

CTM 192



TMC 60

INVERTITORI MARINI
MARINE REVERSE-GEAR UNIT
INVERSEURS MARINS

TECHNODRIVE MARINE REVERSE-GEAR UNIT TYPE TMC 60

INSTRUCTIONS FOR INSTALLATION, USE AND MAINTENANCE - SPARE PARTS.

GENERAL INFORMATION

- The reverse-gear unit type TMC 60 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 reverse-gear unit may be coupled only to engines which turn in clockwise direction (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 and 2.5, the reverse-gear unit can transmit the full power both in forward speed and in reverse speed and maintains the same ratio in both directions. In ratios 1.52 and 2.94 the reverse-gear unit can transmit the full power only in forward speed and the reverse speed does not have the same reduction ratio as the forward speed.

INSTALLATION

- The reverse-gear unit is supplied without oil. Therefore, prior to its starting, it must be filled up with oil type *SAE 30* 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 axle.
- The reverse-gear unit may be installed with a maximum inclination of 15° with respect to the horizontal surface.
- The reverse-gear unit coupling must be achieved 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 corresponds to the actual advancement of the hull.

USE AND MAINTENANCE

- Employ only oil type *SAE 30*; perform the first replacement after 30 working hours then replace the oil after every 500 working hours, or every 6 months at the most.
- Check the oil level weekly by means of the appropriate dipstick while the engine is off.
- When the reverse-gear unit is used continuously, oil temperature must not exceed 105° C.
- The shifting from one speed to the other must be performed by stopping shortly in the neutral position while the engine is running at minimum speed. A direct shifting from the forward speed to the reverse speed without stopping in the neutral position, is allowed only in case of emergency.
- 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 and then to remove a shim ref. 29 from screw ref. 31 which is located on the reverse-gear drive shaft.
- 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 lever) and if the neutral position of the reverse-gear unit corresponds to that 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-unit ref. 39. If the clutch unit 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. 38 and 40 must also be checked; such surface must show no marks of burning or seizure and no material deposits coming from the clutch cone otherwise the gears must be replaced. If the clutch-unit is replaced, its cone-shaped surfaces must be adjusted into their relevant gear conical seats by rubbing them with a fine grain abrasive paste. In the case the clutch-unit alone is replaced, it is not necessary to disassemble adjusting shims ref. 58 and, therefore, bearings need not to be adjusted during assembly.

COOLING SYSTEM

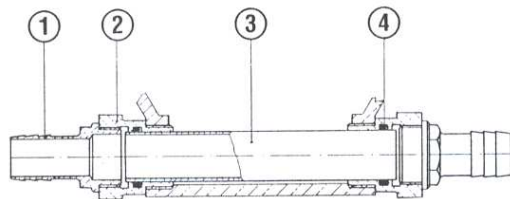
In heavy-duty conditions and especially when the reverse speed is regularly used as forward speed, it is advisable to use the reverse-gear unit cooling system (see fig. 1). The approximate continuous power values above which the employment of the cooling system is advisable are:

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 which must be carried out as follows: position "O" rings ref.

4 on fittings ref. 2. Fasten hose fittings ref. 1 on hose fittings ref. 2. Insert copper pipe ref. 3 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 unit. All threaded connections must be assembled by means of Loctide type 542 or equivalent material.



REVERSE-GEAR UNIT DISASSEMBLY

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

- Remove the reverse-gear control unit by unscrewing M8 two nuts ref. 22 and extracting the whole unit (control lever ref. 26, cover ref. 9, shaft ref. 20, guide shoe ref. 16, screw ref. 31, shims ref. 29) carefully avoiding to drop guide shoe ref. 26 into the reverse-gear unit as it has no axial lock.
- Remove output flange ref. 32 from the reverse-gear unit by unscrewing nut ref. 30 and by extracting the flange from the shaft spline.
- Loosen fastening screws ref. 51, 52, 54 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. 56 with a copper hammer in order to separate the box from the cover.
- While the reverse-gear unit is open, remove input shaft ref. 28 together with bearing cones ref. 3 and the whole output shaft. Loosen screw ref. 49 which fastens the transmission shaft to the reverse-gear cover and remove the whole transmission shaft.
- In order to disassemble the clutch cone from the output shaft, extract all parts according to the following sequence: bearing ref. 34 located on the flange side, spacer ref. 35, gear ref. 38, pin housing cage ref. 37, bush ref. 36, spacer ref. 8 and clutch cone ref. 39.
- In order to complete the disassembly of the output shaft remove nut ref. 55 and extract, in the following order, bearing ref. 34, spacer ref. 35, gear ref. 40, pin housing cage ref. 27, bush ref. 36 and spacer ref. 8.
- Spacers ref. 58 are located between cover ref. 57 and bearing ref. 3 and ref. 34; therefore, in order to remove them it is necessary to remove the cups of the taper roller bearings from their seats.
- Disassembly of transmission gear ref. 43: straighten lock washer ref. 46 and unscrew ring nut ref. 47, extract gear ref. 43 towards the splined side of shaft ref. 41. together with the gear also one of bearings ref. 45, distance ring ref. 42 and stop ring ref. 44 and the cup of the other bearing will come out.

REVERSE-GEAR UNIT REASSEMBLY

- **Output shaft unit assembly:** orderly assemble, starting from the end opposite the output flange, spacer ref. 8, bush ref. 37, housing ref. 36, gear ref. 40, spacer ref. 35, bearing cone ref. 34, nut ref. 55 (torque wrench setting 16 kgm). Tighten the stop nut in the appropriate place on the shaft. Insert clutch unit ref. 39 and moving toward the output flange end, assemble, in sequence, the following parts: ref. 8, 36, 37, 38, 35, 34.
- **Transmission shaft unit assembly:** upon positioning stop ring ref. 44 and distance ring ref. 42, assemble the cups of the two bearings ref. 45 on gear ref. 43. Assemble the bearing cone on shaft ref. 41 making it close on the shoulder. Insert the gear on the shaft and assemble the last cone. Assemble lock washer ref. 46 and ring nut ref. 47 fastening the ring nut very tightly in order to move bearings ref. 45 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. 3.
- **Shaft assembly on cover:** place cover ref. 57 on a horizontal surface with the bearing seat upward and an opening which allows the protruding part of shaft ref. 28 and the spigot 88 to go through. Place bearing cups ref. 3 and 34 in the relevant cover seats. Insert both input and output shafts, which have been previously assembled, in the relevant positions. Insert pins ref. 4. Assemble the cups of bearings ref. 3 and 35 on box ref. 7. Close box ref. 7 using only 3 screws

to fasten the box to its cover. Insert flange ref. 32 on the output shaft and lock it into place by means of screw ref. 30 (torque wrench setting 16 kgm). By means of a comparator measure the 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 0.05 ± 0.02 . 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 transmission shaft ref. 41 to cover ref. 57 by means of screw ref. 49 and of washer ref. 50.

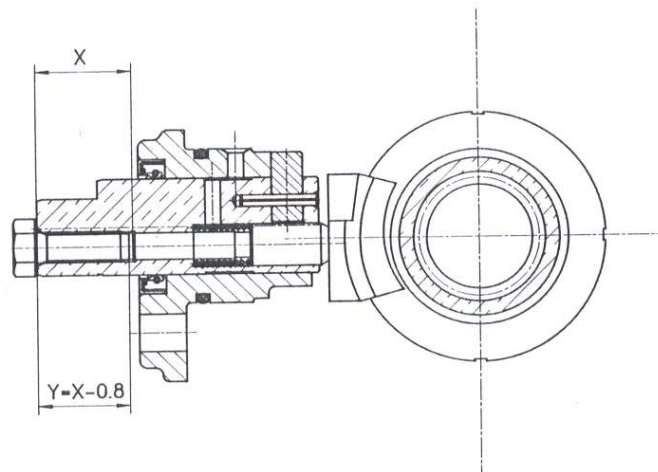
- Position the input and output shafts and close with box ref. 7 by inserting sealing paste into the connecting surface between the box and the cover and by tightening screws ref. 54. Assemble oil seals ref. 33, 27, 59. Insert flange ref. 32 on the output shaft spline, tighten the lock nut ref. 30 by a 16 kgm torque wrench setting.

- **Transmission unit:** upon positioning spring ref. 11 on the stem of guide shoe ref. 16, insert it into the hole of drive shaft ref. 20. Guide shoe ref. 16 must be positioned with its beveled side upward (behind the v-shaped surface touching the clutch-unit). Insert the complete transmission unit (cover ref. 9, shaft ref. 20, spring ref. 11, guide shoe ref. 16) 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. 22 and assemble control lever ref. 26 fastening it by means of screw ref. 24.

- **Clutch control unit adjustment:** by means of lever ref. 26 find the neutral position; manually rotate output flange ref. 32. Due to the eccentricity of the clutch control unit groove ref. 39, this rotation causes an axial shift of guide shoe ref. 16. Therefore, the distance X between the stem end of guide shoe ref. 16 and the plane of transmission shaft ref. 20, changes from a maximum to a minimum size. It is therefore necessary to easure the minimum value of X by means of a depth gauge. Then measure the height of screw ref. 31, from the plane end to the head and add shims ref. 29 until a Y size value, equal to the X minimum value previously recorded minus 0.8 mm, is reached:

$$Y = X - 0.8$$

Tighten screw ref. 31 on drive shaft ref. 20 using as many shims ref. 29 as needed.



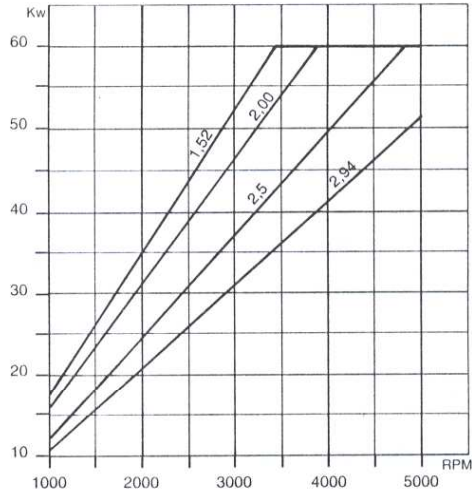
SPARE PARTS

To place an order for spare parts, clearly state the position number of the detail on the drawing together with the type of reverse gear, the ratio and the part number written on the data plate.

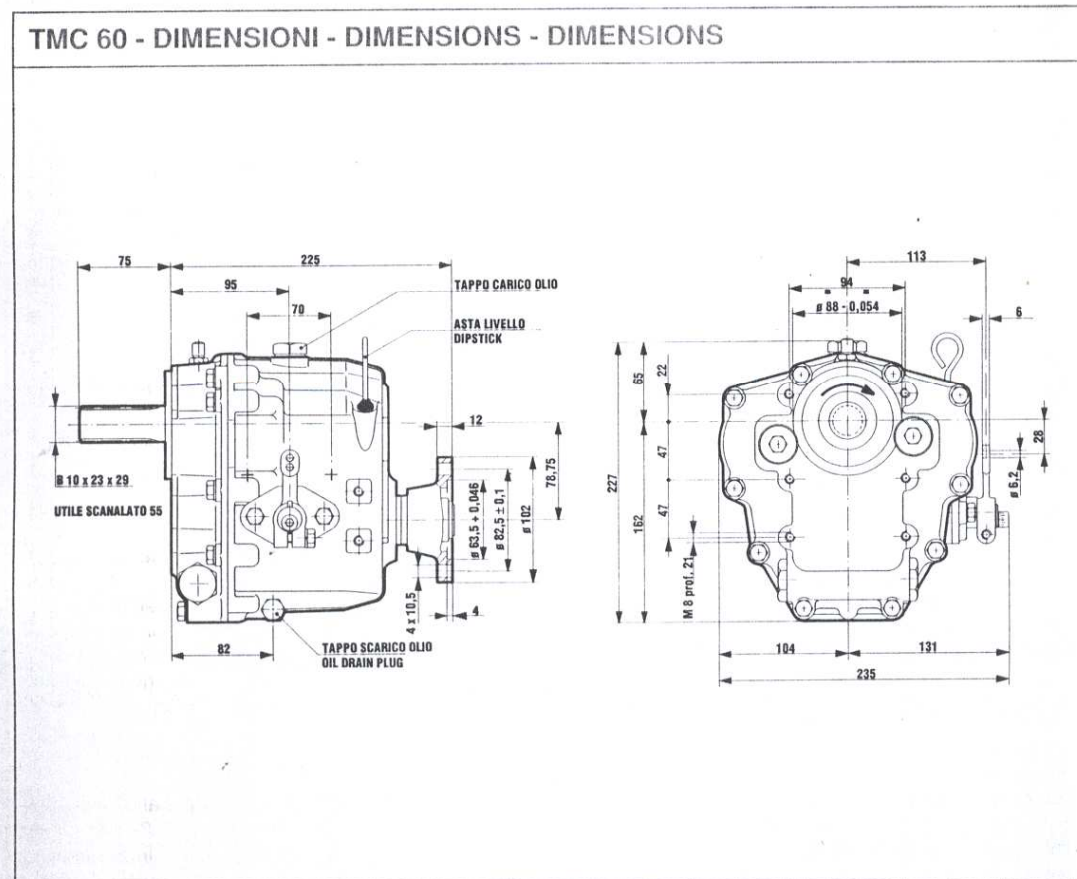
Caratteristiche tecniche
Technical data
Caractéristique techniques

Rapporto marcia avanti - Forward ratio - Rapport marche avant	1,52	2,00	2,50	2,94	
Rapporto retromarcia - Reverse ratio - Rapport marche arrière	2,00	2,00	2,50	2,50	
Coppia max en entrée Max input torque Nm	Diporto-Pleasure Plaisance	170	150	120	100
Couple max. en entrée Lavoro-Commercial Travail		120	110	90	75
Potenza max entrata Max input power	Diporto-Pleasure Plaisance	60 Kw			
Puissance max en entrée Lavoro-Commercial Travail		45 Kw			
Velocità max entrata Max input speed Vitesse max. en entrée		5000 RPM			
Peso a secco - Weight without oil - Poids à vide		14 Kg			
Quantità olio - Oil quantity - Quantité huile		0,8 l			
Tipo olio - Oil type - Type huile		SAE 20/30			

Diagramma di potenza (diporto)
Power curve (pleasure)
Diagramme de puissance (plaisance)



TMC 60 - DIMENSIONI - DIMENSIONS - DIMENSIONS



Rif. Esploso	Codice	Denominazione	Q.tà	Rif. Esploso	Codice	Denominazione	Q.tà
1	T.4.609.011	Rondella	1	32	T.2.062.191	Flangia	1
2	T.2.055.032	Tappo di sfiato	1	33	T.4.595.133	Anello di tenuta	1
3	T.4.622.036	Cuscinetto	2	34	T.4.622.036	Cuscinetto	2
4	T.4.614.006	Spina	2	35	T.2.013.509	Distanziale	2
5	T.4.588.040	Tappo	1	36	T.4.584.023	Anello interno	2
6	T.4.609.021	Rondella	1	37	T.4.604.015	Gabbia a rullini	2
7	T.2.009.080	Scatola	1	38	T.2.061.534	Ingranaggio rapp. 1:1,52	1
8	T.2.013.285	Rasamento	2	38	T.2.061.535	Ingranaggio rapp. 1:2	1
9	T.2.010.251	Coperchio laterale	1	38	T.2.061.536	Ingranaggio rapp. 1:2,5	1
10	T.4.598.135	Guarnizione	1	38	T.2.061.537	Ingranaggio rapp. 1:2,94	1
11	T.2.020.068	Molla	1	39	T.2.056.092	Frizione	1
12	T.2.070.050	Asta livello	1	40	T.2.061.534	Ingranaggio rapp. 1:1,52/1:2	1
13	T.2.055.042	Tappo	1	40	T.2.061.533	Ingranaggio rapp. 1:2,5/1:2,94	1
14	T.2.035.054	Perno forato	1	41	T.2.021.388	Albero rinvio	1
15	T.4.613.034	Spina elastica	1	42	T.2.013.145	Distanziale	2
16	T.2.056.091	Patino	1	43	T.2.061.545	Ingranaggio folle marcia ind.	1
17	T.2.055.044	Tappo	2	44	T.4.591.013	Anello di fermo	1
18	T.4.609.011	Rondella piana	1	45	T.4.622.015	Cuscinetto	2
19	T.4.588.030	Tappo	1	46	T.4.608.025	Rosetta di sicurezza	1
20	T.2.021.390	Albero di comando	1	47	T.4.579.025	Ghiera	1
21	T.4.610.008	Rosetta piana	2	48	T.4.611.108	Rosetta elastica	4
22	T.4.632.008	Dado	2	49	T.4.615.214	Vite	2
23	T.4.617.067	Prigioniero	2	50	T.2.014.004	Rosetta di fermo	2
24	T.4.615.214	Vite	1	51	T.4.615.214	Vite	4
25	T.4.595.083	Anello di tenuta	1	52	T.4.615.215	Vite	4
26	T.2.037.036	Leva	1	53	T.4.611.208	Rosetta ondulata	10
27	T.4.595.103	Anello di tenuta	1	54	T.4.615.232	Vite	2
28	T.2.021.384	Albero rapp. 1:1,52	1	55	T.2.038.025	Dado fissaggio frizione	1
28	T.2.021.385	Albero rapp. 1:2	1	56	T.2.021.389	Albero secondario	1
28	T.2.021.386	Albero rapp. 1:2,5	1	57	T.2.010.261	Coperchio	1
28	T.2.021.387	Albero rapp. 1:2,94	1	58	T.2.013.192	Spessore registro	3
29	T.2.014.085	Rosetta di registro	3	59	T.4.595.103	Anello di tenuta	1
30	T.2.038.024	Dado fissaggio flangia	1	60	T.2.013.192	Spessore registro	1
31	T.4.615.214	Vite	1				

