bearing ref. 55 will come out.

GEARBOX REASSEMBLY

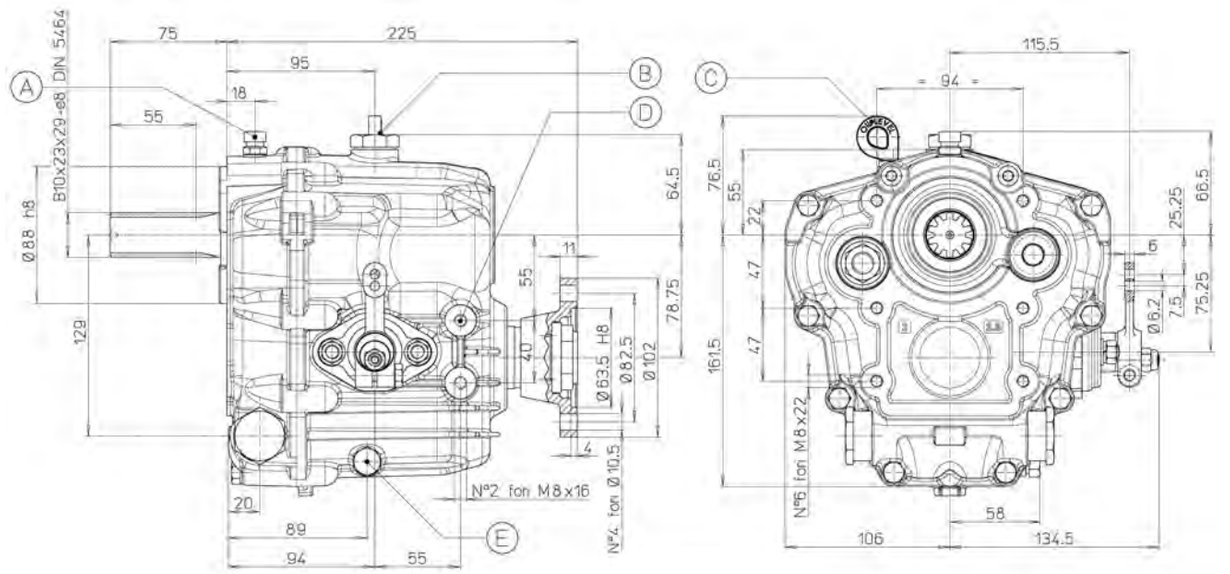
⚠ **Disassembly and assembly of the gearbox or of its parts is to be made by specialized technicians only.**

- *Output shaft unit assembly:* orderly assemble, starting from the end opposite the output flange, spacer ref. 6, bush ref. 32, cage ref. 40, gear ref. 25, spacer ref. 7, bearing cone ref. 56, nut ref. 19 (torque wrench setting 155 Nm). Tighten the stop nut in the appropriate place on the shaft. Insert clutch unit ref. 24 and moving toward the output flange end, assemble, in sequence, the following parts: ref. 6, 32, 40, 26, 7, 56.
- *Intermediate shaft unit assembly:* upon positioning stop ring ref. 35 and distance ring ref. 4 assemble the cups of the two bearings ref. 55 on gear ref. 27. Assemble the bearing cone on shaft ref. 11 making it close on the shoulder. Insert the gear on the shaft and assemble the last cone. Assemble lock washer ref. 41 and ring nut ref. 30 fastening the ring nut very tightly in order to move bearings ref. 55 to the correct position; loosen the ring nut until the gear can rotate smoothly, which corresponds to an adjustment leaving zero play of the bearing, and lock the ring nut into place by means

of the lock washer.

- *Input shaft unit assembly:* the gears are enbloc with the shaft; therefore it is necessary only to assemble the cones of bearings ref. 56.
- *Shafts assembly on cover:* place cover ref. 3 on a horizontal surface with the bearing seat upward and an opening which allows the protuding part of shaft ref. 13 and the spigot 88 mm to go through.
  Place bearing cups ref. 56 in the relevant cover seets. Insert both input and output shafts, which have been previously assembled, in the relevant positions. Insert pins ref. 50. Assemble the cups of bearings ref. 56 on box ref. 1. Close box ref. 1 using only three screws to fasten the box to its cover. Insert flange ref. 28 on the output shaft and lock it into place by means of nut ref. 18 (torque wrench setting 155 Nm). By means of a comparator measure the play end of both input and output shafts. Bearings will have to be shimmed using as many shims as required in order to build a preloading of 0,03 ± 0,02 mm. Shims must be inserted between the bearing cone and the reverse-gear cover seat; therefore, it is necessary to disassemble once again the output flange, the box, the shafts and the bearing cups located on the cover.
  Upon positioning all required shims, assemble the bearing cups on the box again, fasten the previously assembled intermediate shaft ref. 11 to cover ref. 3 by means of screw ref. 58 and of washer ref. 45, 47. Put sealing paste between the cover plate ref. 3 and the shaft ref. 11.
- Position the input and output shafts and close with box ref. 1 by inserting sealing paste into the connecting surface between the box and the cover and by tightening screws ref. 51, 52, 53.
  Assemble oil seals ref. 37 and 38. Insert flange ref. 28 on the output shaft spline, insert sealing paste and tighten the lock nut ref. 18 by a 155 Nm torque wrench setting and lock it.
- *Control unit assembly:* upon positioning spring ref. 9 on the stem of guide shoe ref. 23, insert it into the hole of drive shaft ref. 10. Guide shoe ref. 23 must be positioned with its beveled side upward (behind the v-shaped surface touching the clutch-unit). Insert the complete control unit (cover ref. 2, shaft ref. 10, spring ref. 9, guide shoe ref. 23) into the reverse-gear unit box making sure to maintain the guide shoe position described above and to avoid dropping the guide into the casing. Fasten both bolts ref. 57 and assemble control level ref. 17 fastening it by means of screw ref. 51.
- *Clutch control unit adjustment:* with the operating lever ref. 17 in neutral position, turn by hand the output flange ref. 28 and, at the same time, screw the adjusting screw ref. 31 with an alien wrench (4 mm) until the output flange rotation gets hard on a small arc only. Unscrew of 3/4 of turn the adjusting screw and fix it by locking the nut ref. 59.

TMC 60 P - Dimensioni - Dimensions - Dimensions



(A) - Sfiato - Oil breather plug - Reniflard
(B) - Tappo carico olio - Filling plug - Bouchon de remplissage
(C) - Asta livello olio - Oil dipstick - Bouchon de niveau
(D) - Fori per staffa telecomando - Holes for control cables bracket - Trous pour bride télécommande
(E) - Tappo scarico olio - Oil drain plug - Bouchon de vidange

Caratteristiche tecniche - Technical data - Caracteristiques tecniques

RAPP. - RATIO - RAPP.		POTENZA MAX MOTORE - INPUT RATINGS - PUISSANCE MAXI MOTEUR KW					
M.AVANTI FORWARD M. AVANT	RETROM. REVERSE M. ARRIERE	DIPORTO - PLEASURE - PLAISANCE		INTERMEDIO-INTERMEDIATE-INTERMEDIAIRE		CONTINUO - CONTINUOUS - CONTINU	
		3000 RPM	3600 RPM	2800 RPM	3000 RPM	1800 RPM	2300 RPM
1,55	2,00	53	60	42	45	23	29
2,00	2,00	47	57	37	40	21	26
2,45	2,45	38	45	32	35	17	22
2,83	2,45	31	38	25	27	14	18

Valocità massima motore - Max engine speed - Vitesse maxi moteur: 5000 Rpm
Potenza massima motore - Max engine power - Puissance maxi moteur: 44 Kw
La potenza in retromarcia è limitata come segue:
TMC 60 P rapp. 1,55: 80% della potenza del motore in rapporto 2,00
rapp. 2,00 e 2,45: 80% della potenza del motore
rapp. 2,83: 80% della potenza del motore in rapporto 2,45
The reverse capacity is limited as follow:
TMC 60 P ratio 1,55: 80% of ratio 2,00 listed ratings
ratio 2,00 e 2,45: 80% of listed ratings
ratio 2,83: 80% of ratio 2,45 listed ratings

La puissance du moteur en marche-arriere est limite comme suit:
TMC 60 P rapp. 1,55: 80% de la puissance du moteur en rapport 2,00
rapp. 2,00 e 2,45: 80% de la puissance du moteur
rapp. 2,83: 80% de la puissance du moteur en rapport 2,45
Peso a secco - Weight without oil - Poids à vide: 14 Kg
Quantità olio - Oil quantity - Quantité d'huile: 0,65 L.
Tipo di olio - Oil type - Type d'huile: ATF
Per la definizione dei tipi di servizio vedere "Tabelle di Potenza"
Duty classification definition: see "Marine Transmissions Capacity Table"
Definition du type de service: voire "Tableau des puissances"

RICAMBI

Per ordinare i ricambi specificare il tipo di invertitore, il numero di serie, il rapporto, il numero di riferimento del disegno, la quantità.

SPARE PARTS

When ordering spare parts specify the gearbox model, the serial number, ratio, reference number indicated on the drawing and desired quantity.

PIÈCES D'ETACHÉES

Pour la commande de pièces d'étachées, veuillez spécifier le type de l'inverseur, le numéro de série, le rapport, le numéro de rep. du plan ainsi que la quantité.

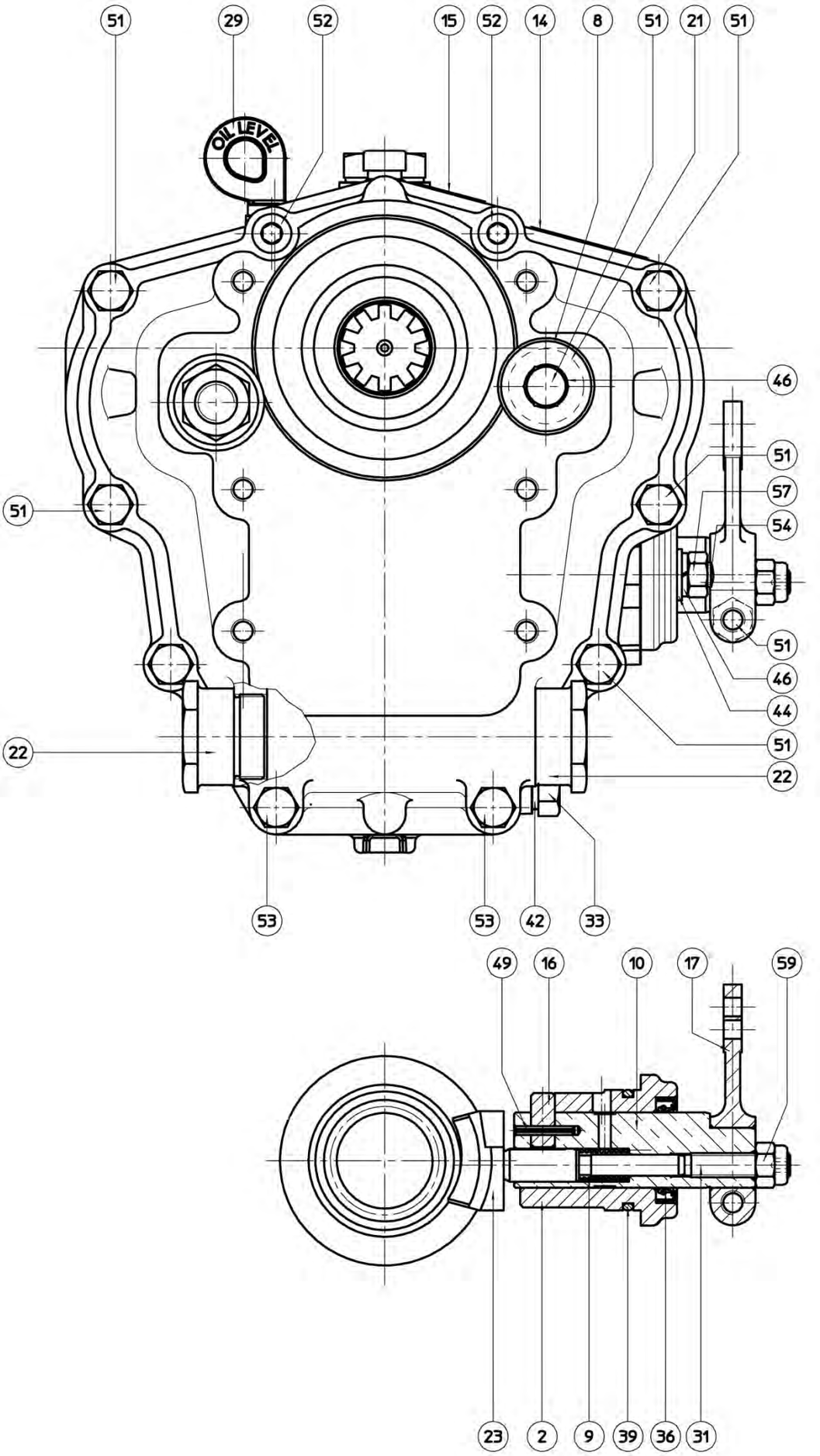
ERSATZTEILE

Zum Bestellen von Ersatzteilen den Typ des Wendegetriebes, die Fabriknummer, die Untersetzung, die Bezugsnummer der Zeichnung und die Menge angeben.

REPUESTOS

Para pedir los repuestos hay que especificar el tipo de inversor, el nùmero de serie, la relaciòn (ratio), el nùmero de referencia del dibujo y la cantidad.

Rif. Ref	Denominazione Denomination		Quantità Quantity	Codice Code	Rif. Ref	Denominazione Denomination	Quantità Quantity	Codice Code
1	Scatola - Housing		1	2009165	27	Ingranaggio rinvio - Gear	1	2061709
2	Coperchio laterale - Cover		1	2010251	28	Flangia di uscita - Output flange	1	2062191
3	Coperchio - Cover		1	2010261	29	Asta livello olio - Gauge	1	2071024
4	Spessore di registro - Shim		2	2013145	30	Ghiera - Nut	1	4579025
5	Spessore di registro - Shim		6	2013192	31	Vite - Screw	1	4581013
6	Distanziale interno - Spacer		2	2013285	32	Anello interno - Cage	2	4584023
7	Distanziale esterno - Spacer		2	2013509	33	Tappo - Plug	1	4588030
8	Rosetta di fermo - Washer		1	2014004	34	Tappo - Plug	1	4588040
9	Molla - Spring		1	2020068	35	Anello di fermo - Seeger	1	4591013
10	Albero di comando - Shaft		1	2021390	36	Anello di tenuta - Oil seal	1	4595083
11	Albero di rinvio - Intermediate shaft		1	2021470	37	Anello di tenuta - Oil seal	1	4595103
12	Albero secondario - Output shaft		1	2021473	38	Anello di tenuta - Oil seal	1	4595133
13	Albero primario - Shaft	R 1,55	1	2021609	39	Guarnizione or - 'O' ring	1	4598135
		R 2,00	1	2021610	40	Gabbia a rullini - Bearing	2	4604015
		R 2,45	1	2021611	41	Rosetta - Washer	1	4608025
		R 2,83	1	2021612	42	Rosetta - Washer	2	4609011
14	Targhetta - Name plate		1	2028008	43	Rosetta - Washer	1	4609021
15	Targhetta olio - Oil plate		1	2028012	44	Rosetta - Washer	2	4610008
16	Perno forato - Pin		1	2035054	45	Rosetta - Washer	1	4610014
17	Leva di comando - Lever		1	2037036	46	Rosetta elastica - Washer	3	4611108
18	Dado di fissaggio - Nut		1	2038024	47	Rosetta elastica - Washer	1	4611114
19	Dado fissaggio - Nut		1	2038025	48	Rosetta ondulata - Washer	10	4611208
20	Tappo di sfiato - Breather		1	2055032	49	Spina - Dowel pin	1	4613034
21	Tappo chiusura rinvio - Plug		1	2055042	50	Spina - Dowel pin	2	4614006
22	Tappo chiusura presa - Plug		2	2055044	51	Vite - Screw	8	4615214
23	Pattino di comando - Pad		1	2056091	52	Vite - Screw	2	4615215
24	Corpo frizione - Clutch		1	2056128	53	Vite - Screw	2	4615232
25	Ingranaggio - Gear	R 1,55	1	2061704	54	Prigioniero - Screw stud	2	4617067
		R 2,00	1	2061704	55	Cuscinetto - Bearing	2	4622015
		R 2,45	1	2061708	56	Cuscinetto - Bearing	4	4622036
		R 2,83	1	2061708	57	Dado - Nut	2	4632008
26	Ingranaggio - Gear	R 1,55	1	2061704	58	Dado - Nut	1	4632019
		R 2,00	1	2061705	59	Dado autobloccante - Nut	1	4634008
		R 2,45	1	2061706				
		R 2,83	1	2061707				


OIL LEVEL
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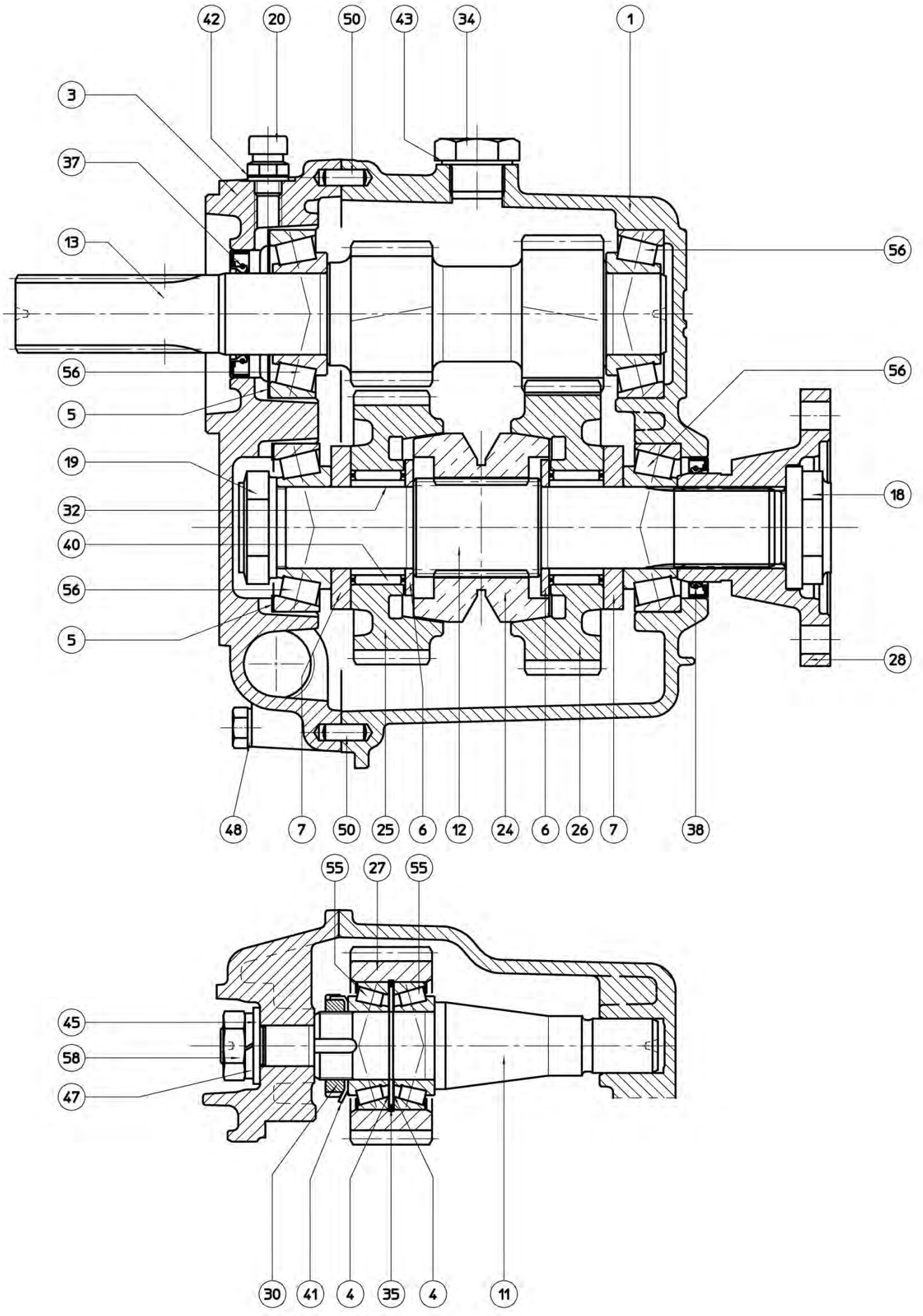
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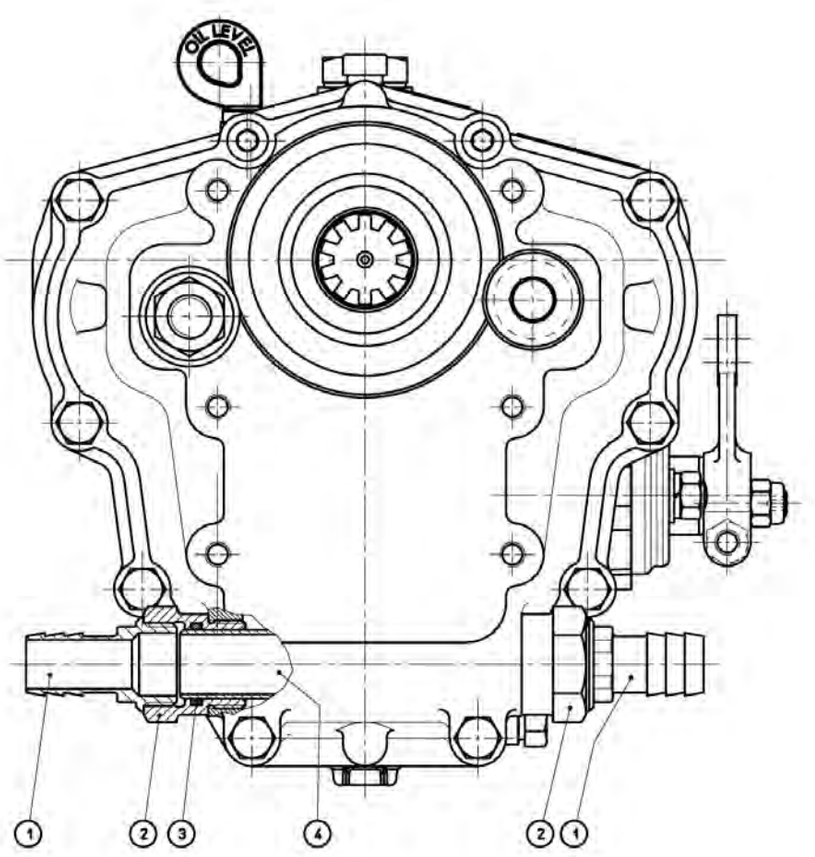
IMPIANTO DI RAFFREDDAMENTO
COOLING SYSTEM
SYSTEME DE REFROIDISSEMENT



Rif. Ref.	Denominazione Denomination	Quantità Quantity	Codice Code
1	Raccordo Ø 20 - Hose fitting Ø 20	2	2048020
	Raccordo Ø 16 - Hose fitting Ø 16	2	2048019
	Raccordo Ø 25 - Hose fitting Ø 25	2	2048021
2	Raccordo	2	2048018
3	OR - "O" Ring	1	4598139
4	Tubo - Pipe	1	2042054