



Velvet Drive Marine Transmission Reduction Gear Service Manual 1.9:1 Ratio



Wardax Gear

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PRICE \$4.99

Velvet Drive Marine Transmission Reduction Gear Service Manual 19:1 Ratio



Build Your Own 19:1 Gear

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This Service Manual for the 19:1 Reduction Gear is prepared and illustrated for use in conjunction with the

garretts 90, 100 and 120 Series Outboard Engines. It also contains supplementary information and data

relative which allow it to be used for servicing of the entire outboard installation.

Warner Gear



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19:1-19:1

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Exploded view diagram of a 1000 cc engine. The diagram shows the following components labeled with numbers:

- 1. Spark plug
- 2. Piston pin
- 3. Piston pin clip
- 4. Piston pin clip
- 5. Piston pin clip
- 6. Piston pin clip
- 7. Piston pin clip
- 8. Piston pin clip
- 9. Piston pin clip
- 10. Piston pin clip
- 11. Piston pin clip
- 12. Piston pin clip
- 13. Piston pin clip
- 14. Piston pin clip
- 15. Piston pin clip

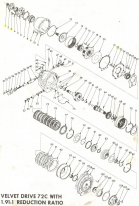
For 1.00–1.000 reduction range, the system is composed with any of the following models: 10, 100, 200, 2000, 51, 101, 102, 1000, 1010, 1020, 1001 and 1002. The reduction principle goes as follows: the input uncertainty is $\pm 1000 \times 10^{-6} \pm 100$ ppm, the output uncertainty depends on input value, when reduced is obtained as $\pm 1.00 \times 10^{-6}$ reduction ppm.

Country	Region	Year	Population (millions)		GDP (billion USD)		GDP per capita (USD)		GDP growth (%)
			2010	2015	2010	2015	2010	2015	
China	East Asia	2010	1,370	1,370	5,878	5,878	4,289	4,289	9.2
China	East Asia	2015	1,375	1,375	7,400	7,400	5,381	5,381	9.2
China	East Asia	2020	1,380	1,380	9,000	9,000	6,521	6,521	9.2
China	East Asia	2025	1,385	1,385	10,600	10,600	7,654	7,654	9.2
China	East Asia	2030	1,390	1,390	12,200	12,200	8,787	8,787	9.2
China	East Asia	2035	1,395	1,395	13,800	13,800	9,920	9,920	9.2
China	East Asia	2040	1,400	1,400	15,400	15,400	11,053	11,053	9.2
China	East Asia	2045	1,405	1,405	17,000	17,000	12,186	12,186	9.2
China	East Asia	2050	1,410	1,410	18,600	18,600	13,319	13,319	9.2

- (1) **Input and output shaft rotation is described as clockwise (CW) or counter clockwise (CCW) when the observer is seated at the control console looking along the axis from a forward or aft position.**

Any following are the identification number for the above case: 2002-08-01-0000079. Please acknowledge.





VELVET DRIVE 73C WITH
1.9:1 REDUCTION RATIO

W

Item #	Part #	Description	Qty	Unit Price	Total Price	Comments	Lot #
1	000000	000000	1	\$0.00	\$0.00	000000	000000
2	000000	000000	1	\$0.00	\$0.00	000000	000000
3	000000	000000	1	\$0.00	\$0.00	000000	000000
4	000000	000000	1	\$0.00	\$0.00	000000	000000
5	000000	000000	1	\$0.00	\$0.00	000000	000000
6	000000	000000	1	\$0.00	\$0.00	000000	000000
7	000000	000000	1	\$0.00	\$0.00	000000	000000
8	000000	000000	1	\$0.00	\$0.00	000000	000000
9	000000	000000	1	\$0.00	\$0.00	000000	000000
10	000000	000000	1	\$0.00	\$0.00	000000	000000
11	000000	000000	1	\$0.00	\$0.00	000000	000000
12	000000	000000	1	\$0.00	\$0.00	000000	000000
13	000000	000000	1	\$0.00	\$0.00	000000	000000
14	000000	000000	1	\$0.00	\$0.00	000000	000000
15	000000	000000	1	\$0.00	\$0.00	000000	000000
16	000000	000000	1	\$0.00	\$0.00	000000	000000
17	000000	000000	1	\$0.00	\$0.00	000000	000000
18	000000	000000	1	\$0.00	\$0.00	000000	000000
19	000000	000000	1	\$0.00	\$0.00	000000	000000
20	000000	000000	1	\$0.00	\$0.00	000000	000000
21	000000	000000	1	\$0.00	\$0.00	000000	000000
22	000000	000000	1	\$0.00	\$0.00	000000	000000
23	000000	000000	1	\$0.00	\$0.00	000000	000000
24	000000	000000	1	\$0.00	\$0.00	000000	000000
25	000000	000000	1	\$0.00	\$0.00	000000	000000
26	000000	000000	1	\$0.00	\$0.00	000000	000000
27	000000	000000	1	\$0.00	\$0.00	000000	000000
28	000000	000000	1	\$0.00	\$0.00	000000	000000
29	000000	000000	1	\$0.00	\$0.00	000000	000000
30	000000	000000	1	\$0.00	\$0.00	000000	000000
31	000000	000000	1	\$0.00	\$0.00	000000	000000
32	000000	000000	1	\$0.00	\$0.00	000000	000000
33	000000	000000	1	\$0.00	\$0.00	000000	000000
34	000000	000000	1	\$0.00	\$0.00	000000	000000
35	000000	000000	1	\$0.00	\$0.00	000000	000000
36	000000	000000	1	\$0.00	\$0.00	000000	000000
37	000000	000000	1	\$0.00	\$0.00	000000	000000
38	000000	000000	1	\$0.00	\$0.00	000000	000000
39	000000	000000	1	\$0.00	\$0.00	000000	000000
40	000000	000000	1	\$0.00	\$0.00	000000	000000
41	000000	000000	1	\$0.00	\$0.00	000000	000000
42	000000	000000	1	\$0.00	\$0.00	000000	000000
43	000000	000000	1	\$0.00	\$0.00	000000	000000
44	000000	000000	1	\$0.00	\$0.00	000000	000000
45	000000	000000	1	\$0.00	\$0.00	000000	000000
46	000000	000000	1	\$0.00	\$0.00	000000	000000
47	000000	000000	1	\$0.00	\$0.00	000000	000000
48	000000	000000	1	\$0.00	\$0.00	000000	000000
49	000000	000000	1	\$0.00	\$0.00	000000	000000
50	000000	000000	1	\$0.00	\$0.00	000000	000000

**VELVET DRIVE
HYDRAULIC MARINE TRANSMISSION**

PARTS LIST & EQUIPMENT FROM BOB MICHELLE

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TRANSMISSION INSTALLATION

Oil oil cooler must be properly connected into the cooler circuit of oil return line. Transmission oil cooler, high pressure and preheating will cause damage to the base element. The oil cooler should be of sufficient water pressure transmission using temperature from exceeding 100°C recommended maximum 100°F, or 100°C. One cooling is better than insufficient cooling. Because the transmission oil temperature under the minimum temperature is about 140°F, or 60°C.

Cooler line should have a minimum inside diameter of .40 inch or 10.16 mm. Cooler line fittings should not restrict oil flow.

The location for collecting the transmission oil the cooler is a 3/8" to 1/2" pipe tapped opening located just between the cooler.

Oil return at the top rear of the forward and reverse main cooler. Do not confuse this cooler with the oil filter. The pressure opening which is forward and to the left of the cooler outlet.

The cooler oil has been returning from different locations on 1.875 dimensional units. Marked the cooler oil return line to the lower right side of the reduction housing if an opening is located at through, otherwise, return directly to the oil circulating located at the right side near the front of the forward and reverse transmission case.

All transmissions having the factory case have not passed shop in the "to cooler" and "from cooler" locations to identify these locations and know what the words "to cooler" and "from cooler" are on the second transmission unit.

OIL CIRCUIT VARIATIONS

Three variations systems have been used for cooler and filtration circuits to the reduction gear unit variations. Equal 100°F reduction temperatures. Units which have the cooler oil cooler system have cooler connected to a stage of main located on the lower right side of the reduction housing (Figure 6).

Transmissions which have cooler oil returned through a housing in the lower right opening of the forward and or

reverse transmission with other have the cooler oil flow production system which have the second speed/Reverse cooled back on the reduction plates from base. Units which have the third system have two short straight pipes on the reduction plates from base. A short inspection of the cooler front face will be required to determine which of these four variations being used (Figure 6).



FIG. 6 PLANTS REQUIRED FOR THE COOLER CIRCULATION SYSTEM



FIG. 2. STANDARD COOLER RETURN ADAPTING EXTENSIONS WITH OTHER SECOND & THIRD-EXTENSION VALVES.

HYDRAULIC FLUID RECOMMENDATIONS

TRANSMISSION OIL

Deere/In, Type 1, and other hydraulic transmission fluids which meet performance level 2 (Type 1) requirements are recommended for use in all "normal duty" tractor transmissions.

Operating at conditions not recommended for use in closed transmissions may shorten life. Type C2 specifications may be used for the engine compartment but not exceed 5000 RPM. Type 1 oil is required. SAE multigrade oils (such as 10W-30) are recommended. Multigrade oils must be SAE 40 at 100°C. The maximum is 100 at 100°C. The maximum is 100 at 100°C. The maximum is 100 at 100°C. The maximum is 100 at 100°C.

The approved SAE oil grades are:

- 10W-30 SAE 40
- 10W-40 SAE 40
- 10W-50 SAE 40

The new C2 specifications were developed by Deere/In, Inc. to provide a standard for all Deere/In, Inc. products. The specifications of an operator's oil are subject to change. Deere/In, Inc. reserves the right to change the specifications of its products without notice. The operator should be sure to consult the operator's manual for the latest specifications for all Deere/In, Inc. products.

OPERATION

Except in an emergency, shift the forward or reverse clutch with the engine running below 1000 RPM. Shifting with the engine running above 1000 RPM will damage the clutch or transmission.

Short periods of free wheeling can be tolerated. Extended periods of free wheeling at higher speeds may cause the transmission to overheat. Therefore, it is recommended that transmission oil temperature should be monitored and free wheeling should be discontinued whenever the transmission temperature exceeds 100°C or 212°F. Otherwise, the transmission will be damaged.

Shift the clutch with the engine running below 1000 RPM. Shifting with the engine running above 1000 RPM will damage the clutch or transmission. The transmission should be kept cool and free of fluid leaks. Free wheeling is not recommended.

It is recommended that the operator should be sure to consult the operator's manual for the latest specifications for all Deere/In, Inc. products.

PARTS INTERCHANGABILITY

TRANSMISSION CASE

The original case can only be used with the first transmission option. The second case, first used with the second system, may be used for all systems. The part number remains the same and only certain parts will be furnished for certain parts. The second case for the rear first case is shown in detail in Figure 5, Item 2.

SHAFTS AND GEAR

An offset shaft (part number 1025) can offset into the case rear first system (see Figure 4), then fit only in the first system. This shaft should not be ordered when any other system is used.

REDUCTION HOUSING

The original reduction housing (part number 1.2) is not suitable and tapered bushing must be removed right side of the housing (Figure 6). This housing can only be used with the first system.

Reduction housing (part number 1.2) fit removed with the second and third system and had no place for tapered bushing on the reduction housing. This housing can only be used with units having either the second or third system.

REDUCTION SHAFTS GEAR-1-2-3-4-5

Two shaft parts (Figure 7), Item 4) were added as reduction shafts (part number 1.2.1.1.1.1) for use with the second reduction system. This shaft with the new third teeth may be used for all reductions. The shaft without the new third teeth should no longer be ordered but should remain in stock to use with the first reduction system.

REDUCTION SHAFTS GEAR-1-2-3-4-5

The reduction shafts (part number 1.2.1.1.1.1) are changed from the first adding reduction gear the shaft made in shafts from first and last the gear cannot be used in the shafts made with the third system (Figure 7, Item 4). The third shaft may be used for all reductions and will be the only shafts (part number 1.2.1.1.1.1).

REDUCTION UNIT ADAPTOR

The original adaptor (1.2.1.1.1.1) was used with the first system and did not have a shaft on its front face. This adaptor cannot be used with other systems.

The second adaptor (1.2.1.1.1.1) was used with the second system and was changed from the first face. The adaptor used with the third system has two short shafts (see Figure 7) and is not suitable in the second face and the part number was not changed.

Only the second adaptor (1.2.1.1.1.1) will be furnished for certain parts (Figure 7). It may be possible to obtain the information with the second adaptor (1.2.1.1.1.1).

The oil seal, center gear, and shaft (see Figure 8) in Figure 8, can only be used with case facing the case face (see Figure 8) and the shaft (see Figure 8).

Part (Figure 8) in Figure 8 is used with the second and third systems. The shaft (see Figure 8) is used with a second (part number 1.2.1.1.1.1) to replace the second (see Figure 8) for use with the first or second system.

The shaft (see Figure 8) in Figure 8 is used with the first or second system. The shaft (see Figure 8) is used with the first or second system. The shaft (see Figure 8) is used with the first or second system.



FIG. 5. SHAFTS AND GEAR-1-2-3-4-5

DISASSEMBLY OF TRANSMISSION

REMOVE REDUCTION HOUSING AND ATTACHED PARTS

1) Place transmission right side up on a clean bench and loosen the main shaft nut.

2) Place an inch thick block under the rear of forward and reverse transmission just forward of reduction unit adapter so that reduction unit will clear bench.

3) Remove the two 3/16 bolts (8) and lockwashers, which fasten the reduction housing and adapter to forward and reverse transmission and the 3/16 bolts (21) which fasten the reduction adapter to the reduction housing. Slide the reduction housing and attached parts rearward from forward and reverse transmission.

REMOVE SUN GEAR, PINION CASE ASSEMBLY AND LUBE OIL STRAINER

4) Remove the snap ring (15) which retains sun gear to output shaft.

5) Remove the six 8/18-18 x 3/4 bolts (17) which secure pinion cage assembly to the adapter.

6) Tap lightly to help free pinion cage as pinion cage and sun gear are pulled from the assembly.

7) Remove the lube oil strainer (28).

8) Remove the six bolts (22) and remove the adapter. It may be necessary to tap gently on the exposed edge to free the adapter from bearing.

REMOVE COUPLING, MAIN SHAFT AND BEARING

9) Remove main shaft nut and coupling.

10) Pull ring gear and shaft from reduction housing.

11) Remove six bolts (18) and bearing retainer (19).

12) Remove the rear tapered roller bearing cone from output shaft.

13) Place the reduction housing, rear fast-down, on a clean flat surface in an arbor press. Place a suitable tool against the forward face of the front bearing cone and press cone and outer race from reduction housing.

DISASSEMBLE FORWARD AND REVERSE TRANSMISSION

Remove the snap ring (25) from behind the annular bearing and then follow disassembly procedure in the appropriate Valves Drive service manual for either 70C and 71C or 70C direct drive transmissions.

INSPECTION AND GENERAL INSTRUCTIONS

1) Cleanliness is absolutely necessary during assembly to insure proper functioning of transmission. Transmission case passages should always have plugs removed to allow for thorough cleaning. When available, use compressed air to dry parts before they are assembled. Do not wipe parts with rags to clean or dry them as lint from the cloth may cause erratic valve action.

2) Inspect all parts for damage or wear. Replace defective parts.

3) All gaskets, oil seals and rubber sealing rings should be replaced except in relatively new units. Judgment should then be exercised as to the need for replacing these parts.

4) Oil seals and bearings are best installed by using an arbor press, suitable fixtures, and tools to properly align parts being assembled. Hammering seals and bearings into position can severely damage parts.

5) Transmission fluid of the type to be used in the unit should be used to lubricate parts as they are assembled. Petroleum jelly may be used on gaskets or other parts that must be held in position during assembly. All parts will assemble more freely if lubricated.

ASSEMBLY OF TRANSMISSION

1) Place the input shaft and output shaft (differs for each diameter shaft) in an alignment. The shafts should be 0.02 inch (0.5 mm) higher than and 0.01 inch (0.25 mm) narrower for VMC units.

2) Assemble the oil seals (34) into transmission case (28). Insert the output pinion against output shaft and set from face of case on the same surface that the input was pinion is set to setting.

3) Place the output bearing (35), with grease loaded in

case of transmission, over the output shaft and then use new face.

4) Assemble the snap ring (36) in the output shaft grooves behind the output bearing.

5) Complete the assembly of the forward and intermediate of the transmission as described in the appropriate Volvo Cars service manual for V40 and V40 or V40/GLE units (transmission).

ASSEMBLY OF REDUCTION UNIT

ASSEMBLY SHAFTS/GEAR/ADAPTER

1) Assemble the adapter from pinion (26) to case rear face. Check pinion and mating gear teeth for alignment. Ensure that all pinions in case and adapter are free of dirt and interference.

2) Place the input pinion in case face accurately align diameter. Insert alignment of pinion and fast forward by assembling the new 104-14 x 1.24 inch (26 mm) bolt (26). Assemble the pin 104-14 x 1.24 inch (26 mm) bolt (26) into intermediate (28). Tighten the pin bolts evenly to the specified torque value below the new 104 inch bolt.

NOTE: The oil seals placed into case of each axle will prevent assembly due to the oil seal is 1.02 inch (26 mm) hole (26) after the adapter has been fitted in position. The shaft covers the oil hole about the middle of the adapter is inserted in the early stage.

ASSEMBLY FRONT CASE

3) The front cover (28) should be thoroughly cleaned and conditioned to the face of the adapter. The seal and a screw which has hole which could prevent oil to come the lubricant.

4) Check the front surface in the front end of each pinion axle. These holes should be kept and free of contamination. Check to be sure that the bearing ring is freely in place.

5) Place the pinion ring evenly over the propeller pinion diameter of the adapter and align thrust washers of input, output and pinion rings, then insert and finger tighten the pin 104-14 x 1.24 inch (26 mm) bolt (26) into intermediate. Turn on the other direction could make assembly difficult or impossible. The the pinion into center side pinion then tighten the pin bolt evenly to the specified torque.

6) Assemble the gear case output shaft (37) into case face to make with shoulder on output shaft and the mating pinion is fully engaged.

7) Assemble the snap ring (38) into gear (37) shaft (37) pinion. The snap ring is made that it is fully seated in groove.

ASSEMBLY BEARING

8) Place the reduction bearing from intermediate to the surface under an axle case.

NOTE: Bearings are inserted in a method into and each intermediate shaft. Intermediate shaft has a shoulder with an "H" profile, the other side has the same shoulder although the "H" profile. The pinion ring will have the same shoulder with the "H" profile without intermediate on the other end. The intermediate the "H" profile shoulder placed together and the end of the case ring with no shoulder should be placed with the bearing case without the "H" profile.

9) Place the first one of the output bearing so that the rotating side against the shoulder in the reduction bearing.

10) Lubricate the outer race with transmission fluid and press it into the reduction bearing and seated on shoulder.

11) Place the rear input roller in reduction case.

ASSEMBLY MOUNTING RELAXER

12) Place the pinion (2) into reduction bearing (2), aligning the pin (2) against the intermediate in the bearing.

13) Place a cross of seal (3) into bearing relative with the face of seal is flat with the face of the adapter. A seal such as Formica or similar diameter of seal with pressure behind from mounting.

14) Tighten the output bearing washer to case accurately, and insert the 104-14 x 1.24 inch (26 mm) bolt (26) into hole (26) evenly to the specified torque.

