

TWIN DISC
INCORPORATED



Owner's
Manual

Marine
Transmission

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**Marine Transmission
Owner's Manual**

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Identification Plate

Transcribe the following information from your unit's nameplate to the illustration below for ease of reference.

- Model Number
- BOM Number
- Ratio
- Serial Number
- Customer Number (if applicable)
- Oil Capacity
- Minimum Oil Pressure When Cruising

Keep this information at hand, and refer to the model number, serial number, and BOM number when requesting any parts and service.

MODEL NO.	<input type="text"/>		RATIO	<input type="text"/>
BOM NO.	<input type="text"/>		SERIAL NO.	<input type="text"/>
OIL CAPACITY	<input type="text"/>	MARINE TRANSMISSION	CUSTOMER NO.	<input type="text"/>
<input type="text"/> GAL.				
LUBRICATION:		MIN. OIL PRESSURE AT RATED RPM	<input type="text"/>	P.S.I.
EVERY 10 SERVICE HOURS OR DAILY: _____ CHECK OIL LEVEL WITH ENGINE RUNNING AND MARINE TRANSMISSION IN NEUTRAL.				
EVERY 100 HOURS (WHERE A GREASE FITTING IS PROVIDED): _____				
LUBRICATE OUTPUT SHAFT SEALS WITH WATER PUMP GREASE TO PREVENT BILGE WATER ENTERING HOUSING.				
EVERY 1000 SERVICE HOURS OR 6 MONTHS, WHICHEVER COMES FIRST: _____ DRAIN AND REFILL HOUSING WITH CLEAN OIL. REMOVE AND REPLACE FILTER ELEMENT WHERE APPLICABLE. CLEAN SUCTION SCREEN.				
IMPORTANT: WARRANTY IS VOID UNLESS TRANSMISSION IS LUBRICATED AND MAINTAINED AS SPECIFIED IN THE SERVICE MANUAL AVAILABLE ON REQUEST. REFER TO "MARINE TRANSMISSION LUBRICANT" PLATE SHIPPED WITH UNIT.				
(BILL OF MATERIAL NO. MUST BE GIVEN WHEN ORDERING PARTS.)				
MADE IN U.S.A.				
	INCORPORATED RACINE, WI. 53403 U.S.A.			

204099BC

Lubrication Plate

Fill in the blanks below with the information from your unit's lubrication data plate. Keep this information at hand and refer to it when servicing your transmission.

MARINE TRANSMISSION LUBRICANT		
See the Lubrication Plate on your Marine Transmission for Oil Specs		
STARTUP	STEADY OPERATION	VISCOSITY
MIN.		
MIN.		
MIN.		
MIN.		

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Oil temperature listed is the temperature of the oil entering the heat exchanger.

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Section 1

Introduction

1.1 General Information

This publication provides general operating information for Twin Disc Marine Transmissions. Specific product details and performance characteristics can be obtained by contacting your nearest Twin Disc Authorized Distributor or Service Dealer.

This manual is current at the time of printing. When required, changes are made to reflect advancing technology and improvements in state of the art.

1.2 Safety and General Precautions

A. General

All personnel servicing this equipment should employ safe operating practices. Twin Disc, Incorporated will not be responsible for personal injury resulting from careless use of hand tools, lifting equipment, power tools, or unaccepted maintenance/working practices.

B. Important Safety Notice

Because of the possible danger to person(s) or property from accidents that may result from the use of machinery, proper installation, maintenance and operation procedures must be followed. Twin Disc, Incorporated will not be responsible for personal injury resulting from careless maintenance/working practices.

Inspect as necessary to assure safe operations under prevailing conditions. Proper guards and other safety devices that may be specified in safety codes should be provided. These devices

are neither provided by nor are they the responsibility of Twin Disc, Incorporated.

⚠ WARNING

Selecting **NEUTRAL** disengages transmission clutches but does not prevent propeller shaft rotation. If you require positive neutral (propeller shaft locked), a shaft brake or other shaft locking device must be used.

⚠ WARNING

To prevent accidental starting of the engine when performing routine transmission maintenance, disconnect battery cables and remove ignition key from the switch.

1.3 Preventative Maintenance

Frequent reference to the information provided in this manual regarding daily operation and limitations of this equipment will assist in obtaining trouble-free operation. Schedules are provided for recommended maintenance of the equipment in Section 4 of this manual, as well as a chart in the Appendix, Section 6.

1.4 Ordering Parts and Obtaining Service

⚠ WARNING

All replacement parts or products (including hoses and fittings) must be of Twin Disc origin or equal, and otherwise identical with components of the original equipment. Use of any other parts or products will void the warranty and may result in malfunction or accident, causing injury to personnel and/or serious damage to the equipment.

A. Ordering

Renewal parts, service parts kits, optional equipment and product service assistance may be obtained from any authorized Twin Disc distributor or service dealer. Contact Twin Disc for the distributor or service dealer near you. Twin Disc, having stipulated the bill of material number on the unit's nameplate, absolves itself of any responsibility resulting from any external, internal, or installation changes made in the field without the express written approval of Twin Disc. All returned parts, new or old, emanating from any of the above stated changes will not be accepted for credit. Furthermore, any equipment that has been subjected to such changes will not be covered by a Twin Disc warranty.

B. Source of Service Information

For the latest service information on Twin Disc products, contact any Twin Disc distributor or service dealer. Product service manuals are available, which provide more specific and detailed overhaul and installation instructions. Provide your model number, serial number and bill of material number to obtain information on your unit.

C. Warranty Information

The Commercial Twin Disc marine transmission warranty can be found in the Appendix, Section 6.3 of this manual. The Pleasure Craft Twin Disc marine transmission warranty can be found in the Appendix, Section 6.4 of this manual. This warranty may be supplemented by additional published warranty terms dependent upon the product involved. Supplementary warranty terms are available upon request. For details on administering the warranty, contact any Twin Disc distributor, service dealer or the Warranty Administration Department, Twin Disc, Incorporated, Racine, Wisconsin, U.S.A.

NOTES

Section 2

Description and Specifications

2.1 Description

1. While most Twin Disc marine transmissions are forward/reverse reduction units, some units provide speed-increasing capability. All may be used with standard (right-hand) rotation engines and certain models may be modified to accommodate nonstandard (left-hand) rotation engines. Contact your Twin Disc distributor if you anticipate using nonstandard engines.

NOTE: Engine direction of rotation is determined by facing the front of the engine (opposite engine flywheel). From this viewpoint, clockwise crankshaft rotation is defined as right-hand rotation.

2. All current Twin Disc marine transmissions can be operated through either primary or secondary clutch at full-rated horsepower for forward (ahead) propulsion using standard right hand engines. Contact your Twin Disc distributor for the rated horsepower if you anticipate using nonstandard engines.

NOTE: The primary clutch has the shortest power path through the transmission. The secondary shaft is driven in opposite rotation by the primary shaft.

3. Transmission clutches are hydraulically applied using regulated oil pressure. All bearings, clutches and gears are lubricated and cooled with oil.

2.2 Construction Features**A. Oil Pump Drive**

For most transmissions, the secondary clutch shaft drives the oil pump.

B. Lubrication Features

The transmission case serves as the reservoir (sump) for all oil used in the transmission. Bearings and clutches on the primary and secondary shafts are lubricated and cooled through passageways in the shafts. Output shaft bearings are gravity and/or splash lubricated. Some transmissions use pressurized oil spray to lubricate gears and bearings.

C. Suction Screen

All units have a suction strainer located between the sump and oil pump in the hydraulic circuit. Its purpose is to prevent debris from entering the inlet side of the pump. The suction strainer must be cleaned as a part of every oil change. Consult the illustrations found in Section 6.2 for the suction strainer location on your unit.

D. Filter Assembly

Many units have an oil filter installed in the system. Some units incorporate a spin-on filter. Other units use a cartridge type filter plumbed into the hydraulic circuit between the pump outlet and the transmission inlet port. Replace oil filter as part of every oil change. Consult the illustrations found in Section 6.2 for the filter location on your unit.

E. Control Valve

All transmissions utilize a control valve to deliver pressurised oil to the clutches and lubrication circuit. It may be electrically or mechanically actuated and may have an xxx.

F. Accessories

Heat Exchanger, Trolling Valve, Power Take Off, Trailing Pump or monitoring group (See appendix section 6.1)

2.3 Specifications

All Twin Disc marine transmissions are equipped with an identification plate. (See sample identification plate at the front of this manual.) In addition to information identifying the unit (i.e. model number, BOM number, ratio, serial number and customer number), the identification plate provides information on oil capacity, minimum cruise oil pressure and oil check/oil change intervals for your particular transmission. All operators of this equipment are responsible to read and apply the information provided on the transmission identification plate.

2.4 Oil Recommendations

A. Oil Viscosity

See your unit's lubrication data plate for type of oil and viscosity recommendations. Transcribe the information from your transmission's lubrication data plate to the sample plate found at the front of this manual for ease of reference.

B. Oil Pressure and Temperature

⚠ CAUTION

All units have provisions to install oil pressure and oil temperature gauges. Oil pressure gauges are required for all installations. By monitoring “main” oil pressure and temperature, you detect problems before major damage to the unit occurs.

Your unit's identification plate specifies “minimum oil pressure when cruising.” This specification is the “main” oil pressure measured with the oil temperature in the normal operating range and engine speed at approximately 2/3 throttle setting.

It is suggested that an alarm system be installed to notify the operator in the event that the oil pressure falls below the “minimum pressure when cruising” specification. The nominal operating pressure range, the low pressure alarm setting, and the engine shut-down alarm setting for each MG(X) transmission is provided in Figure 5-1.

If you detect abnormal oil pressure:

1. Verify that the pressure reading is accurate. (Gauges can fail or malfunction.)
2. If gauge is malfunctioning, determine that actual operating pressure is within allowable range before resulting operation.
3. If pressure reading is accurate and pressure is outside of the allowable range, shut down the engine and correct the problem. See troubleshooting procedures in Section 5 of this manual.

NOTE: If problem cannot be corrected and engine must be shut down, see instructions for windmilling/backdriving and towing in Section 3.7 of this manual.

If unit must be kept in operation to prevent injury to personnel or damage to equipment, operate at lowest power possible until unit can be safely shut down.

C. Heat Exchanger

The heat exchanger is required to maintain the oil temperature in the hydraulic system within the recommended operating range. Proper oil temperature is maintained by passing coolant through the heat exchanger.

Some models, such as the MG(X)-5300 series and MG(X)-6000 series transmissions, may have an integral heat exchanger. On models with a remote mounted heat exchanger, the heat exchanger should be installed in a location convenient to coolant and marine transmission oil. **See the unit's lubrication plate or the chart in Figure 5-2 for the operating oil temperature.**

D. Oils for Use in Twin Disc Hydraulically Actuated Marine Transmissions

1. Continuous, Medium, Intermediate and Light Duty Applications:

a. Description:

- (1) Typical approved oils are SAE 30W, 40W and 50W.
- (2) Refer to the lubrication plate mounted on the marine transmission for the approved oil types.
- (3) Multi-viscosity oils, synthetic oils or blends of mineral and synthetic oils are not approved for use in the specified applications.

b. Requirements: Oils types listed in D.1.a. must meet the following specifications.

- (1) API CF or ACEA E2.
- (2) Caterpillar TO-2 specifications, Allison C-4 ⁽¹⁾ specifications or has been approved by Twin Disc. Consult Twin Disc for oils that have been approved that do not meet Caterpillar TO-2 or Allison C-4 specifications.

⚠ CAUTION

Supplemental additives are not approved for use in marine transmissions and must not be added. Supplemental additives are products manufactured and marketed as “add-ins” to oils to alter the frictional, anti-wear and/or oxidation properties of the oil.

⚠ CAUTION

Avoid oils with spiral bevel and hypoid gear oil type EP additives, especially those with sulphur, phosphorous and chlorine compounds.

⚠ CAUTION

Re-refined oil is acceptable if it is API certified.

- c. Operating Temperatures:
 - (1) SAE 30W and 40W: 66-85 °C (150-185 °F)
 - (2) SAE 50W: 80-93 °C (175-200 °F)
- d. Cold Start Oils:
 - (1) Cold start oils must only be used when inability to start with those oil types described in D.1.a.
 - (2) Cold start oils used must meet the requirements described in D.1.b.(2).
 - (3) Cold start oils used must have the following viscosities:
 - (a) Maximum viscosity at -40 °C (-40 °F): 20.0 cSt
 - (b) Minimum viscosity at 99 °C (210 °F): 7.0 cSt

- (4) The residual of the cold start oil that remains after draining the marine transmission must be compatible with the oil types described in D.1.a.
 - (5) Prolonged use of cold start oils may reduce transmission life.
 - (6) Cold start oils must be replaced with oils described in D.1.a. as soon as operating conditions permit.
- e. Oil and Filter Change Intervals:
- (1) A 1000 hour or every six months (whichever occurs first) oil and filter change interval⁽²⁾ is suggested as an initial guideline.
 - (2) It is the customer's responsibility to determine the correct oil and filter change interval based on local conditions, severity of the operation/duty cycle.
 - (3) The oil and filter change intervals can be optimized by the use of an oil analysis. Twin Disc, Incorporated strongly recommends the use of an oil analysis to determine the oil and filter change intervals. See section below D.1.f. for additional information on oil analysis.
- f. Oil Analysis:
- (1) Oil analysis requires periodic samples to be taken from the operating marine transmission and sent to a laboratory⁽³⁾ for analysis.
 - (2) Oil analysis may be used to determine the oil change intervals; however, it is important that the oil analysis be performed regularly and results analyzed consistently to determine trends.

- (3) The protection of the transmission and oil and filter change intervals can be optimized by monitoring the following parameters of the oil:
 - (a) Viscosity: $\pm 15\%$ change from the new fluid
 - (b) Total Acid Number (TAN): $+3.0$ ⁽⁴⁾ change from the new fluid
 - (c) Solids: 2% by volume maximum
 - (d) Water contamination: 0.2% maximum
 - (e) Glycol contamination: No trace allowed. If detected, inspect and repair the marine transmission.
 - (f) Cleanliness per ISO 4406 ⁽⁵⁾:
 - 1 Filling of marine transmission: 16/13
 - 2 Maximum level: 18/15

2. Pleasure craft duty applications:

a. Description:

- (1) Vessels used in charter service, shared ownership (timeshare), patrol vessels, tournament sport fish vessels, other vessel operating more than 500 hours per year or any kind of commercial service are not considered in this category.
- (2) Typical approved oils are SAE 30W, 40W, 50W, 5W40 and 15W40.
- (3) Refer to the lubrication plate mounted on the marine transmission for the approved oil types.

- (4) Alternate oil types that are approved for use in pleasure craft duty application, but not listed on the lubrication plate mounted on the marine transmission include multi-viscosity oils, synthetic oils or blends of mineral and synthetic oils.
- b. Requirements: Oil types listed in D.2.a. must meet the following specifications.
- (1) API categories CF, CF-2 or CG-4 or ACEA categories E2 or E7.
 - (2) Caterpillar TO-2 specifications, Allison C-4 ⁽¹⁾ specifications or has been approved by Twin Disc. Consult Twin Disc for oils that have been approved that do not meet Caterpillar TO-2 or Allison C-4 specifications.
 - (3) Valid for private vessels operating less than 500 hours per year.

⚠ CAUTION

Avoid oils with spiral bevel and hypoid gear oil type EP additives, especially those with sulphur, phosphorous and chlorine compounds.

⚠ CAUTION

Re-refined oil is acceptable if it is API certified.

- c. Operating Temperatures:
- (1) SAE 30W, 40W, 5W40 and 15W40: 66-85 °C (150-185 °F)
 - (2) SAE 50W: 80-93 °C (175-200 °F)

d. Cold Start Oils:

- (1) Cold start oils must only be used when inability to start with those oil types described in D.2.a.
- (2) Cold start oils used must meet the requirements described in D.2.b(2).
- (3) Cold start oils used must have the following viscosities:
 - (a) Maximum viscosity at -40 °C (-40 °F):
20.0 cSt
 - (b) Minimum viscosity at 99 °C (210 °F):
7.0 cSt
- (4) The residual of the cold start oil that remains after draining the marine transmission must be compatible with the oil types described in D.2.a.
- (5) Prolonged use of cold start oils may reduce transmission life.
- (6) Cold start oils must be replaced with oils described in D.2.a. as soon as operating conditions permit.

e. Oil and Filter Change Intervals:

- (1) For 15W40: A 500 hour or once a year (whichever occurs first) oil and filter change interval⁽²⁾ is suggested as an initial guideline.
- (2) For 30W, 40W and 50W: A 1000 hour or once a year (whichever occurs first) oil and filter change interval⁽²⁾ is suggested as an initial guideline.
- (3) It is the customer's responsibility to determine the correct oil and filter change interval based on local conditions, severity of the operation/duty cycle.

- (4) The oil and filter change intervals can be optimized by the use of an oil analysis. Twin Disc, Incorporated strongly recommends the use of an oil analysis to determine the oil and filter change intervals. See section D.1.f. for additional information on oil analysis.

E. Oils for Use in Twin Disc Mechanically Actuated Marine Transmissions

- 1. Description:
 - a. Typical approved oils are SAE 80W90 and 85W140.
 - b. Refer to the lubrication plate mounted on the marine transmission for the approved oil types.
- 2. Requirements: Oil types listed in E.1.a. must meet one of the following specifications.
 - a. API-GL-5
 - b. AGMA mild EP
- 3. Oil and Filter Change Intervals:
 - a. A 1000 hour oil and filter change interval⁽²⁾ is suggested as an initial guideline.
 - b. It is the customer's responsibility to determine the correct oil and filter change interval based on local conditions, severity of the operation/duty cycle.
 - c. The oil and filter change intervals can be optimized by the use of an oil analysis. Twin Disc, Incorporated strongly recommends the use of an oil analysis to determine the oil and filter change intervals. See section D.1.f. for additional information on oil analysis.

F. Grease for Use in Twin Disc Marine Transmissions Equipped with Ball Bearings, Roller Bearings, Pilot Bearings, Throwout Bearings and Seals

1. Description:
 - a. Acceptable greases are NLGI grades #0, #1 and #2.
 - b. Recommended greases include the following
 - (1) Mobilgrease XHP 222
 - (2) Mobilgrease XHP 322 mine
2. Requirements: Grease listed in F.1. must meet the following specifications.
 - a. Greases lubricating ball and roller bearings must be approved by the bearing manufacturer.
 - b. Lithium complex thickened to improved water washout resistance and extreme pressure additives
 - c. A minimum viscosity of 150 cSt at 40 °C (104 °F)
 - d. The base oil is either a mineral or synthetic.
 - e. A minimum operating temperature of 135 °C (275 °F) under continuous use.
3. Recommendations:
 - a. For fretting wear conditions use NLGI grades #0 and #1
 - b. Use NLGI grades #0 and #1 if the maximum component temperature is 20 °C (68 °F). Use NLGI grade #2 for higher temperatures.
 - c. When adding grease to plain bearings and oil seals pump a small amount.

- d. When adding grease to ball and roller bearings pump until clean grease appears. Then operate the marine transmission at half of the maximum operating speed for 10 minutes and then wipe away the discharged grease.
4. Grease Intervals: 100 hours or when the boat is docked to prevent bilge water from entering.

Notes:

- (1) A list of Allison C-4 approved oils is available from the Allison Transmission website found at www.allisontransmission.com.
- (2) Oil change interval hours are accumulated operating hours.
- (3) Oil companies can recommend an oil analysis laboratory source.
- (4) Milligram of KOH required to neutralize a gram of fluid.
- (5) The ISO code system has 28 possible code numbers. The code number for cleanliness is expressed as two numbers. The first number relates to the particles that are larger than 0.005 mm (0.0002 in) in size. The second number relates to the number of particles that are larger than 0.015 mm (0.0005 in) in size.

Section 3

Operation

3.1 Selector Valve

A. General Description

In this transmission, a selector valve controls the application of primary and secondary clutches. This selector valve can be either a detented, lever-operated mechanical valve or an electric, solenoid-operated valve. The general purpose (GP) control valve coupled with the EC050 electronic control module or EC300 electronic control module is used to place the transmission in neutral, or to engage the primary or secondary clutches in the cruise and troll modes of operation. When either of the clutch engagement positions is selected, the control valve directs high-pressure oil through internal passages to the selected clutch to instantaneously and smoothly engage the clutch. The pressure rate-of-rise, which is controlled by the EC050 or EC300 control module, provides a rapid and smooth clutch engagement. The control monitors various input signals continuously, and controls the transmission electrical valves accordingly, updating transmission control signals to optimize vessel operation.

The EC050 control module has three LEDs that inform the operator of control status:

In cruise mode, both the power LED and the energized solenoid LED display green

In troll mode, the power LED displays green and the energized solenoid LED displays red.

The LEDs also provide fault message information during operation. Refer to Table MG(X) Series LED Chart in the TROUBLESHOOTING section.

The EC050 or EC300 control module is available either as a Profile Module or an Etroll Module. The Profile Module provides cruise operation only.

⚠ CAUTION

Control Systems that fail to place a mechanical selector valve in detented positions will damage or cause failure of the clutch packs.

Manually holding the shift selector out of the detented position will also damage or cause failure of the clutch packs.

⚠ CAUTION

Control systems for units equipped with electric solenoid valves must not permit actuation of both forward and reverse solenoids at the same time.

B. Safety

Whenever maintenance is performed on the marine transmission or control valve, always make sure that the transmission controls are free and are adjusted properly. Be certain that the transmission range selected at the operator's station places the control valve in the fully detented position for the selection made.

3.2 Prestart-up Checks

Prior to starting the engine, check the transmission as follows.

1. Check that there is oil in the transmission.

NOTE: This check will determine that there is oil in the transmission but will not determine if oil level is correct. Oil level check must be performed with engine operating at low idle with transmission in neutral and oil temperature in operating range. Refer to 3.3, step 3.

2. Check transmission for leaks, cracks and obvious damage.
3. Check mountings for tightness or damage such as cracks. Tighten loose mountings and replace damaged parts.
4. Inspect heat exchanger oil and coolant lines and hoses for leaky connections, kinks, cracks and other damage. Replace damaged lines and/or hoses.
5. Check pressure and temperature gauges where applicable.
6. Inspect driveline and input and output shaft oil seals for signs of leakage. Replace parts as required.
7. Inspect unit identification plate and lubrication plate for looseness and corrosion. Tighten mounting screws that are loose and replace corroded plates.

NOTE: If you need to replace an identification or lubrication plate, make sure all pertinent information is transferred to the new plate. Failure to do so could result in the loss of important information necessary to obtain parts and service.

3.3 Startup

1. Place the transmission control in NEUTRAL.
2. As soon as engine starts, check the transmission oil pressure (oil pressure gauges are required for all installations). Pressure should register within 15 seconds. If no pressure is indicated, stop the engine and determine the cause.
3. Check the oil level as follows.
 - a. Fill the transmission to LOW mark on the dipstick. Run the engine at idle until oil temperature reaches operating range.
 - b. Continue running at idle and check the oil level with the oil level gauge (dipstick). The level should be at the FULL mark on the gauge. Add or remove oil as necessary to bring the level to the FULL mark on the gauge.
 - c. Allow the oil to cool to ambient temperature (perhaps overnight). Start the engine and check the oil level while cold at low idle engine speed with the engine in neutral. Make a note of this adjusted cold oil FULL level for future reference. **DO NOT OVERFILL.**

3.4 Normal Operation

1. For maximum service life, make all shifts from NEUTRAL into either FORWARD or REVERSE with engine running at low idle.
2. When a shift range is selected, assure that the control lever is in the fully detented position for the range selected.

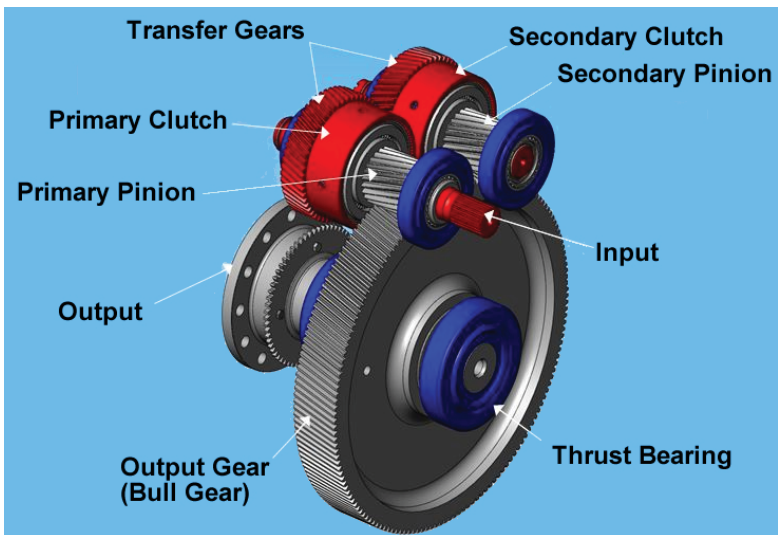
3. Monitor transmission oil pressure and temperature. See oil pressure information on identification plate and oil temperature information on lubrication plate.

NOTE: Sustained operation of the marine transmission with oil temperature outside of normal operating range is not recommended.

4. Shifting Limits

For all shifts (NEUTRAL into FORWARD or REVERSE, and FORWARD or REVERSE through NEUTRAL into the opposite direction) limit engagement to a maximum of 1000 RPM or 50% of engine speed which ever is lower. Limits for surface drive or dynamic positioning applications may vary. Please contact Twin Disc regarding limits for these applications.

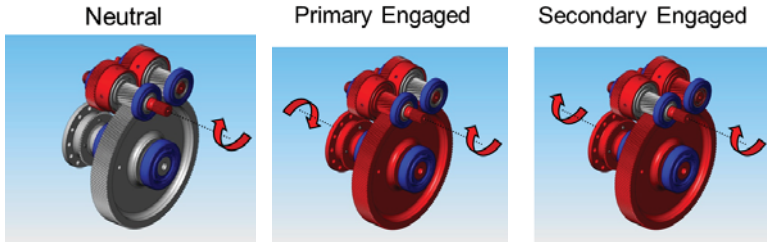
NOTE: The recommended engine rpms pertain to normal operation only. In an emergency, the owner/operator is expected to employ whatever procedures are necessary to prevent loss of life and reduce damage to property.



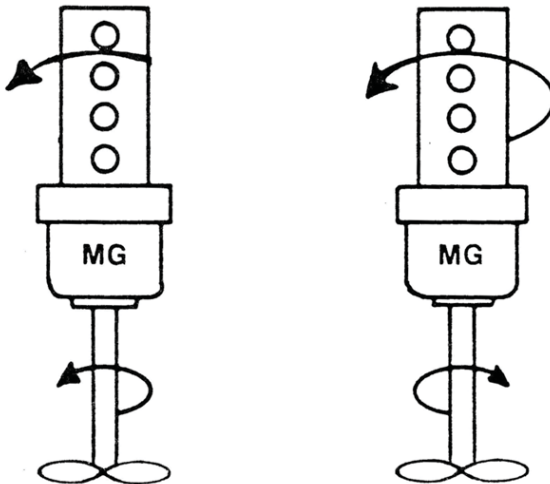
SECTION 3

Forward – Neutral – Reverse

To allow disengagement, forward and reverse propulsion.

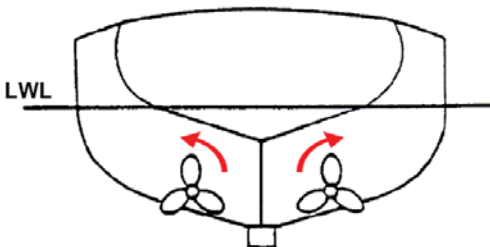


Most engines require a reverse reduction transmission because they rotate counter clock wise (right hand rotation).



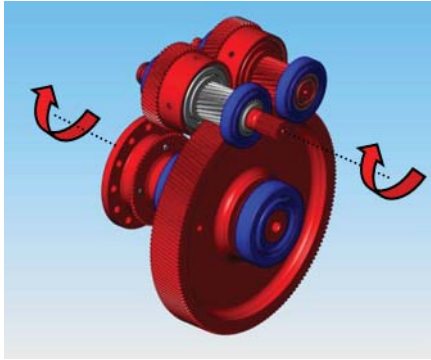
Modern marine transmissions have equal ratios and equal rating capacities through primary and secondary shafts.

Propellers turn OUTBOARD for forward propulsion.



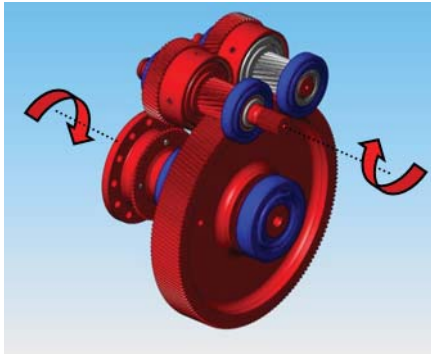
Port Side Transmission

Secondary Shaft Clutch = FORWARD

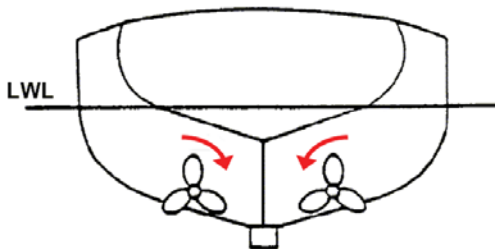


Starboard Side Transmission

Primary Shaft Clutch = FORWARD



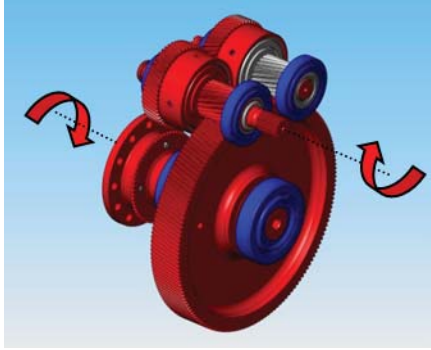
Propellers turn INBOARD for forward propulsion



SECTION 3

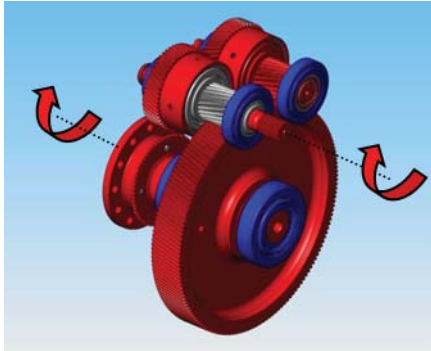
Port Side Transmission

Primary Shaft Clutch = FORWARD



Starboard Side Transmission

Secondary Shaft Clutch = FORWARD



3.5 Operation in Dirty or Debris-filled Waters

Operation in waters that contain debris such as logs, ropes, or cables must be done cautiously. Throttle the engine back to near idle to prevent damage to the propellers, drivelines, and transmissions.

⚠ WARNING

Getting a rope (or similar object) caught in the propeller, or “propeller strikes” can cause serious damage to the Marine Transmission. If the vessel gets a rope (or similar object) caught in the propeller, or the propeller strikes an object, the engine should be shut down and a visual inspection of the Marine Transmission should be conducted. If in doubt, the transmission should not be operated. Follow the towing or back-driving procedures outlined in the manual to reach port. Continued operation of the transmission after getting a rope (or similar object) caught in the propeller, or a severe propeller strike may cause further damage to the transmission and place the safety of vessel and crew in jeopardy.

3.6 Operation with Optional Trolling Valve

A. General

Trolling valves are available as optional equipment for most Model MG-XXXX Twin Disc marine transmissions. An ETROLL control module is available for Model MG(X)-XXXX Twin Disc marine transmissions. The trolling valve allows reducing and controlling propeller speed below that normally attained when operating the engine at low idle. Examples of operations requiring such slow speeds are trolling or movement through “no wake” restricted areas.

Most trolling valves can be used with the selector valve in either the forward or reverse position. Actuating the trolling valve reduces applied clutch pressure, which allows the clutch to slip and reduce propeller speed.

B. Operating Limits

Trolling is a vessel movement in a specific direction and therefore limits are only required for maximum engine speed with a single clutch engaged. For all marine transmission models, limit trolling to a maximum of 1000 RPM or 50% of engine speed whichever is lower. Limits for surface drive or dynamic positioning applications may vary. Please contact Twin Disc regarding limits for these applications.

NOTE: Additional cooling may be required for applications involving surface piercing propellers. Twin Disc should be contacted for all inquiries involving this application. Trolling valve performance may be affected by operating oil temperature. Additional cooling is not required when in the trolling mode but trolling valve performance can be affected by operating oil temperature. In some cases a thermostatic bypass valve is recommended to maintain operating oil temperature at desired level.

C. Normal Operation – Trolling Mode

The following is the normal procedure for engaging and operating a marine transmission when trolling mode is to be used.

1. Shift transmission selector to NEUTRAL.
2. Reduce engine rpm to low idle.
3. Move trolling valve control lever out of detented NO TROLL position to MAXIMUM TROLL (slowest vessel speed) position.
4. Move transmission selector lever to desired direction of travel.
5. Adjust trolling valve lever setting (and if necessary, engine rpm) up to specified limit to attain desired vessel speed.

⚠ CAUTION

Do not exceed specified maximum engine speed while operating in TROLL mode. To do so will result in excessive clutch heat buildup and possible clutch failure.

⚠ WARNING

Set the trolling valve in the detented NO TROLL position when docking the vessel or when operating in congested areas. Failure to do so could result in sluggish response to power changes or shift reversals and loss of necessary control of vessel speed and direction of travel.

NOTE: Do not attempt to use a marine transmission equipped with a trolling valve as a “power dividing” device. Attempts to use a trolling valve equipped transmission for such a purpose at engine speeds above the limits specified will result in clutch failures.

6. To return to NO TROLL operation:
 - a. Set the engine speed to IDLE.

NOTE: Moving the trolling valve control lever to the NO TROLL position while engine speed is at the high limit for trolling operations will cause an abrupt change in propeller (and vessel) speed. Reducing engine speed to idle before selecting NO TROLL will result in a smoother transition to NO TROLL operation.

- b. Move the trolling valve control lever to the detented NO TROLL position.
 - c. Resume normal no troll operation.

⚠ WARNING

Make sure that the trolling valve cable control system is adjusted properly. The trolling valve control lever on the transmission must be in the detented NO TROLL position when the control at the operator's station is moved into the NO TROLL position. Failure to do so could result in inadequate response to power and/or direction changes, endangering personnel and equipment.

3.7 Windmilling, Backdriving, and Towing

Backdriving occurs when an engine is shut down and the propeller shaft is being driven by the flow of water across the propeller. This is sometimes referred to as windmilling. The propeller shaft is rotating components in the marine transmission. Locking the propeller shaft in place will prevent backdriving.

Situations where backdriving may occur:

- Vessel being towed for any reason.
- Multiple-transmission vessel with one or more engines shut down while under way.
- Sailboat under way with auxiliary engine shut down.
- Vessel tied up or docked in heavy current.

Most current Twin Disc production marine transmissions (with the exceptions that follow) can be backdriven in the situations listed. Vessel speed under all towing or backdriving conditions must not exceed the normal propulsion speed of the vessel.

The following backdriving (towing) options are applicable to all transmissions except MG-5170 series, MG-5300 series, MG-5600 serial, and all MG-6000 series (without the optional trailing pump). For these transmissions, only the instructions in b and c are applicable.

You need to employ only one of the following methods.

⚠ WARNING

Do not exceed normal vessel speed during backdriving. If oil sump temperature exceeds 100°C, damage will occur to internal components. If oil temperature increases to 100°C, reduce temperature either by reducing backdriving speed, or supplying additional cooling with water flow or by idling the engine.

- a. Start the engine and operate the marine transmission in neutral at normal fluid pressures for five minutes, doing this once every eight hours. Maintain the backdriven marine transmission's oil level at the FULL mark on the dipstick.
- b. Lock the propeller shaft to prevent rotation.
- c. Add a trailing pump to the lube circuit. See the hydraulic system prints for more details on auxiliary pump specifications for the applicable transmission or contact your Twin Disc distributor.
- d. In the case of an inoperable engine, or pump failure, where pressure lubrication of the transmission is not possible; plug the dipstick tube and completely fill the transmission with oil. Prior to backdriving or towing, drain the oil down to FULL oil level. Repeat this process every eight hours.

3.8 Emergency Operation

A. Mechanical Stop on Failed Torsional Coupling

⚠ CAUTION

Limit operation to 50 percent of maximum engine speed or a maximum of 1000 rpm, whichever is lower, to avoid additional costly damage to transmission internal components.

Many torsional couplings used with Twin Disc transmissions have mechanical stops to allow power to be transmitted to the transmission in the event of a coupling failure. Continued

operation at high power levels could result in costly damage to the transmission internal components. In the event of a torsional coupling failure, return to a safe harbor immediately to initiate repair or replacement of the failed coupling.

B. Electric Selector Manual Override

If, for transmission fitted with electric selector, an electrical power interruption occurs, the electric selector can be overridden. Manual override is accomplished differently depending on the type of solenoid. There are two methods: Solenoid with built-in manual override, or the manual override plug.

Method 1: Solenoid with Built-in Manual Override

Solenoids that have a built-in manual override can be identified by a round nut with two flats cut into it. Removing the round nut exposes a knurled knob. Pushing and turning the knob counterclockwise activates the manual override.

When the solenoid is manually overridden, that clutch will be engaged any time the engine is running. Returning the knurled knob to its previous position restores electric control.

WARNING

Once the solenoid is manually overridden, the transmission cannot be shifted to neutral, or into the opposite gear.

Shut down the engine and place the vessel under tow before entering any congested area or dock area.

Failure to do so will endanger the safety of the crew and vessel as well as other people and vessels in the area.

Method 2: Manual Override Plug

When solenoids do not have a built-in manual override feature, a manual override plug is available. To override the solenoids at the time of an electrical power interruption, the appropriate solenoid must be removed and replaced with the override plug.

When the solenoid is manually overridden, that clutch will be engaged any time the engine is running.

C. Installation of Override Plug

1. Stop the engine.

⚠ WARNING

Once the override plug is installed, the transmission cannot be shifted to neutral, or into the opposite gear.

Shut down the engine and place the vessel under tow before entering any congested area or dock area.

Failure to do so will endanger the safety of the crew and vessel as well as other people and vessels in the area.

2. Locate and remove the stored manual override plug from the selector valve body for use in step 4.
Note: The location of the stored plug varies on different models.
3. Determine which clutch should be engaged (primary or secondary clutch) and remove the appropriate solenoid.
4. Install the override plug in place of the removed solenoid.

⚠ CAUTION

The selected clutch is engaged whenever the engine is running. If the vessel is going in the wrong direction, stop the engine and remove the override plug. Reinstall the removed solenoid, then repeat the above procedure with the opposite solenoid.

5. Store the removed solenoid where the override plug was stored until repairs are performed.

Figure 3-1. General Purpose (GP) Selector Valve

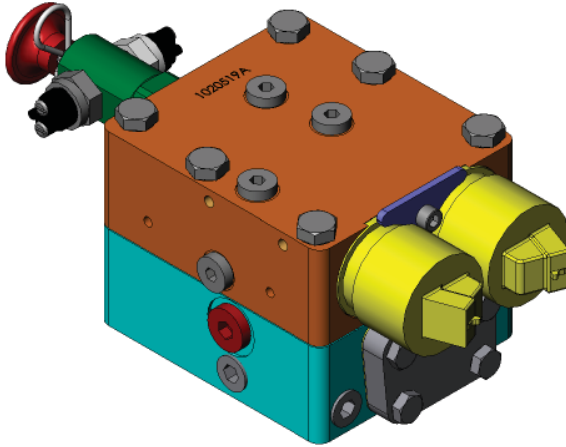
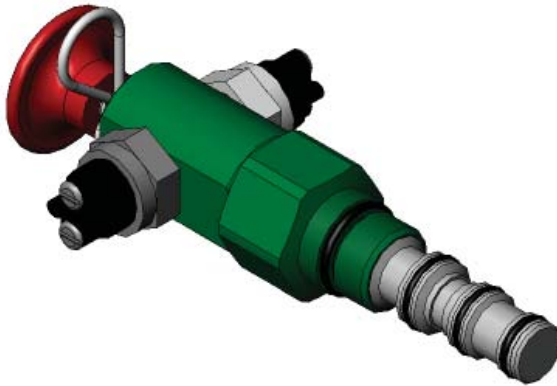


Figure 3-2. Manual Override Valve



Section 4

Maintenance

4.1 General Maintenance

NOTE: A chart is provided in the front of the manual to record the dates/hours that maintenance procedures are performed.

A. Oil Level Check

Check oil level daily or every 10 hours of engine operation. Check with engine running at low idle and with marine transmission in neutral. Check the oil level with the transmission oil temperature in normal operating range. See Section 3.3, Start-Up.

B. Lubrication

If your unit is equipped with a lubrication fitting, grease the oil seals at the output end of the transmission output shaft through the lubrication fitting with water pump grease. See the illustrations in Section 6.2 for location of the lubrication fitting. Apply grease approximately every 100 hours when boat is docked. No other lubrication is required.

NOTE: Preferred grease is one with lithium soap, NLGI consistency #2 for component temperatures above 20° C (68° F).

C. Filter and Oil Change Interval

With a new transmission, change the oil and filter element within first 50 hours of operation. Change oil and filter element after each 1000 hours of operation, or six months, whichever comes first. Change the oil more frequently if conditions warrant.

For a rebuilt transmission, check the suction screen and filter element after eight hours of operation. Look for lint or other material that may collect from rags or towels used in the parts cleaning process. Look for chips or shavings particularly if the transmission has had a problem that caused debris in the system. (For units with spin-on filters, this will require cutting the filter element apart to access the element core.) If the filter is clean, install a new filter element and then change the oil and filter element after 1000 hours of service. If the filter is dirty, change the element and operate for another eight hours. Check the filter again. Continue this cycle until the filter is clean and then change the oil and filter after 1000 hours of service, or more often if conditions warrant.

NOTE: Situations involving debris in the hydraulic system will require that heat exchangers and all connecting lines and hoses be thoroughly cleaned. If the heat exchanger cannot be disassembled, or if it cannot be assured that all debris is removed, the heat exchanger should be replaced.

Draining

Drain the transmission by removing the oil drain plug from the rear/bottom of the transmission. See the illustrations in Section 6.2 or service literature for your transmission for location of transmission and filter drain plugs.

NOTE: Dispose of used oil and oil filters in accordance with federal, state or local laws. Exercise precautions to prevent environmental contamination during any transmission servicing procedure.

Filling

1. Remove the breather or the oil fill closure from the top of transmission case.
2. Pour new oil through breather or closure opening. Fill with recommended clean oil, taking necessary precautions to prevent entry of dirt or debris. (See lubrication plate on transmission and information transcribed to the front of this manual for additional oil information.)

D. Oil Capacity

See the transmission lubrication plate. Capacity given will be the internal quantity required to fill the transmission to its proper level, but may not include the quantity to fill the external hoses and heat exchanger. Check oil level per Section 3.3, Start-Up.

E. Heat Exchanger Check

Heat exchangers furnished by Twin Disc to be used for salt water applications have anodes installed at the inlet and outlet heads. Check these anodes every 30 to 90 days, depending on factors such as coolant conditions, pH factor, and salinity. If over one half of the rod is disintegrated, replace it to assure effective protection. Excessive corrosion of the anode indicates electrolytic action. Make a careful inspection to determine if this action is caused by a short circuit or an external grounded electric current. If either of these conditions is found, do what is required to correct it to avoid frequent replacement of the anodes. If these conditions do not exist, it is evident that the corrosion is due to local electrolysis. If the anodes are corroded with foreign material, use a wire brush to clean them.

F. Suction Strainer

Remove and clean the suction strainer at every oil change or sooner if necessary. See illustrations in Section 6.2 for the location of the suction strainer for your transmission.

G. Flexible Input Coupling

Do not obstruct the flywheel housing vents, which will prevent the free flow of air for cooling the coupling. Life of the coupling may be reduced if the ambient temperature of the air around the coupling is outside the operating range. Operating air temperatures above -6°C (22°F) and below 82°C (180°F) must be maintained. If possible, visually inspect the coupling after the first 100 hours of operation, and every 2000 hours thereafter, or every six months, whichever comes first. Torsional vibration, misalignment, degradation by contaminants (oil), heat, ultraviolet radiation, and excessive system torque can cause cracks or other signs of distress to appear on the surface of the rubber. These conditions affect the life of the coupling element. If coupling access is restricted, inspection may be possible only at engine overhaul or whenever the transmission is separated from the engine. On such units, frequently check the flywheel housing vents. An accumulation of residue at the vents is an indication of coupling deterioration, which can occur from a variety of causes. If an accumulation of residue is found, inspect to determine the cause.

H. Bearing Inspection and Replacement

At the engine overhaul interval, or more frequently, inspect all transmission bearings and replace as necessary.

I. Overhaul Interval

Overhaul the transmission at the same time the engine is overhauled.

4.2 Storage Maintenance Procedures

It is sometimes necessary to store Twin Disc transmissions or boats equipped with Twin Disc components. In order to prevent corrosion damage, the following procedures are recommended:

A. Short Term Storage (Less than One Year)

Transmission installed in a boat on an engine that can be run (boat is in the water).

1. To the extent possible, store boat in a location that minimizes exposure to the elements.
2. Prior to storage, drain the oil and refill to FULL level on the dipstick with recommended new oil. Install a new filter, if applicable. After changing the oil and filter, run the engine long enough to bring the oil to operating temperature. Operate the transmission in all ranges. Shut the engine down.
3. Use only recommended oils to maintain proper levels. Do not use preservative-type oils.
4. Every three months, check the oil level and availability of coolant. Start the engine and run at approximately 1000 rpm to bring the oil temperature up to normal operating range, running the engine at least five minutes. When the transmission oil reaches the normal operating temperature range, set the engine speed to the shift speed range for your transmission and shift into each range. Shut the engine down.
5. Drain and refill with recommended oil and change filters, if applicable, prior to returning unit to regular service.
6. Before returning the transmission to service, check the condition of the anodes in the heat exchanger according to Section 4.1.E.

B. Long Term Storage (More than One Year)

Transmission installed in a boat where the engine cannot be run (boat is out of the water).

1. Use standard recommended oil for the following procedures:
 - a. Once each year, remove dipstick and plug dipstick tube.
 - b. Completely fill the transmission with oil.
 - c. Rotate the output shaft at least five revolutions.
 - d. Partially drain oil, reinstall dipstick, and then drain the oil down to the FULL mark on the dipstick.
2. Seal breather, dipstick tube and all other openings with waterproof tape.
3. Grease exposed members that are subject to corrosion.
4. Every three months rotate output shaft four or five revolutions.
5. Tag transmission to show date it was placed in storage and current status relating to storage procedure.
6. To remove from storage and place in regular service:
 - a. Remove waterproof tape from breather, dipstick tube and all openings.
 - b. Drain oil and remove oil filter.
 - c. Install new oil filter and fill transmission with new recommended oil to FULL mark on dipstick.
 - d. Replace anodes in heat exchanger.

C. Heat Exchanger Storage

When storing a heat exchanger, oil and water ports must be kept sealed. Heat exchangers stored during cold weather must have the water chamber drained to prevent freezing. Take precautions to prevent damage from freezing and corrosion.

NOTES

Section 5

Troubleshooting

5.1 Troubleshooting Tables

The following charts are intended as a guide for determining the cause of problems that could be encountered and the corrective actions for those difficulties.

The transmission is one part of a complete propulsion system. Problems before the transmission (in the engine) or after the transmission (in the output shaft or propeller) can cause problems to develop in the transmission. It is important that the entire propulsion system be considered when transmission problems are encountered.

Note that there are three separate charts on the following pages.

- Troubleshooting charts for standard MG Marine Transmissions
- LED Troubleshooting chart for MG(X) Series of Marine Transmission
- Troubleshooting charts for MG(X) Series of Marine Transmissions

NOTE: Troubleshooting assistance, as well as maintenance, repair and parts service is available from your Twin Disc distributor or service dealer.

Standard MG Chart 1

Symptom	Cause	Remedy
1. Low main oil pressure	1-1. Engine idle speed too low. 1-2. Partially clogged oil strainer 1-3. Stuck pressure regulation piston in selector valve. 1-4. Worn or broken piston rings on clutch shafts or clutch pistons. 1-5. Damaged or worn oil pump assembly. 1-6. Incorrect linkage adjustment to control valve. 1-7. Clogged or plugged orifice in orifice plate. 1-8. Shimming required between inner and outer springs and rate-of-rise piston.	1-1. Raise engine speed to correct idle setting. Recheck main oil pressure. 1-2. Remove and clean oil strainer. 1-3. Disassemble the selector valve and clean the piston. 1-4. Remove the collector and inspect piston rings. Replace damaged piston rings. 1-5. Pump is not serviceable. Replace damaged or worn oil pump assembly. 1-6. Adjust linkage so that control valve stem is indexed by correct detent. 1-7. Remove orifice plate cover. Clean parts. 1-8. Shim as required.
2. No main oil pressure, or low pressure at control valve tap.	2-1. Oil level low. 2-2. Oil pump suction strainer plugged. 2-3. Air leak on suction side of pump. 2-4. Pump drive broken. 2-5. Regulating valve stuck in open position. 2-6. Oil pump defective. 2-7. Leaking heat exchanger has caused oil to be lost overboard.	2-1. Check and correct oil level. 2-2. Remove and clean strainer. 2-3. Correct cause of air leak. 2-4. Disassemble and repair as required. 2-5. Remove, disassemble, clean, and repair the regulating valve. 2-6. Replace oil pump. 2-7. Replace heat exchanger.
3. High main oil pressure.	3-1. Regulating valve stuck. 3-2. Verify location of test port.	3-1. Remove and clean regulating valve. Check valve operation before reinstallation. 3-2. Use recommended oil.

Standard MG Chart 2

Symptom	Cause	Remedy
<p>4. High temperature.</p>	<p>4-1 Improper oil level.</p> <p>4-2 Fault heat exchanger.</p> <p>4-3 Air leak on suction side of pump.</p> <p>4-4 Control valve malfunction.</p> <p>4-5 Clutches slipping.</p> <p>4-6 Bearing failure.</p>	<p>4-1 Check oil level and fill or drain to the proper level with approved oil.</p> <p>4-2 Inspect, and repair or replace the heat exchanger, if necessary.</p> <p>4-3 Inspect for and correct cause of leak on suction side of pump.</p> <p>4-4 Inspect, and repair or replace control valve.</p> <p>4-5 Check clutch apply oil pressure. If the pressure is normal, remove, disassemble, and repair the slipping clutch. If pressure is low, replace the proportional valve, and service the transmission oil filter.</p> <p>4-6 Overhaul the marine transmission.</p>
<p>5. Excessive transmission noise.</p>	<p>5-1 Misfiring engine.</p> <p>5-2 Improper alignment.</p> <p>5-3 Excessive torsional vibration.</p> <p>5-4 Worn or damaged input coupling.</p> <p>5-5 Damaged propeller.</p> <p>5-6 Worn or damaged gears.</p> <p>5-7 Bearing failure.</p>	<p>5-1 Repair the engine.</p> <p>5-2 Check the alignment of engine and transmission output flange to the propeller shaft. Correct as necessary.</p> <p>5-3 Select proper torsional the coupling.</p> <p>5-4 Remove marine transmission. Replace the coupling if worn or damaged.</p> <p>5-5 Repair propeller.</p> <p>5-6 Overhaul marine the transmission.</p> <p>5-7 Overhaul marine the transmission.</p>

Standard MG Chart 3

Symptom	Cause	Remedy
6. No neutral. Neutral selected, but boat continues to move.	6-1. Control valve incorrectly indexed. 6-2. Worn seal rings. 6-3. Broken or faulty clutch linkage. 6-4. Clutch plates warped.	6-1. Check and adjust control linkage. 6-2. Check clutch apply pressure. Replace seal rings as necessary. 6-3. Repair control linkage. 6-4. Overhaul unit and replace clutch plates.
7. Harsh engagement.	7-1. Engine speed too high. 7-2. Orifice plate ball in control valve not seating properly. 7-3. Regulating piston or rate-of-rise piston stuck.	7-1. Reduce engine speed to correct shift speed. 7-2. Remove orifice plate cover. Clean parts. Replace parts if necessary. 7-3. Disassemble control valve. Clean parts. Replace parts if necessary.
8. Low lube oil pressure.	8-1. Air leak on suction side of pump. 8-2. Pump suction strainer plugged. 8-3. Lube relief valve stuck open. 8-4. Damaged piston rings. 8-5. Pump output too low.	8-1. Inspect and correct cause of suction leak. 8-2. Remove, clean, inspect, and install the suction screen. 8-3. Remove and clean or replace parts as necessary. Check operation before reinstallation. 8-4. Replace damaged piston rings. 8-5. Replace pump.
9. Oil escaping from breather.	9-1. Oil level too high. 9-2. Incorrect type of oil.	9-1. Correct oil level. 9-2. Drain and refill with recommended type of oil.

MG(X) Series LED Chart

Light Status	Profile Generator (Non-trolling)	E- troll Module
Green light on (Illuminated only when Clutch A or B is selected. Not illuminated in Neu- tral.)	Supply Voltage > 9.0 Volts	Supply Voltage > 9.0 Volts
Red light on	Valve coil commanded on	Valve coil commanded on
One red light flashing	Open circuit in an ener- gized valve coil circuit	Open circuit in an ener- gized valve coil circuit, or valve coil leads shorted to- gether, or low coil current
Both red lights flashing simultaneously	Not applicable	After entering troll from neutral with both voltage and current troll signals present, or power is applied to Solenoid A and B switch inputs at the same time.
Both red lights flashing alternately	Not applicable	Either or both speed signals missing.

MG(X) Series Chart 1		
Symptom	Cause	Remedy
1. Low main oil pressure	1-1. Engine idle speed too low. 1-2. Partially clogged oil strainer 1-3. Contamination on pilot relief valve seat. 1-4. Contamination in main valve cartridge. 1-5. Broken piston rings on clutch shaft(s). 1-6. Damaged or worn oil pump assembly.	1-1. Raise engine speed. 1-2. Remove and clean oil strainer 1-3. Disassemble the pilot relief valve and clean. Service the transmission oil filter. 1-4. Clean or replace the main valve cartridge, and service the transmission oil filter. 1-5. Remove the collector and inspect piston rings. 1-6. Replace damaged or worn oil pump assembly (pump is not serviceable).
2. No oil pressure or erratic low pressure at control valve.	2-1. Oil level low. 2-2. Oil pump suction strainer plugged. 2-3. Air leak on suction side of pump. 2-4. Pump drive failed. 2-5. Regulating valve stuck in open position. 2-6. Oil pump failed. 2-7. Leaking heat exchanger has caused oil to be lost overboard.	2-1. Check and correct oil level. 2-2. Remove and clean oil strainer. 2-3. Correct cause of air leak. 2-4. Disassemble and repair as required. 2-5. Remove, disassemble, clean, and repair the valve. 2-6. Replace oil pump. 2-7. Replace heat exchanger.
3. High main oil pressure.	3-1. Regulating valve stuck. 3-2. Wrong oil type.	3-1. Remove and clean regulating valve. 3-2. Drain and refill with recommended oil type.

MG(X) Series Chart 2

Symptom	Cause	Remedy
<p>4. High Temperature.</p>	<p>4-1. Incorrect oil level (high or low).</p> <p>4-2. Air leak on suction side of pump.</p> <p>4-3. Failed heat exchanger (if used).</p> <p>4-4. Blockage in heat exchanger line restricting flow of oil or cooling water through heat exchanger.</p> <p>4-5. Clutch is slipping.</p> <p>4-6. Bearing failure.</p>	<p>4-1. Check oil level. Drain, or fill to correct oil level with recommended oil.</p> <p>4-2. Determine and correct the cause of the suction leak.</p> <p>4-3. Inspect, clean, repair, or replace heat exchanger.</p> <p>4-4. Clear or replace blocked line.</p> <p>4-5. Check clutch-apply oil pressure. If pressure is normal, remove, disassemble, and repair slipping clutch. If oil pressure is not in the correct range, determine the cause and repair as described in troubleshooting sections 1, 2, and 3. Sequence valve may need to be replaced.</p> <p>4-6. Overhaul the transmission.</p>

SECTION 5

<p>5. Excessive noise.</p>	<p>5-1. Gear rattle from torsional vibration. 5-2. Misfiring engine. 5-3. Incorrect alignment.</p> <p>5-4. Damaged propeller. 5-5. Worn or damaged input coupling.</p> <p>5-6. Worn or damaged gears. 5-7. Bearing failure.</p>	<p>5-1. Raise the low idle setting. 5-2. Repair the engine. 5-3. Check the alignment of the engine and transmission, and the transmission output flange to the propeller shaft. Eliminate any misalignment. 5-4. Replace the propeller. 5-5. Remove the transmission. Replace the coupling if worn or damaged. 5-6. Overhaul the transmission. 5-7. Overhaul the transmission.</p>
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MG(X) Series Chart 3		
Symptom	Cause	Remedy
6. No neutral	6-1. Clutch plates warped. 6-2. Disengaged clutch has apply pressure.	6-1. Remove clutch plates. Overhaul unit. 6-2. Replace proportional valve. Service transmission oil filter.
7. Harsh engagement or no engagement	7-1. Faulty proportional valve. 7-2. Faulty temperature sensor (if equipped). 7-3. Profile generator defective or out of adjustment. 7-4. Faulty sequence valve.	7-1. Replace proportional valve. 7-2. Replace temperature sensor. 7-3. Replace profile generator. Adjust if proper equipment is available. 7-4. Replace sequence valve.
8. Low lube oil pressure.	8-1. Pump output flow too low. 8-2. Pump suction strainer plugged. 8-3. Air leak on suction side of pump. 8-4. Lube relief valve malfunction. 8-5. Broken piston rings.	8-1. Replace pump. 8-2. Remove, clean, inspect, and reinstall the suction screen. 8-3. Inspect and correct cause of suction leaks. 8-4. Remove and clean or replace parts as necessary. 8-5. Replace damaged piston rings.
9. Oil spilling out of breather.	9-1. Oil level too high. 9-2. Wrong type of oil.	9-1. Adjust oil level. 9-2. Draw and refill with recommended oil.
10. Low clutch-apply pressure	10-1.Low main pressure. 10-2.Defective proportional valve. 10-3.Low voltage to profile generator. 10-4.Internal clutch leakage.	10-1.See Paragraph 1. 10-2.Replace proportional valve. 10-3.Verify that green (voltage supply) light, and red (clutch energized) lights are bright. 10-4.Rebuild transmission.

Figure 5-1. Oil Pressure Alarm Settings, by Model

Model	Pv(4) Valve Pressure Nominal			Low Pressure Alarm			Engine Shutoff Alarm		
	psi	kPa	bar	psi	kPa	bar	psi	kPa	bar
MG-5050 Series	320	2205	22.1	290	2000	20	270	1860	18.6
MG-5061 Series	320	2205	22.1	290	2000	20	270	1860	18.6
MG(X)-5065 Series	390	2690	26.9	340	2345	23.5	320	2205	22.1
MG-5075 Series	340	2345	23.5	310	2135	21.4	290	2000	20.0
MG(X)-5075 Series	340	2345	23.5	330	2275	22.8	310	2135	21.4
MG(X)-5086 Series	340	2345	23.5	330	2275	22.8	310	2135	21.4
MG-5091 Series	230	1585	15.9	200	1380	13.8	180	1240	12.4
MG-5091 Series	270	1860	18.6	240	1655	16.6	220	1515	15.2
MG(X)-5095 Series	270	1860	18.6	240	1655	16.6	220	1515	15.2
MG(X)-5114 Series	250	1725	17.3	230	1585	15.9	220	1515	15.2
MG(X)-5135 Series	270	1860	18.6	250	1725	17.3	230	1585	15.9
MG(X)-5147 Series	300	2070	20.7	270	1860	18.6	250	1725	17.3
MG(X)-516	250	1725	17.3	220	1515	15.2	205	1415	14.2
MG(X)-5170DC	250	1725	17.3	220	1515	15.2	205	1415	14.2
MG(X)-5202SC Series, MG(X)- 5204SC Series, MG(X)-5222DC	250	1725	17.3	230	1585	15.9	215	1480	14.8
MG(X)-5225DC	250	1725	17.3	230	1585	15.9	215	1480	14.8
MG(X)-5321DC	290	2000	20.0	280	1930	19.3	265	1825	18.3
MG-5600	250	1725	17.3	240	1655	16.6	220	1515	15.2
MG-5600	290	2000	20.0	230	1585	15.9	210	1450	14.5
MG(X)-5600	250	1725	17.3	240	1655	16.6	230	1585	15.9
MG(X)-5600DR	290	2000	20.0	280	1930	19.3	260	1795	18.0
MG(X)-6598 Series	350	2415	24.2	300	2070	20.7	280	1930	19.3
MG(X)-6599 Series	350	2415	24.2	300	2070	20.7	280	1930	19.3
MG(X)-6620 Series	350	2415	24.2	300	2070	20.7	280	1930	19.3
MG(X)-6690SC	350	2415	24.2	340	2345	23.5	330	2275	22.8
MG(X)-6848SC	350	2415	24.2	340	2345	23.5	330	2275	22.8
MG(X)-61000SC	350	2415	24.2	330	2275	22.8	310	2135	21.4
MG(X)-61242SC	355	2450	24.5	330	2275	22.8	310	2135	21.4
MG(X)-61500SC	350	2415	24.2	320	2205	22.1	300	2070	20.7
MG(X)-61500SC- HL & -HR	350	2415	24.2	320	2205	22.1	300	2070	20.7
MG(X)-62000SC- HL & -HR	350	2415	24.2	320	2205	22.1	300	2070	20.7

Figure 5-2. Oil Operating Temperature Limits

Model	SAE 30				SAE 40			
	Minimum		Maximum		Minimum		Maximum	
	°C	°F	°C	°F	°C	°F	°C	°F
MG-5050 Series	65	150	85	185	80	175	93	200
MG-5061 Series	65	150	85	185	80	175	93	200
MG(X)-5065 Series	65	150	85	185	65	150	85	185
MG-5075 Series	65	150	85	185	65	150	85	185
MG(X)-5075 Series	65	150	85	185	65	150	85	185
MG(X)-5086 Series	65	150	85	185	65	150	85	185
MG-5091 Series	65	150	85	185	65	150	85	185
MG(X)-5095 Series	65	150	85	185	65	150	85	185
MG(X)-5114 Series	65	150	85	185	65	150	85	185
MG(X)-5135 Series	65	150	85	185	80	175	93	200
MG(X)-5145 Series	65	150	85	185	80	175	93	200
MG(X)-5147 Series	65	150	85	185	80	175	93	200
MG(X)-516	65	150	85	185	65	150	85	185
					SAE 50			
					°C	°F	°C	°F
MG(X)-516 (continued)					80	175	93	200
	SAE 40				SAE 50			
	°C	°F	°C	°F	°C	°F	°C	°F
MG(X)-5170DC	65	150	85	185	80	175	93	200
MG(X)-5202SC Series, MG(X)-5204SC Series, MG(X)-5147DC	65	150	85	185	80	175	93	200
MG(X)-5225DC	65	150	85	185	80	175	93	200
MG(X)-5321DC	65	150	85	185	80	175	93	200
MG(X)-5600	65	150	85	185	80	175	93	200
MG(X)-5600DR	65	150	85	185	80	175	93	200
MG(X)-6598 Series	65	150	93	200				
MG(X)-6599 Series	65	150	93	200				
MG(X)-6620 Series	65	150	93	200				
MG(X)-6650SC	65	150	85	185	80	175	93	200
MG(X)-6690SC	65	150	85	185	80	175	93	200
MG(X)-6848SC	65	150	85	185	80	175	93	200
MG(X)-61000SC	65	150	85	185	80	175	93	200
MG(X)-61500SC	65	150	85	185	80	175	93	200
MG(X)-61500SC-HL & HR	65	150	85	185	80	175	93	200
MG(X)-62000SC- HL & HR	65	150	85	185	80	175	93	200

Note: for reference only. Please consult your local Twin Disc authorized distributor for up-to-date information.

NOTES

Section 6

Appendix

6.1 Accessories and Optional Equipment

Optional accessories are available for use with Twin Disc marine transmissions. Contact your local Twin Disc distributor for specific information on items to fit your transmission and the procedures for installation.

The following items are available for all units:

1. Oil Temperature Gauges – Used to monitor transmission sump oil temperature. Scales are calibrated in Celsius and Fahrenheit ranges.
2. Oil Pressure Gauges – Used to monitor main (clutch apply) oil pressure. Scales are calibrated in kilopascal and pound-force-per-square-inch ranges. The use of oil pressure gauges is required for all installations.
3. Output Shaft Companion Flanges – Used to connect the transmission output flange with the vessel propeller shaft and possible shaft break.
4. Hub to Fit Flexible Input Couplings – Provides the connection between the engine-driven coupling and the transmission input shaft.
5. Trolling Valves – Used to reduce propeller speed below what can be obtained by operating the engine at low idle (e.g. trolling operations and operating in no-wake areas).

6. Filter by-pass indicator switch - to announce when filter needs to be changed.
7. Switches and transducers - for monitoring oil pressures, speeds, and oil temperatures.
8. Heat Exchangers – Use to control and maintain hydraulic system oil temperature at the proper level. Thermostatic bypass valves are available for use where needed. Contact your Twin Disc distributor for specific cooling information and recommendations to fit your transmission installation.

The following options and accessories are available for use where needed. Contact your Twin Disc distributor for specific cooling information on items compatible with your transmission installation.

1. Front-Mount Power Takeoffs – Used to drive a variety of items such as pumps, compressors, and generators. Equipped with spring-loaded clutches housing one or two driving plates. Available in a variety of SAE housing sizes and plate diameters.
2. Clutch Controlled Power Takeoffs – Lever actuated or hydraulically applied clutch models are available.
3. Live Power Takeoffs – Provides live power to accessories at all times the engine is running.
4. Electric Solenoid Valves – Used to select FORWARD, NEUTRAL, or REVERSE. Available in 12 and 24-volt DC power configurations. Must be mated with a control system for selection of the desired range.
5. Flexible Input Coupling – Used to reduce gear rattle caused by input vibrations.
6. Trailing Pump – Used to supply oil pressure for lubrication during windmilling or backdriving situations.

6.2 Marine Transmission Illustrations

The following illustrations are representative of Twin Disc Marine Transmissions. These illustrations show the general locations of the following components and other important components.

- Oil Fill
- Oil Level Gauge
- Oil Drain
- Breather
- Suction Strainer
- Oil Out To Heat Exchanger
- Oil In From Heat Exchanger
- Main Pressure Port
- Primary Shaft Clutch Solenoid
- Secondary Shaft Clutch Solenoid
- Manual Override Valve

SECTION 6

To find the illustration that matches your transmission model, look up the model number on the following chart and go to the referenced Figure.

NOTE: The illustrations identified by figure number are accurate for the general location of features; however, they may not be an exact depiction of all design variations. If more specific information is needed on your marine transmission's features, please refer to your service manual.

Transmission Model	Figure Number
MG-5050SC	6-1
MG-5061SC	6-2
MG-5075SC	6-3
MG-5091SC	6-4
MGX-5065SC	6-5
MGX-5075IV	6-6
MGX-5086A	6-7
MGX-5095SC	6-8
MGX-5114A	6-9
MGX-5114IV	6-10
MGX-5114SC	6-11
MGX-5126A	6-12
MGX-5135A	6-13
MGX-5135RV	6-14
MGX-5135SC	6-15
MGX-5136A	6-16
MGX-5136RV	6-17
MGX-5136SC	6-18
MGX-5147A	6-19
MGX-516	6-20
MGX-5170DC	6-21
MGX-5202SC	6-22
MGX-5204SC	6-23
MGX-5222DC, MGX-5225DC	6-24

Transmission Model	Figure Number
MGX-5321DC	6-25
MG-5600	6-26
MGX-5600	6-27
MGX-5600DR	6-28
MGX-6598DC	6-29
MGX-6599A	6-30
MGX-6599RV	6-31
MGX-6599SC	6-32
MGX-6620A	6-33
MGX-6620RV	6-34
MGX-6620SC	6-35
MGX-6690SC, MGX-6848SC	6-36
MGX-61000SC	6-37
MG-61242SC	6-38
MGX-61500SC	6-39
MGX-61500SC-HL, MGX-62000SC-HL	6-40
MGX-61500SC-HR, MGX-62000SC-HR	6-41

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Figure 6-1. MG-5050SC (1 of 2)

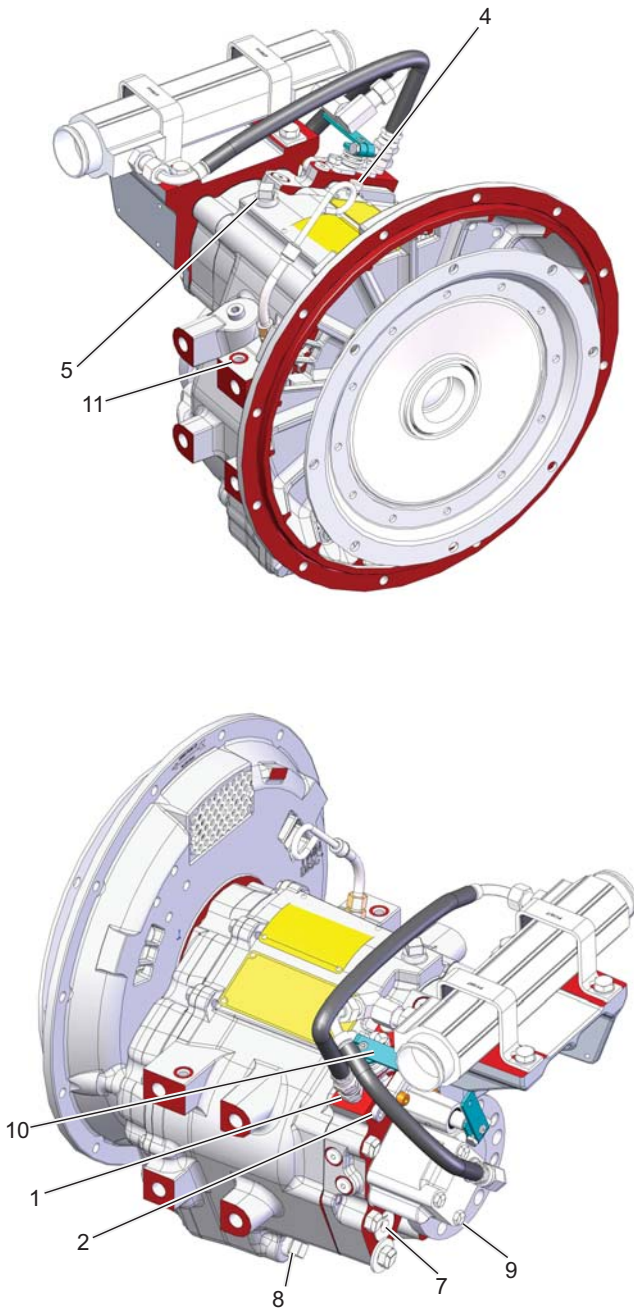
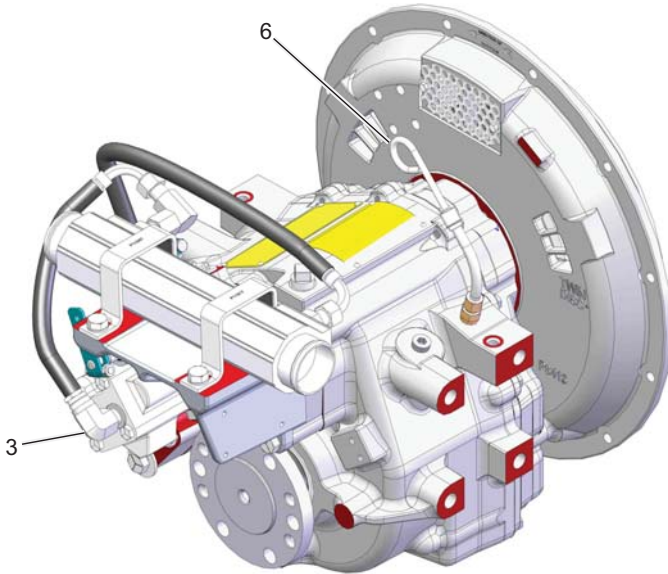


Figure 6-1. MG-5050SC (2 of 2)



MG-5050SC Callout List - Figure 6-1

Callout	Component
1.	Oil in from heat exchanger
2.	Alternate oil in from heat exchanger
3.	Oil out to heat exchanger
4.	Breather
5.	Oil fill port
6.	Oil level gauge
7.	Suction screen
8.	Oil drain plug
9.	Oil pump
10.	Control valve selector lever
11.	Holes for eyebolts for lifting marine transmission

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Figure 6-2. MG-5061SC (1 of 2)

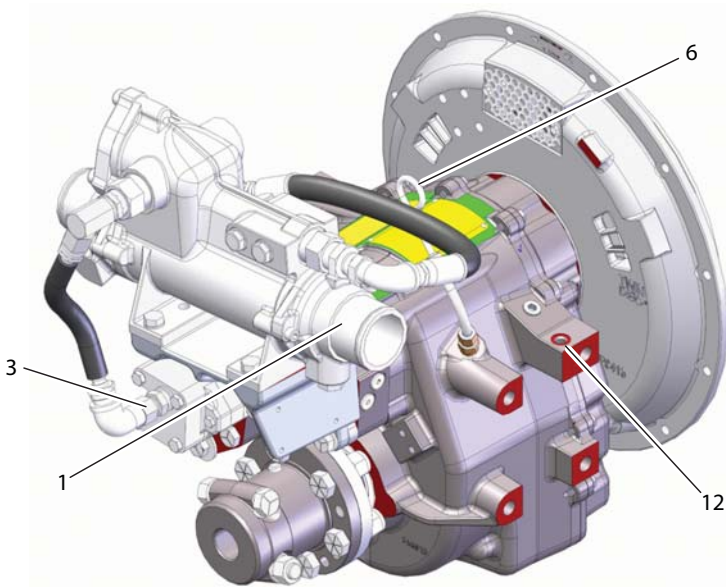
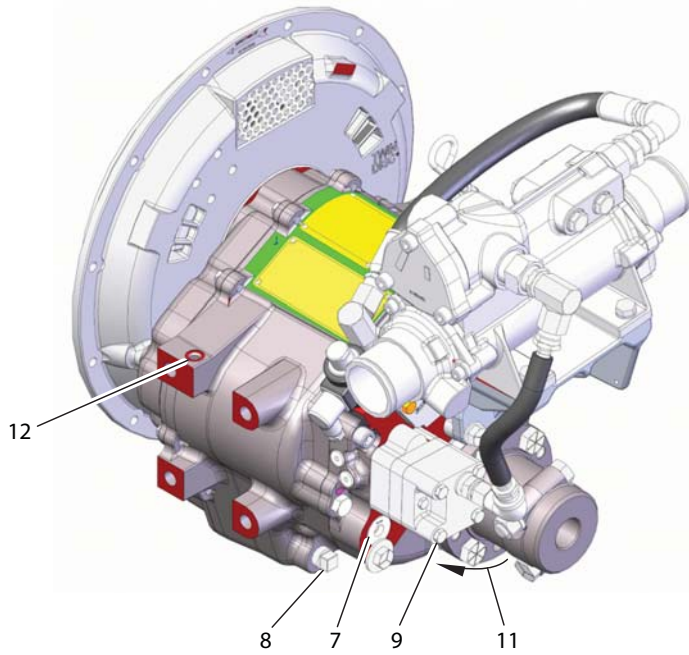
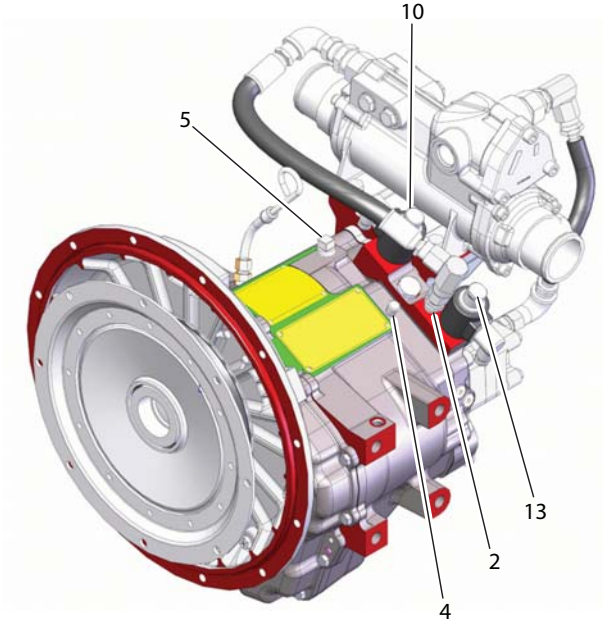


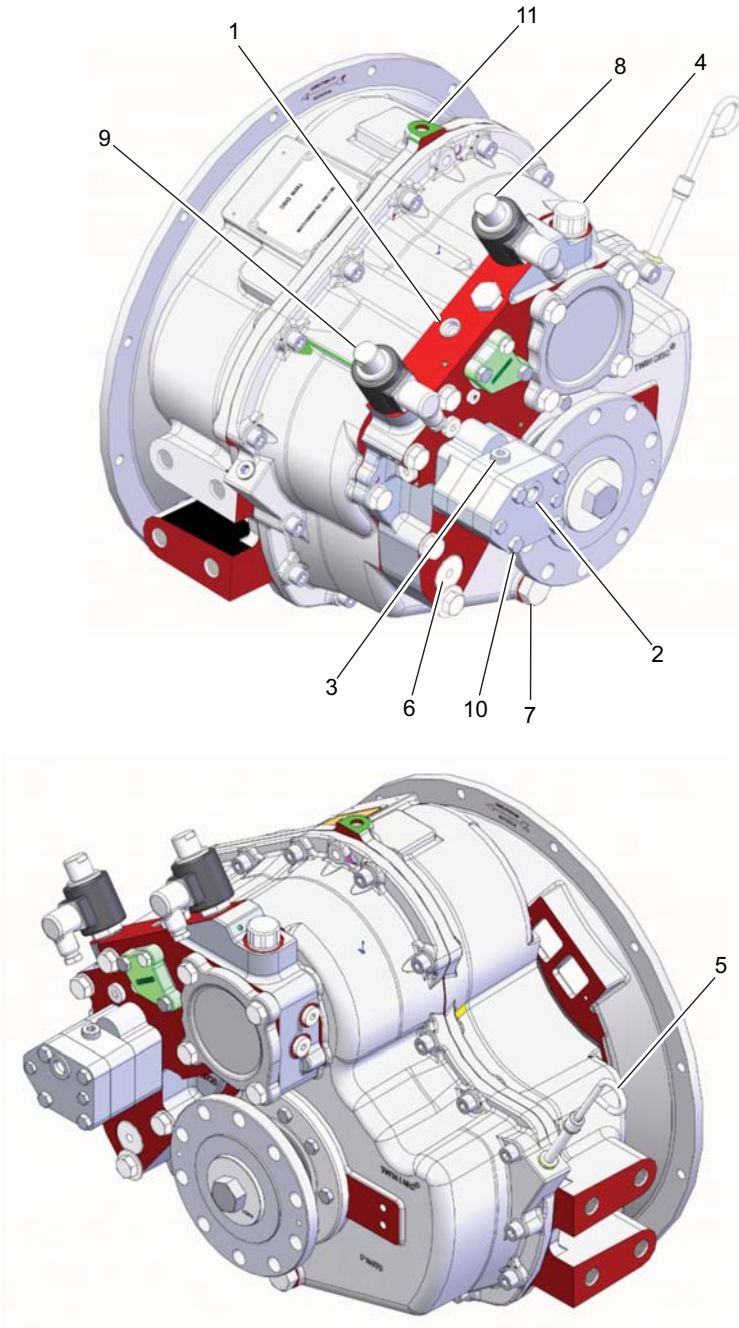
Figure 6-2. MG-5061SC (2 of 2)



MG-5061SC Callout List - Figure 6-2

Callout	Component
1.	Heat exchanger
2.	Oil-in from heat exchanger
3.	Oil-out to heat exchanger
4.	Breather
5.	Oil fill port and oil level gauge
6.	Oil level gauge
7.	Suction screen
8.	Oil drain plug
9.	Main pump
10.	Primary clutch actuating solenoid
11.	Forward, with right hand engine rotation driven through forward clutch
12.	Holes for eyebolts for lifting marine transmission
13.	Secondary clutch actuating solenoid

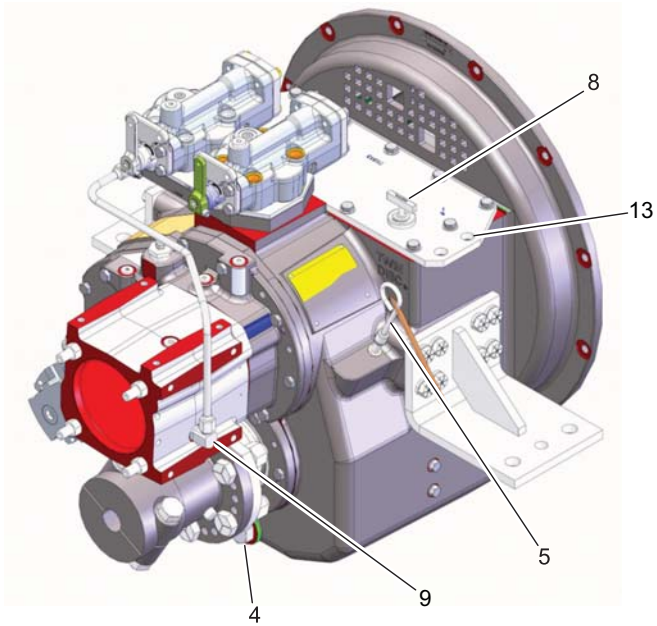
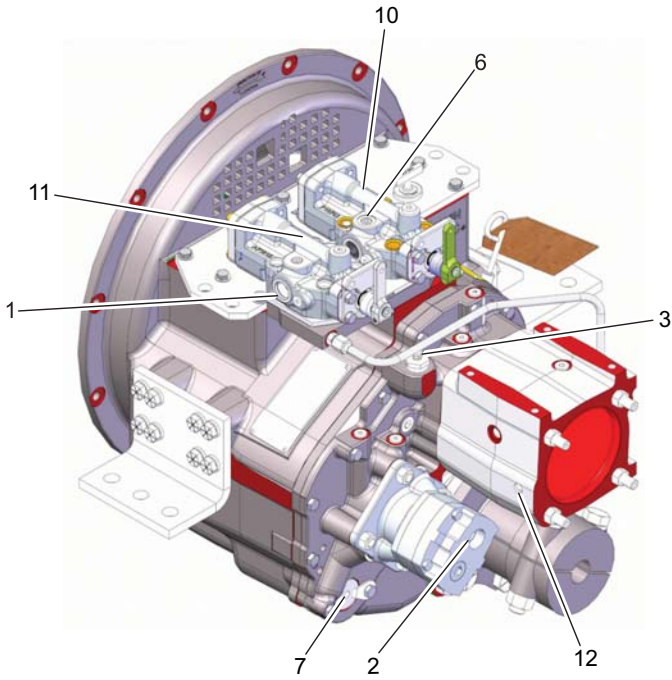
Figure 6-3. MG-5075SC



MG-5075SC Callout List - Figure 6-3

Callout	Component
1.	Oil-in from heat exchanger
2.	Oil-out to heat exchanger
3.	Alternate oil-out to heat exchanger
4.	Breather and oil fill
5.	Oil level gauge
6.	Suction screen
7.	Oil drain plug
8.	Primary solenoid
9.	Secondary solenoid
10.	Hydraulic pump
11.	Holes for eyebolts for lifting marine transmission

Figure 6-4. MG-5091SC



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MG-5091SC Callout List - Figure 6-4

Callout	Component
1.	Oil-in from heat exchanger
2.	Oil-out to heat exchanger
3.	Breather
4.	Oil drain plug
5.	Oil level gauge
6.	Main oil pressure port
7.	Suction screen
8.	Oil fill port
9.	PTO pressure port
10.	Transmission control valve
11.	Hydraulic PTO control valve
12.	PTO oil drain to transmission sump
13.	Holes for eyebolts for lifting marine transmission

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Figure 6-5. MGX-5065SC (1 of 2)

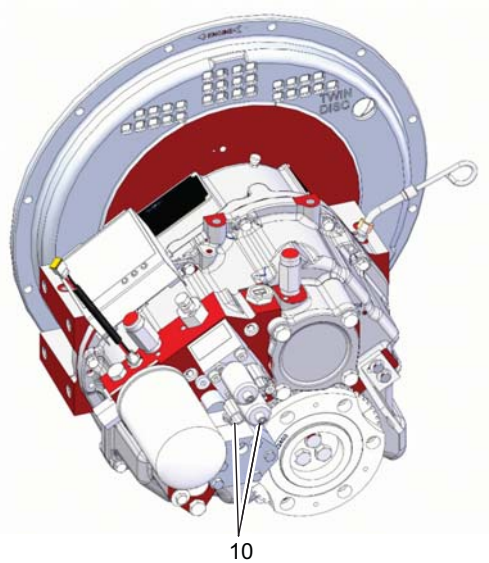
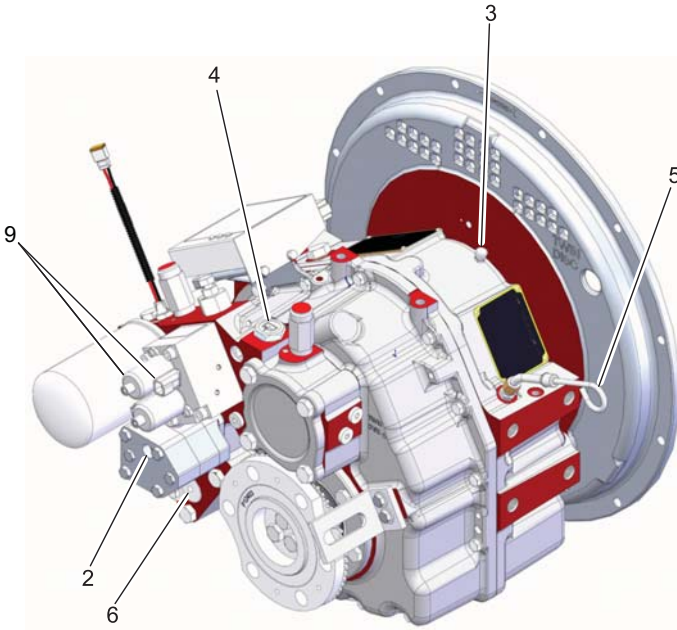
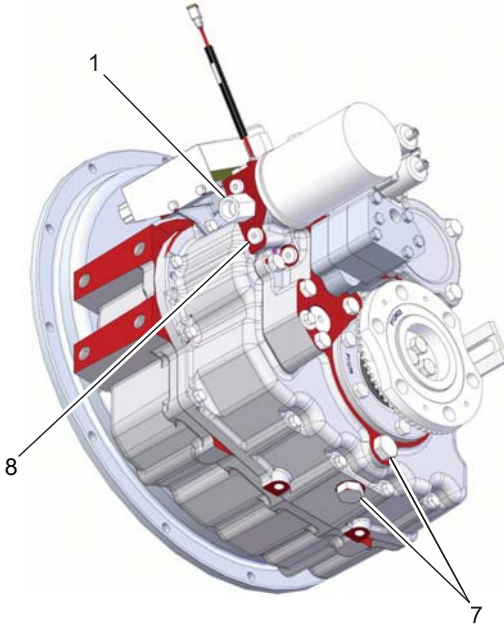


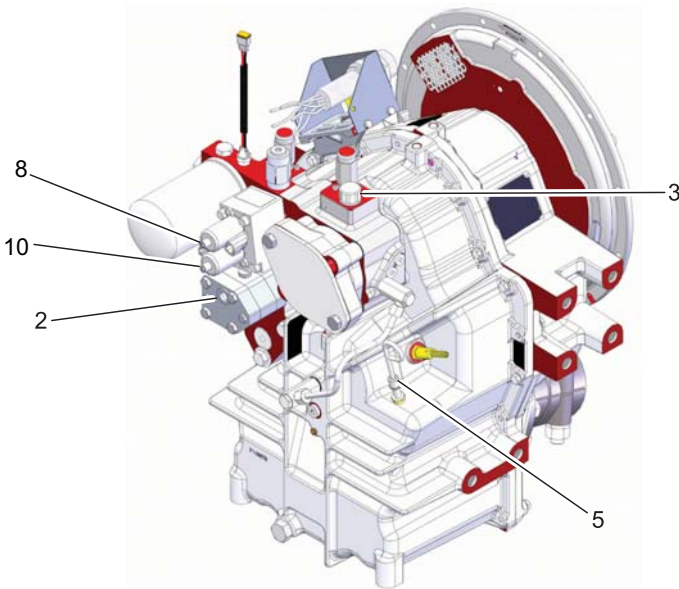
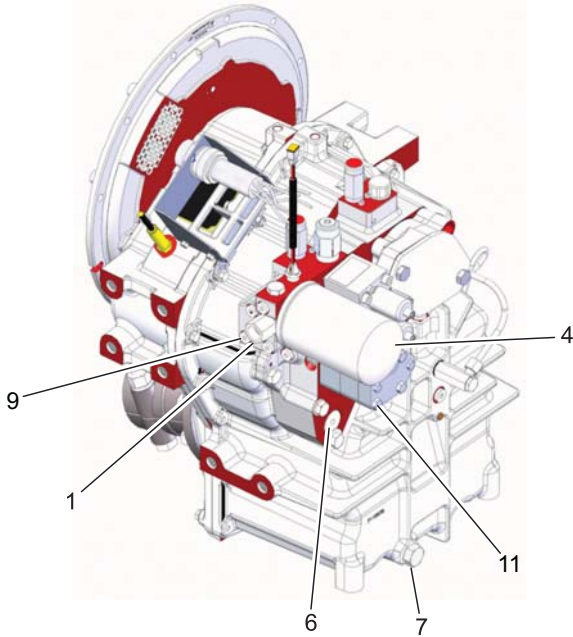
Figure 6-5. MGX-5065SC (2 of 2)



MGX-5065SC Callout List - Figure 6-5

Callout	Component
1.	Oil-in from heat exchanger
2.	Oil-out to heat exchanger
3.	Breather
4.	Oil fill port
5.	Oil level gauge
6.	Oil strainer
7.	Oil drain plug
8.	Main pressure port
9.	Proportional control valve (engages primary clutch)
10.	Proportional control valve (engages secondary clutch)

Figure 6-6. MGX-5075IV



MGX-5075IV Callout List - Figure 6-6

Callout	Component
1.	Oil-in from heat exchanger
2.	Oil-out to heat exchanger
3.	Breather and oil fill port
4.	Oil filter
5.	Oil level gauge
6.	Oil strainer
7.	Oil drain plug
8.	Primary clutch proportional valve
9.	Secondary clutch (first) pressure port
10.	Secondary clutch proportional valve
11.	Oil pump

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Figure 6-7. MGX-5086A (1 of 2)

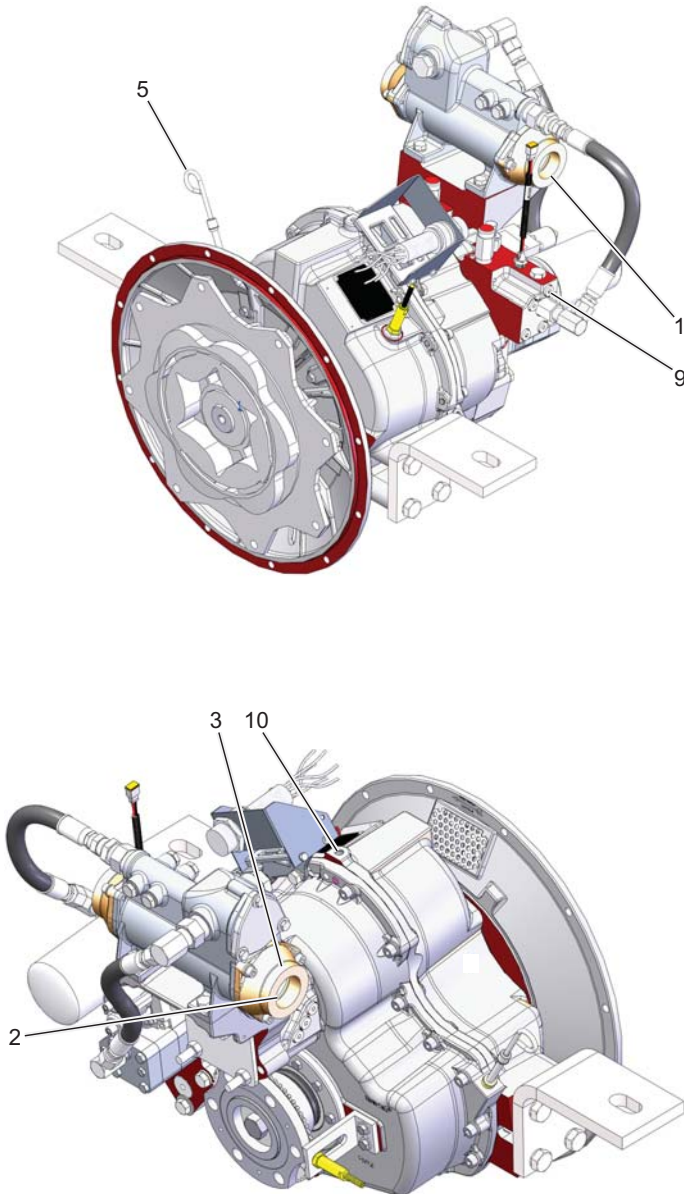
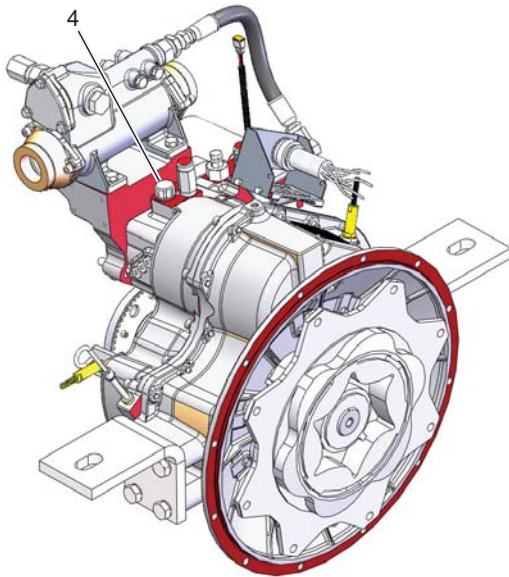
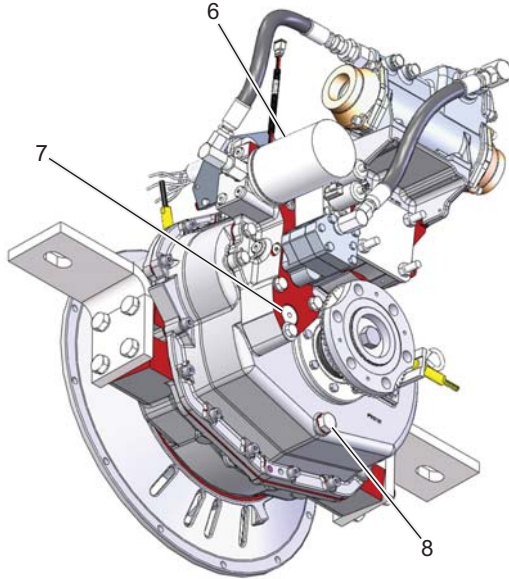


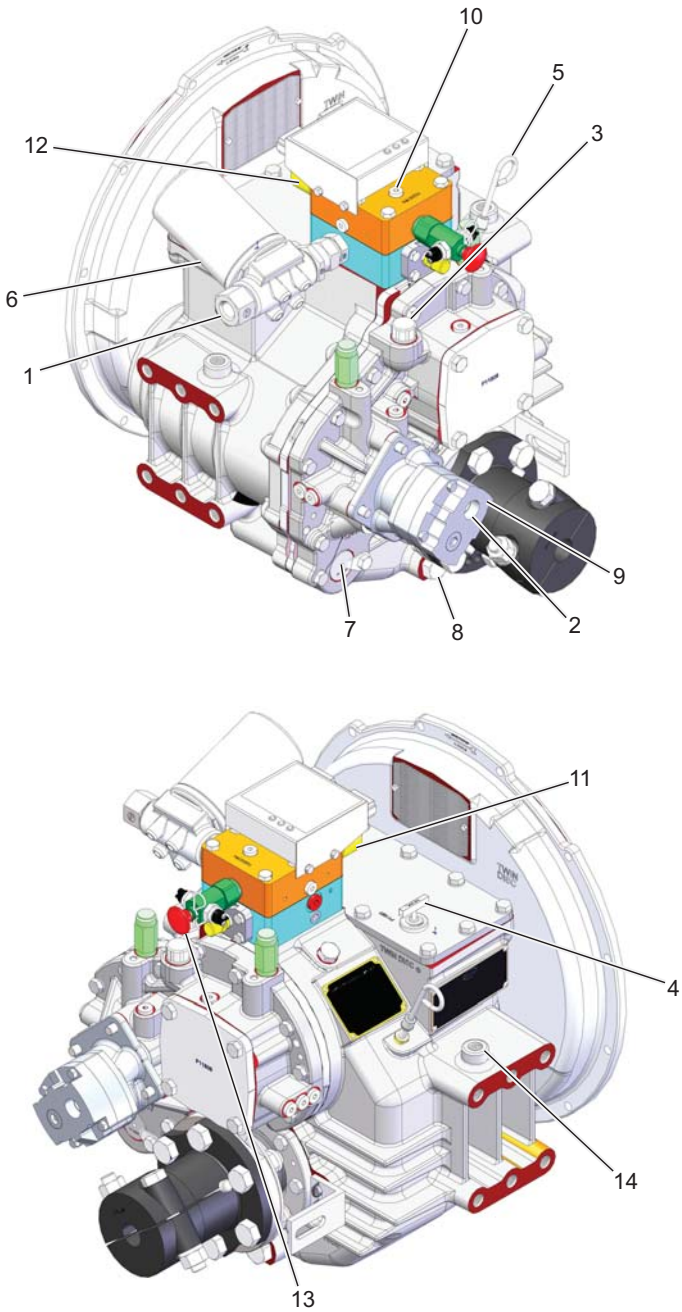
Figure 6-7. MGX-5086A (2 of 2)



MGX-5086A Callout List - Figure 6-7

Callout	Component
1.	Water in to heat exchanger
2.	Water out from heat exchanger
3.	Heat exchanger
4.	Breather and oil fill port
5.	Oil level gauge
6.	Filter
7.	Oil strainer
8.	Oil drain plug
9.	Main pressure port
10.	Holes for eyebolts for lifting marine transmission

Figure 6-8. MGX-5095SC



MGX-5095SC Callout List - Figure 6-8

Callout	Component
1.	Oil in from heat exchanger
2.	Oil out to heat exchanger
3.	Breather and oil fill port
4.	Oil fill port when engine is not running
5.	Oil level gauge
6.	Filter
7.	Suction screen
8.	Oil drain plug
9.	Oil pump
10.	Main pressure port
11.	Primary solenoid
12.	Secondary solenoid
13.	Manual override valve
14.	Holes for eyebolts for lifting marine transmission

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Figure 6-9. MGX-5114A (1 of 2)

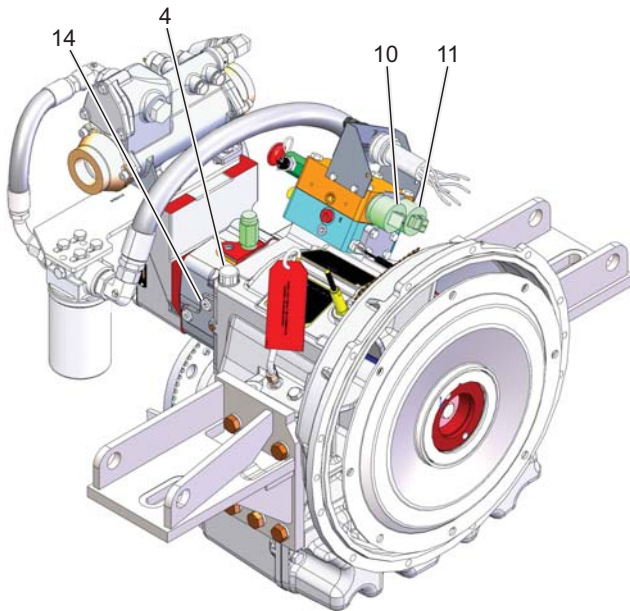
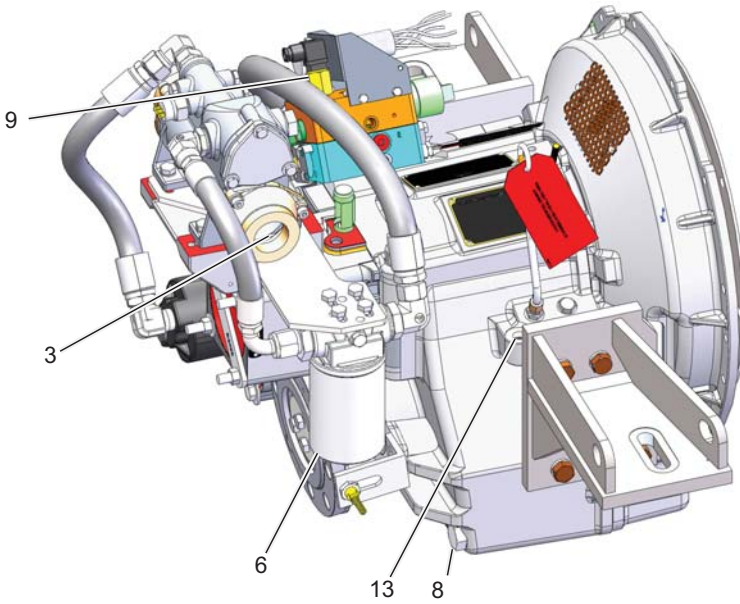
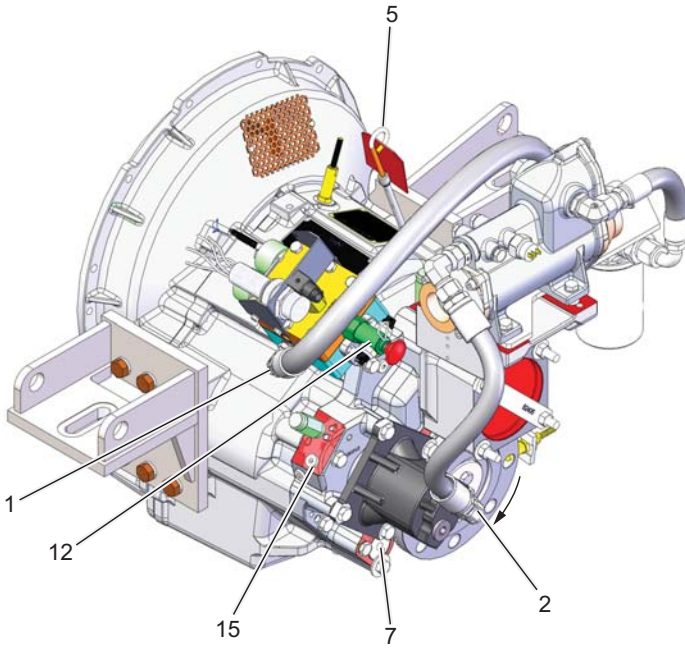


Figure 6-9. MGX-5114A (2 of 2)

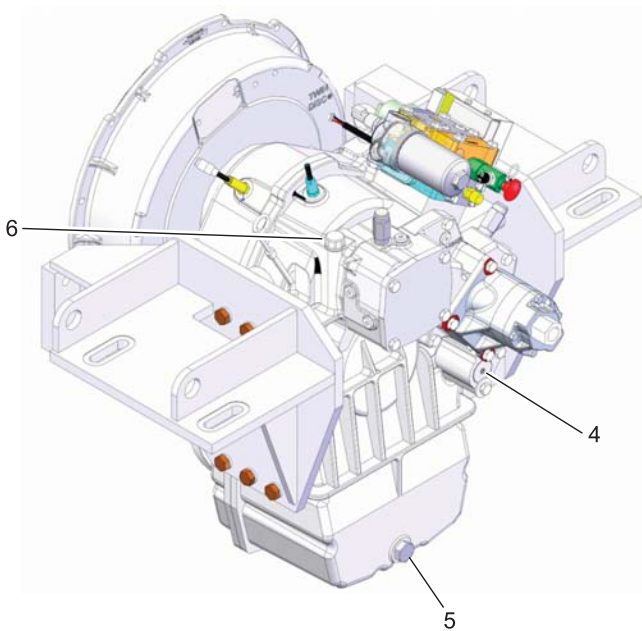
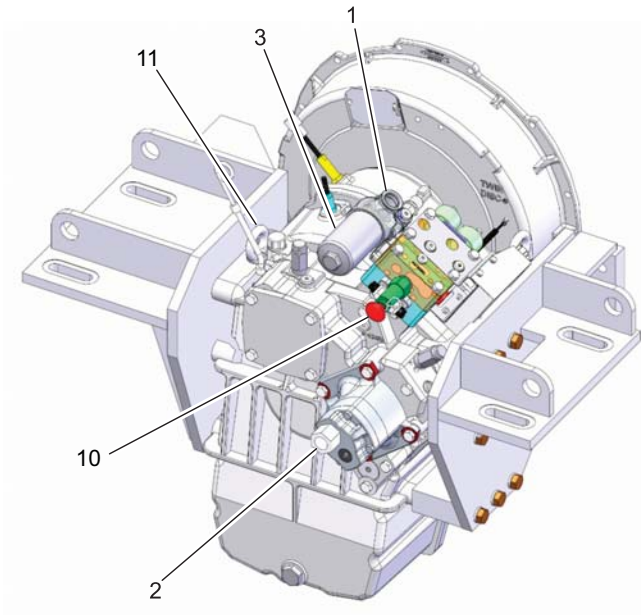


MGX-5114A Callout List - Figure 6-9

Callout	Component
1.	Oil in from heat exchanger
2.	Oil out to heat exchanger
3.	Heat exchanger
4.	Breather and oil fill port
5.	Oil level gauge
6.	Filter
7.	Oil strainer
8.	Oil drain plug
9.	Main pressure port
10.	Primary solenoid
11.	Secondary solenoid
12.	Manual override valve
13.	Holes for eyebolts for lifting marine transmission
14.	Primary clutch pressure port
15.	

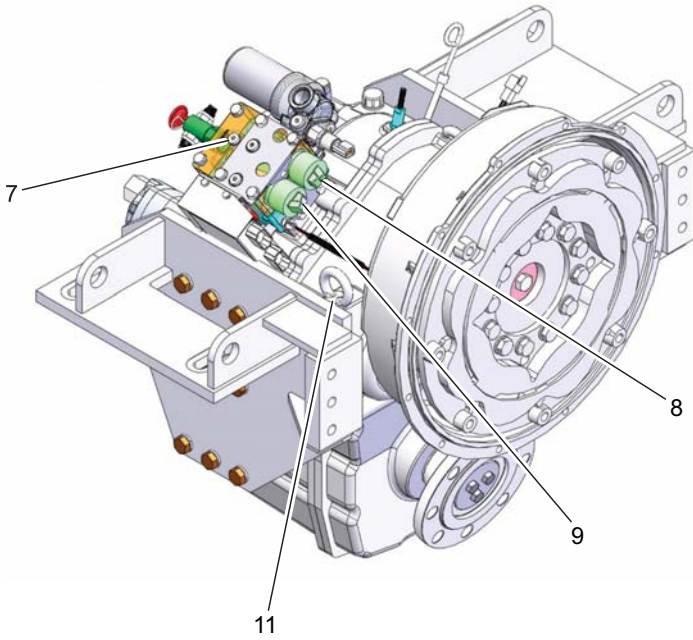
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Figure 6-10. MGX-5114IV (1 of 2)



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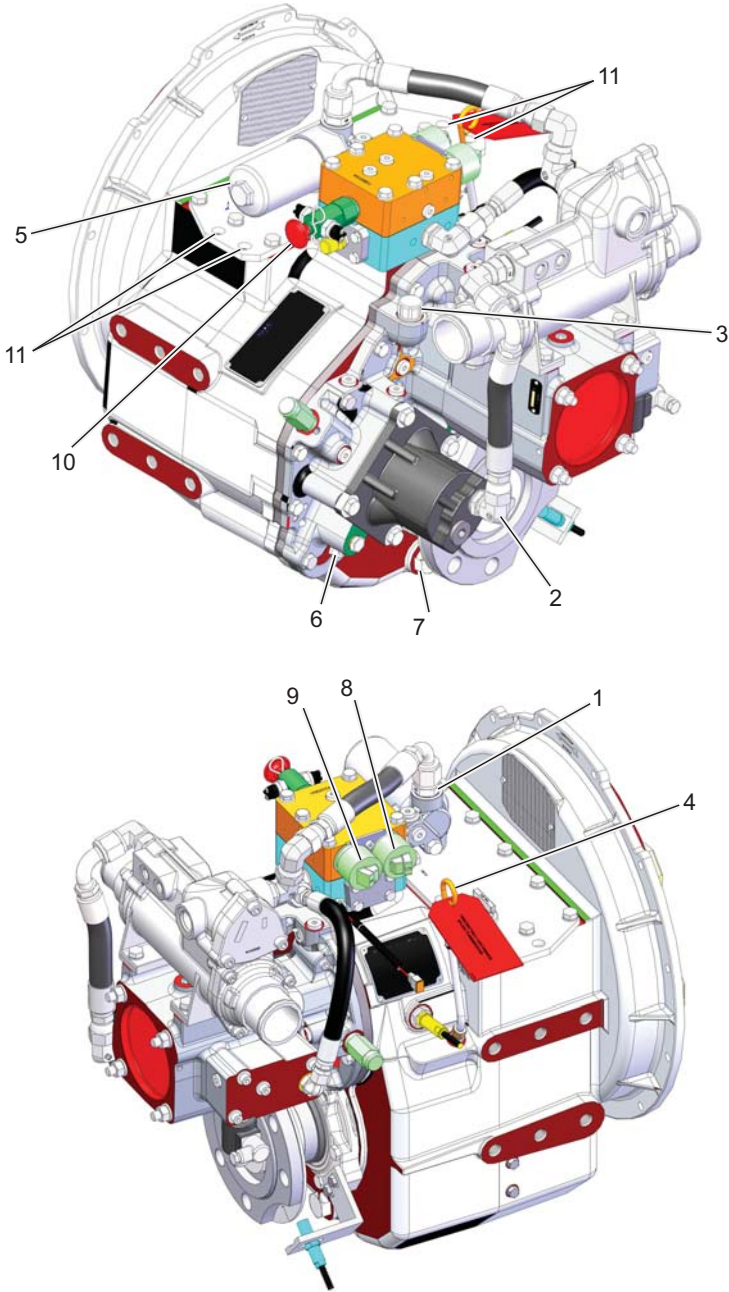
Figure 6-10. MGX-5114IV (2 of 2)



MGX-5114IV Callout List - Figure 6-10

Callout	Component
1.	Oil inlet from heat exchanger
2.	Oil outlet to heat exchanger
3.	Oil filter
4.	Oil strainer
5.	Oil drain plug
6.	Oil fill plug
7.	Main pressure port
8.	Primary solenoid
9.	Secondary solenoid
10.	Manual override valve
11.	Eyebolts for lifting marine transmission

Figure 6-11. MGX-5114SC



MGX-5114SC Callout List - Figure 6-11

Callout	Component
1.	Oil in from heat exchanger
2.	Oil out to heat exchanger
3.	Breather and oil fill port
4.	Oil level gauge
5.	Filter
6.	Oil strainer
7.	Oil drain plug
8.	Primary solenoid
9.	Secondary solenoid
10.	Manual override valve
11.	Holes for eyebolts for lifting marine transmission

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Figure 6-12. MGX-5126A (1 of 2)

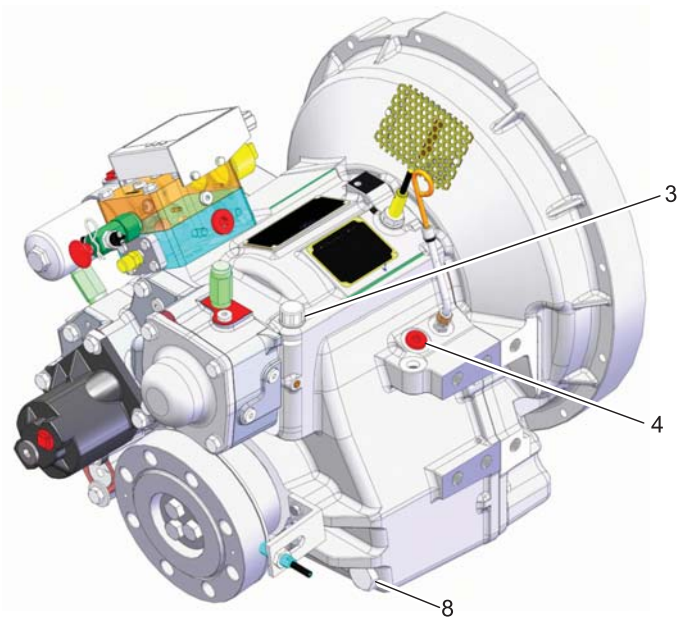
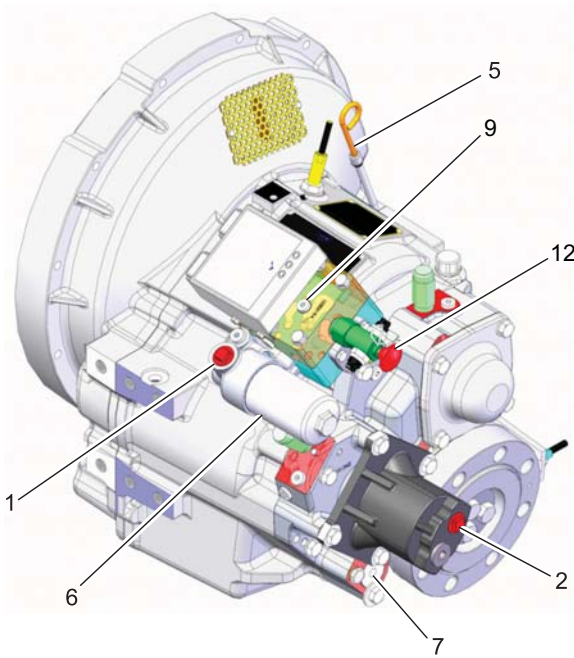
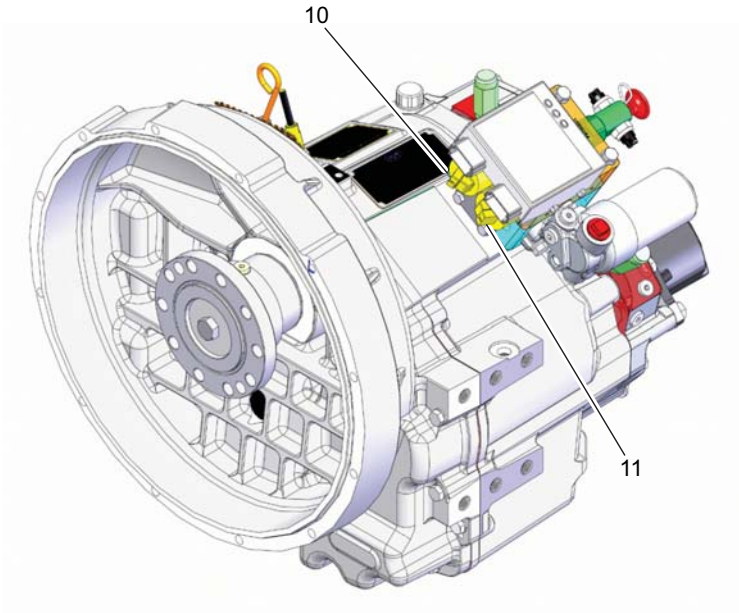


Figure 6-12. MGX-5126A (2 of 2)



MGX-5126A Callout List - Figure 6-12

Callout	Component
1.	Oil-in from heat exchanger
2.	Oil-out to heat exchanger
3.	Breather
4.	Oil fill port
5.	Oil level gauge
6.	Oil filter
7.	Oil strainer
8.	Oil drain plug
9.	Main pressure port
10.	Primary solenoid
11.	Secondary solenoid
12.	Manual override valve

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Figure 6-13. MGX-5135A (1 of 2)

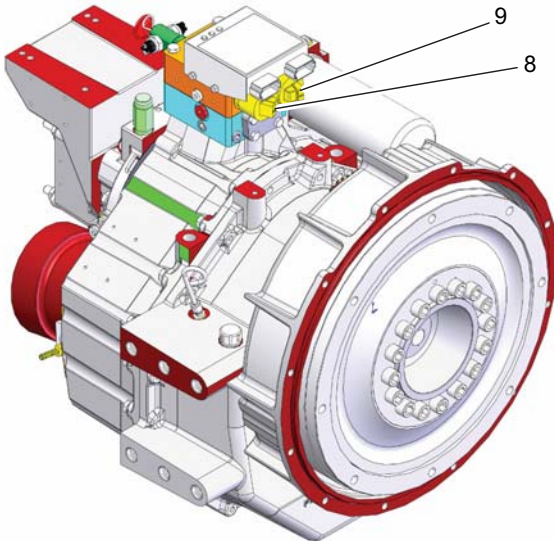
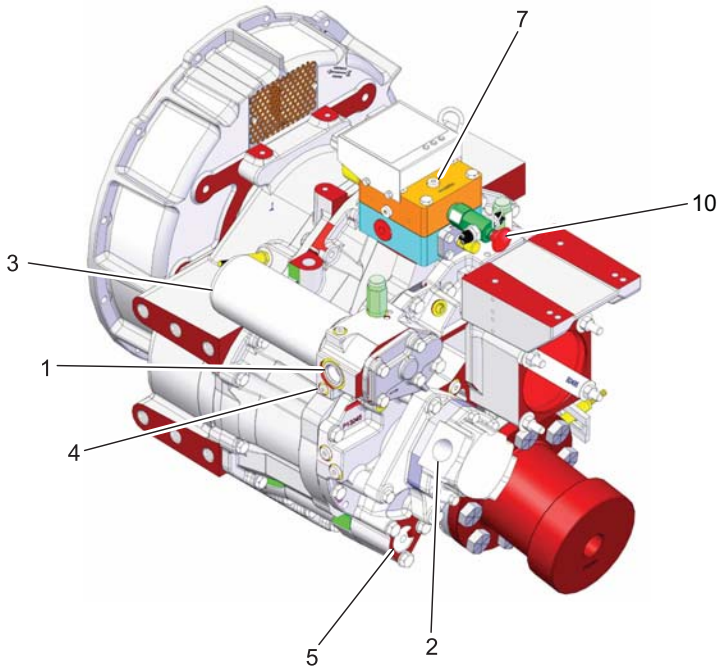
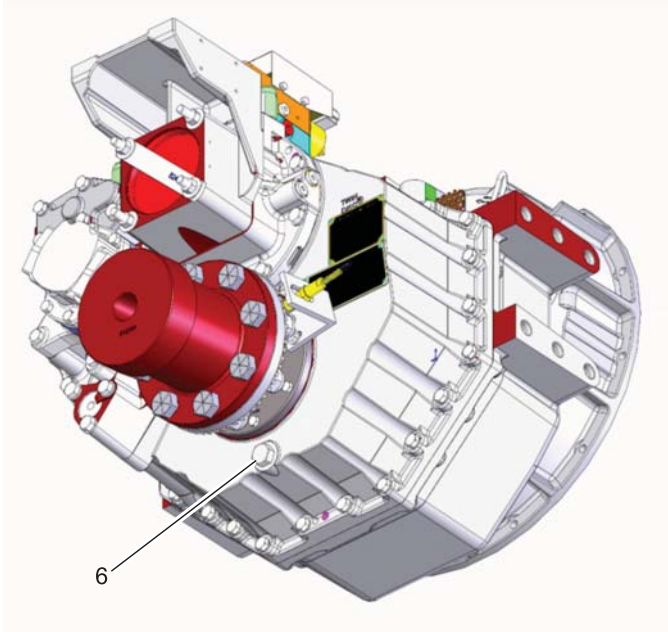


Figure 6-13. MGX-5135A (2 of 2)



MGX-5135A Callout List - Figure 6-13

Callout	Component
1.	Oil-in from heat exchanger
2.	Oil-out to heat exchanger
3.	Oil filter
4.	Oil filter drain
5.	Oil strainer
6.	Oil drain plug
7.	Main pressure port
8.	Primary solenoid
9.	Secondary solenoid
10.	Manual override valve

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Figure 6-14. MGX-5135RV (1 of 2)

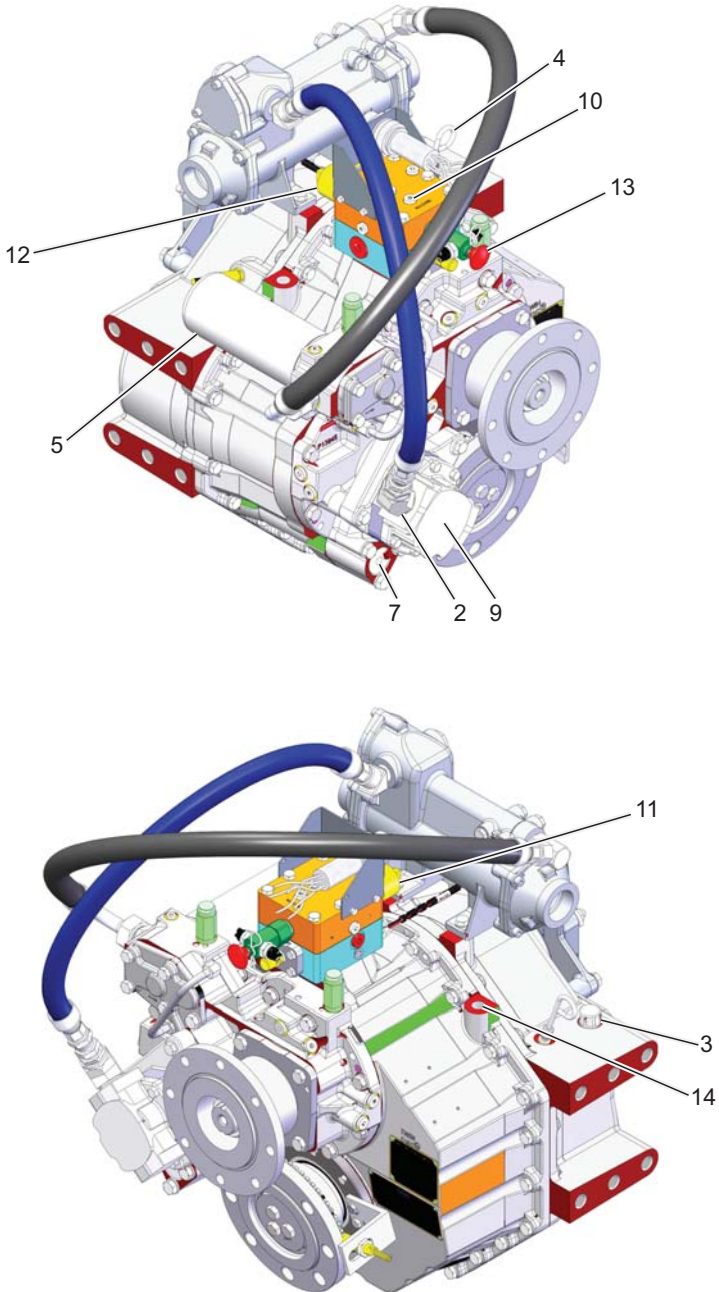
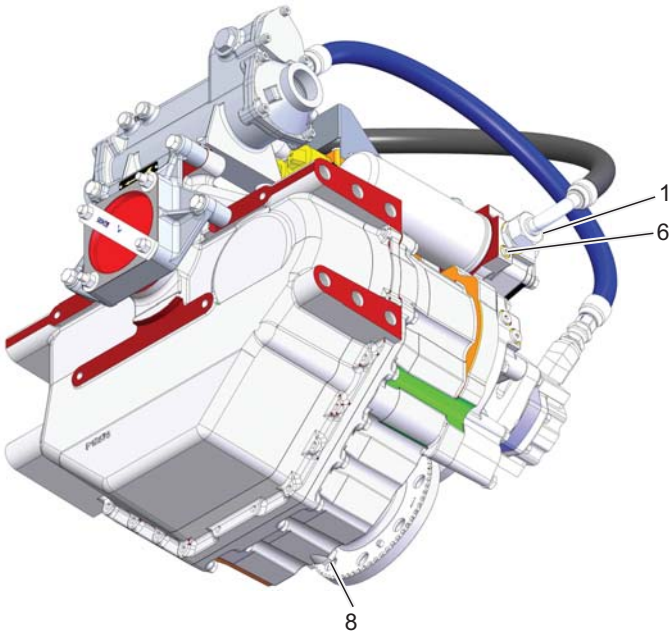


Figure 6-14. MGX-5135RV (2 of 2)



MGX-5135RV Callout List - Figure 6-14

Callout	Component
1.	Oil-in from heat exchanger
2.	Oil-out to heat exchanger
3.	Breather and oil fill port
4.	Oil level gauge
5.	Filter
6.	Filter drain
7.	Oil strainer
8.	Oil drain plug
9.	Oil pump
10.	Main pressure port
11.	Primary solenoid
12.	Secondary solenoid
13.	Manual override valve
14.	Holes for eyebolts for lifting marine transmission

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Figure 6-15. MGX-5135SC (1 of 2)

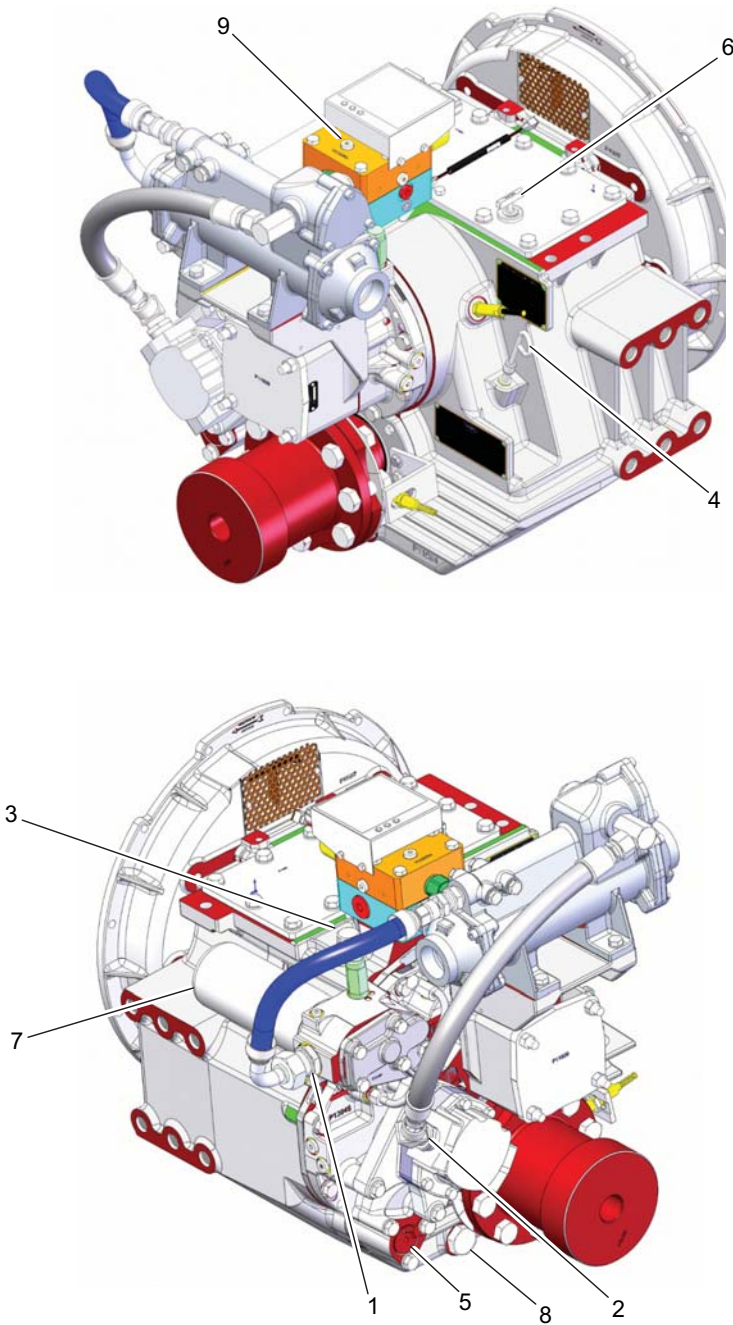
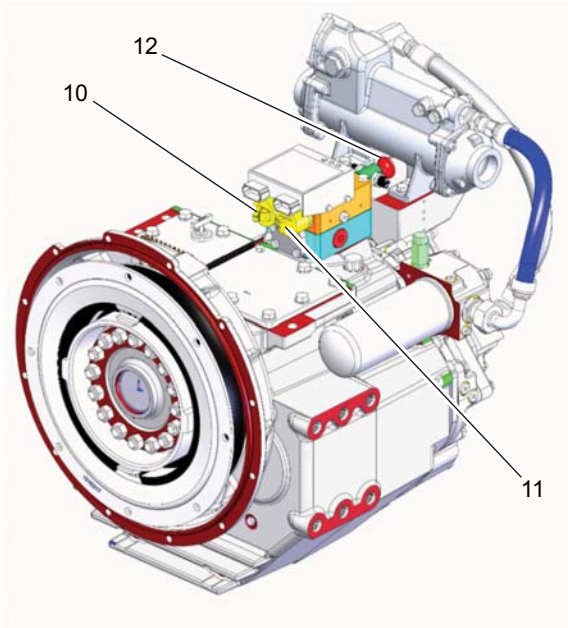


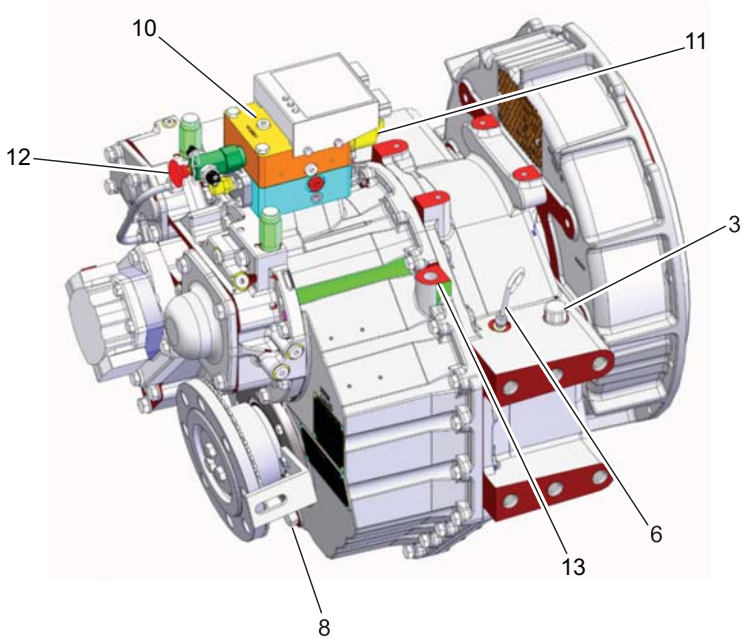
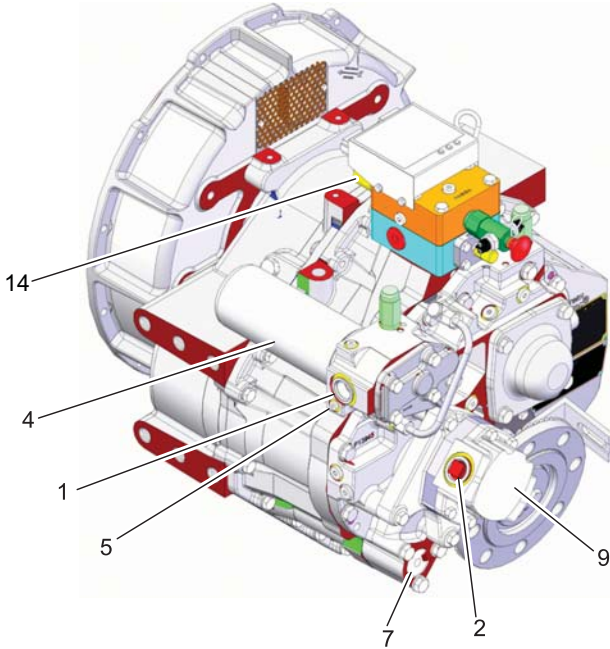
Figure 6-15. MGX-5135SC (2 of 2)



MGX-5135SC Callout List - Figure 6-15

Callout	Component
1.	Oil-in from heat exchanger
2.	Oil-out to heat exchanger
3.	Breather and oil filler
4.	Oil level gauge
5.	Oil strainer
6.	Oil filler when engine is not running
7.	Oil filter
8.	Oil drain plug
9.	Main pressure port
10.	Primary solenoid
11.	Secondary solenoid
12.	Manual override valve

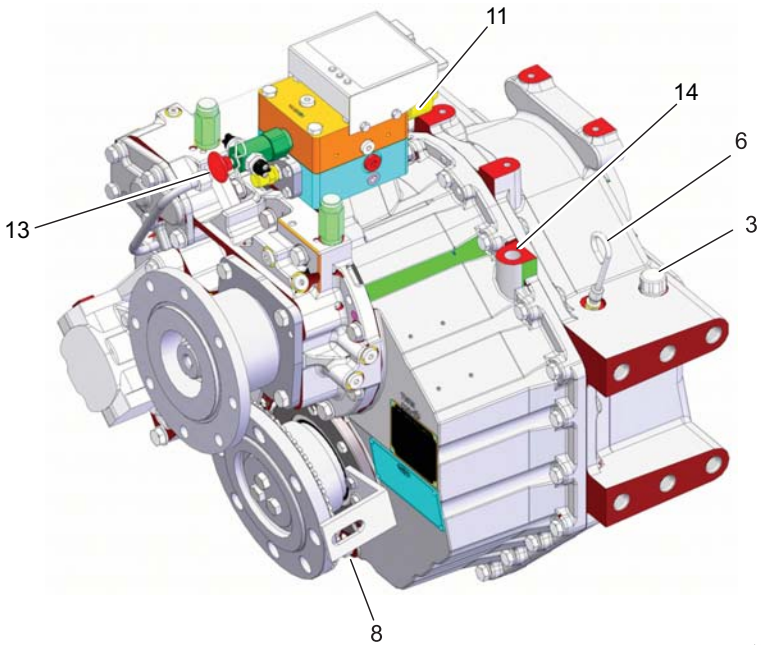
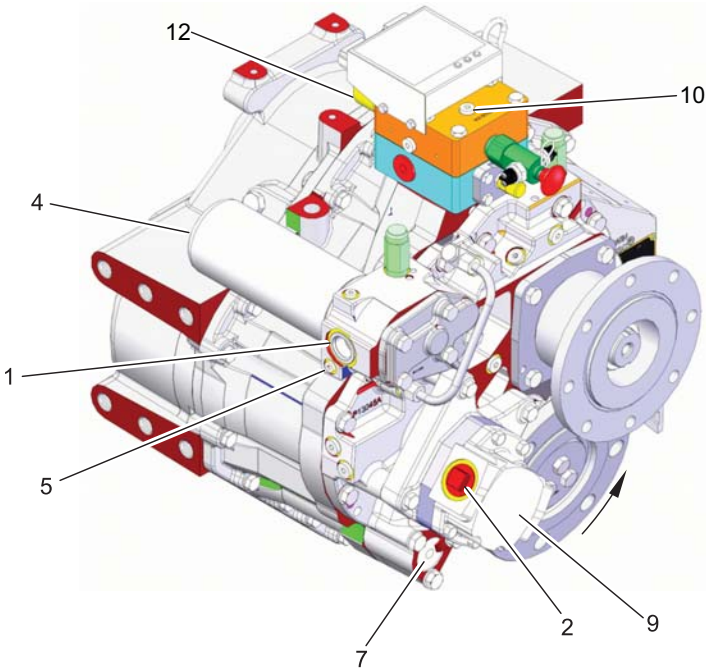
Figure 6-16. MGX-5136A



MGX-5136A Callout List - Figure 6-16

Callout	Component
1.	Oil-in from heat exchanger
2.	Oil-out to heat exchanger
3.	Breather and oil fill port
4.	Oil filter
5.	Filter drain
6.	Oil level gauge
7.	Oil strainer
8.	Oil drain plug
9.	Oil pump
10.	Main pressure port
11.	Primary solenoid
12.	Manual override valve
13.	Holes to lift marine transmission
14.	Secondary solenoid

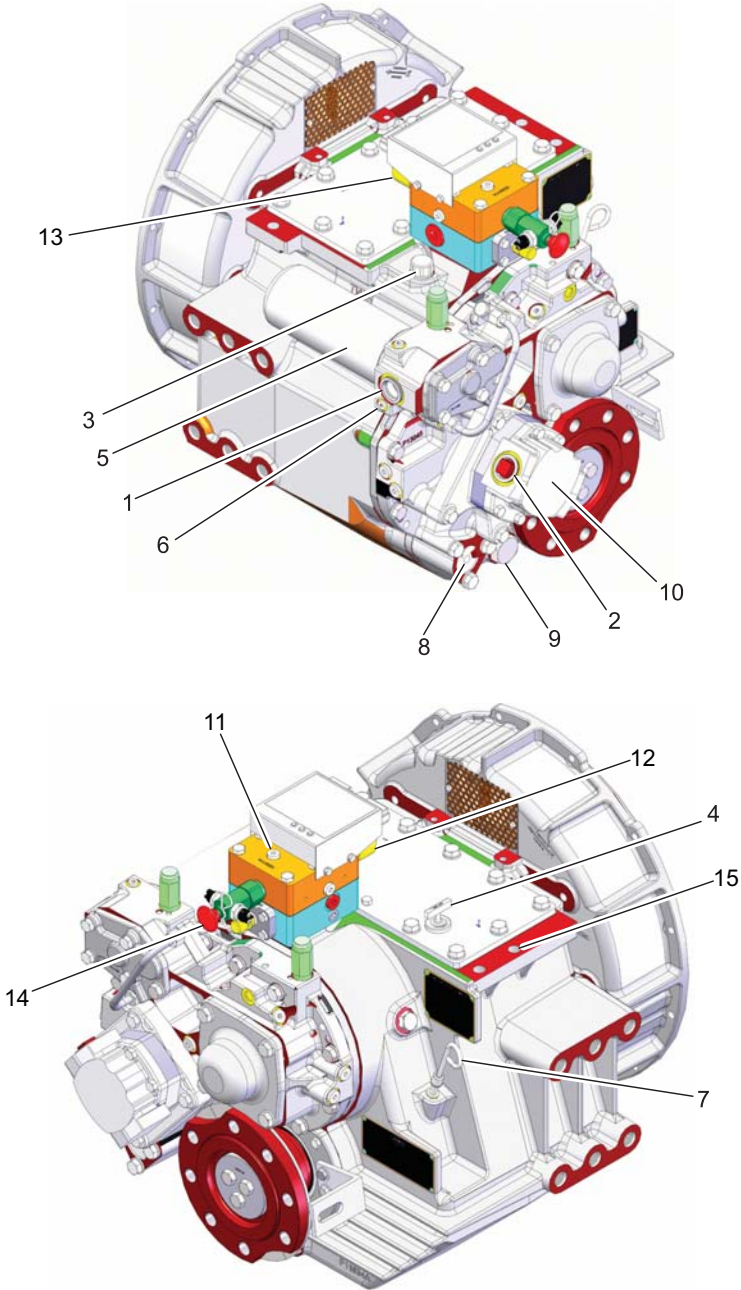
Figure 6-17. MGX-5136RV



MGX-5136RV - Figure 6-17

Callout	Component
1.	Oil-in from heat exchanger
2.	Oil-out to heat exchanger
3.	Breather and oil fill port
4.	Oil filter
5.	Filter drain
6.	Oil level gauge
7.	Oil strainer
8.	Oil drain plug
9.	Oil pump
10.	Main pressure port
11.	Primary solenoid
12.	Secondary solenoid
13.	Manual override valve
14.	Holes to lift marine transmission

Figure 6-18. MGX-5136SC



MGX-5136SC Callout List - Figure 6-18

Callout	Component
1.	Oil-in from heat exchanger
2.	Oil-out to heat exchanger
3.	Breather and oil fill port
4.	Oil fill port with engine not running
5.	Oil filter
6.	Filter drain
7.	Oil level gauge
8.	Oil strainer
9.	Oil drain plug
10.	Oil pump
11.	Main pressure port
12.	Primary solenoid
13.	Secondday solenoid
14.	Manual override valve
15.	Holes to lift marine transmission

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Figure 6-19. MGX-5147A (1 of 2)

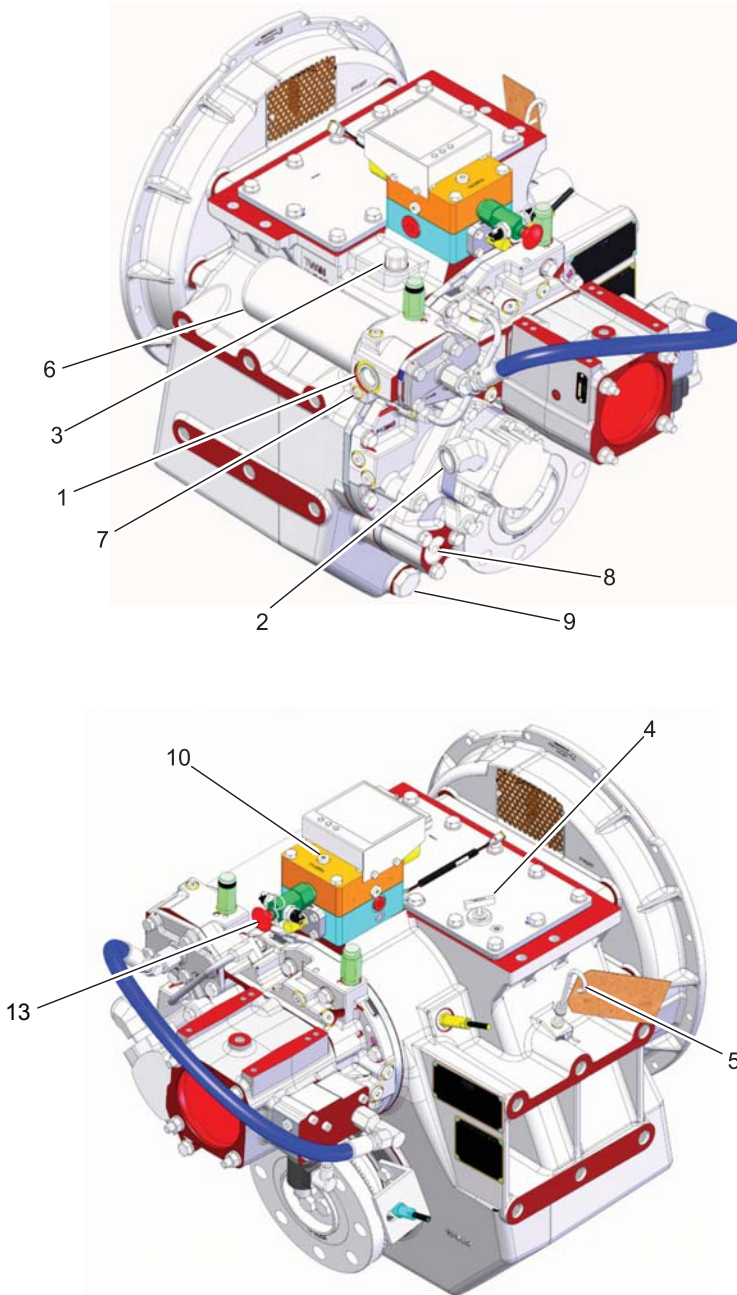
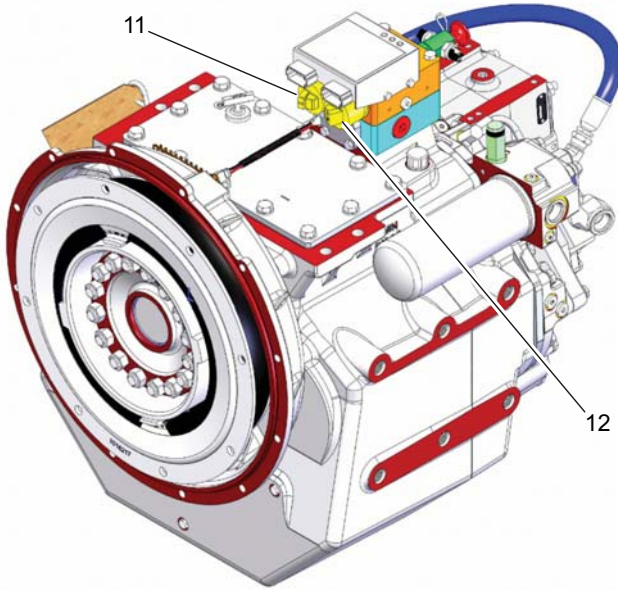


Figure 6-19. MGX-5147A (2 of 2)

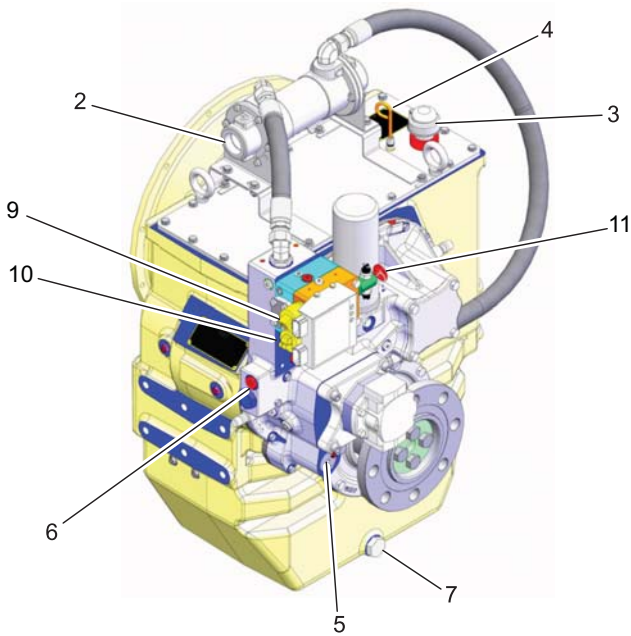
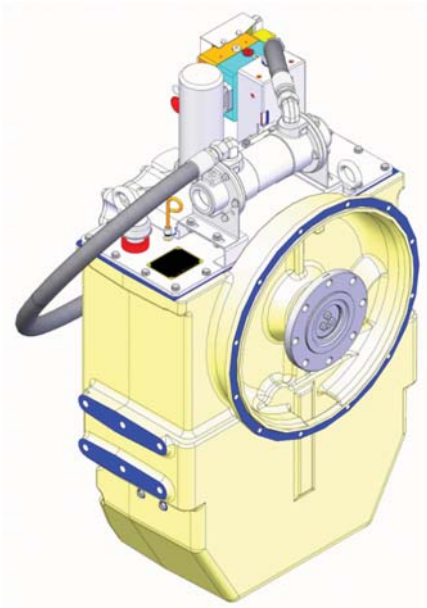


MGX-5147A Callout List - Figure 6-19

Callout	Component
1.	Oil-in from heat exchanger
2.	Oil-out to heat exchanger
3.	Breather and oil fill
4.	Oil fill when engine not running
5.	Oil gauge
6.	Oil filter
7.	Filter drain
8.	Oil strainer
9.	Oil drain
10.	Main pressure port
11.	Primary solenoid-engaged clutch on primary shaft
12.	Secondary solenoid-engaged clutch on secondary shaft
13.	Manual override valve

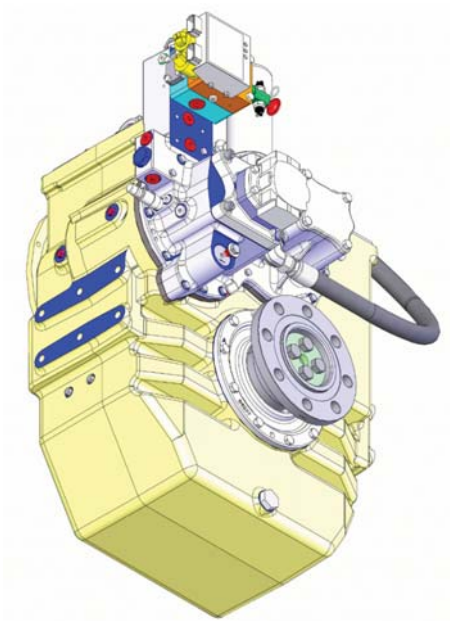
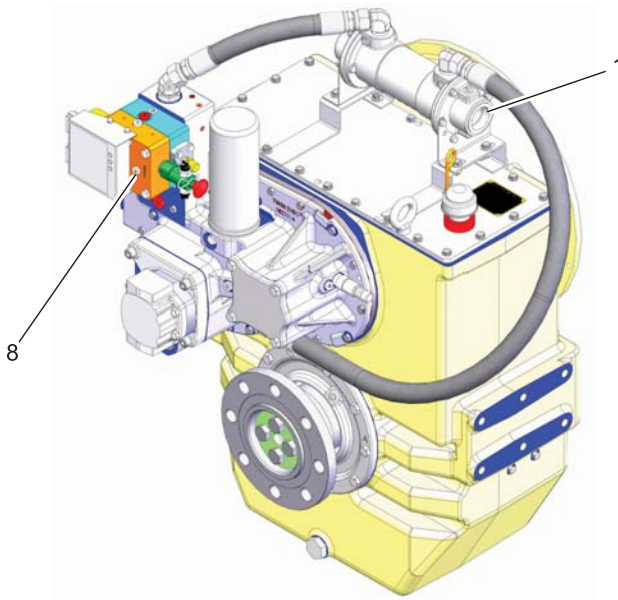
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Figure 6-20. MGX-516 (1 of 2)



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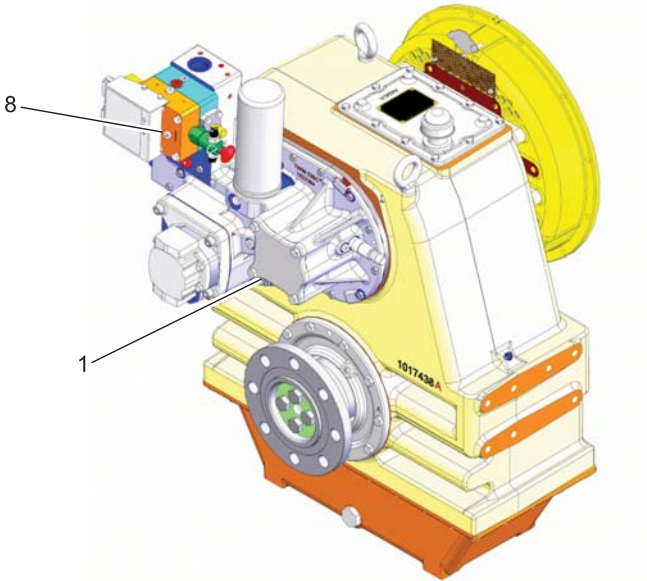
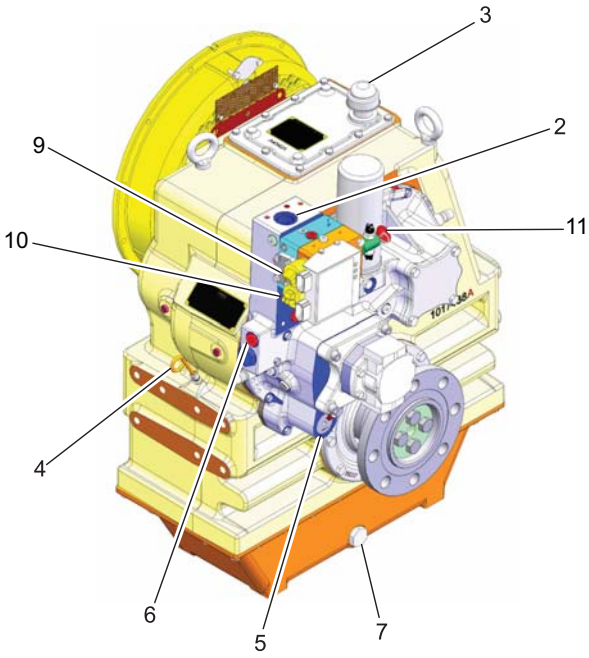
Figure 6-20. MGX-516 (2 of 2)



MGX-516 Callout List - Figure 6-20

Callout	Component
1.	Water-in to heat exchanger
2.	Water-out from heat exchanger
3.	Breather and fill port
4.	Oil level gauge
5.	Oil strainer
6.	Filter drain
7.	Oil drain plug
8.	Main pressure port
9.	Primary solenoid
10.	Secondary solenoid
11.	Manual override valve

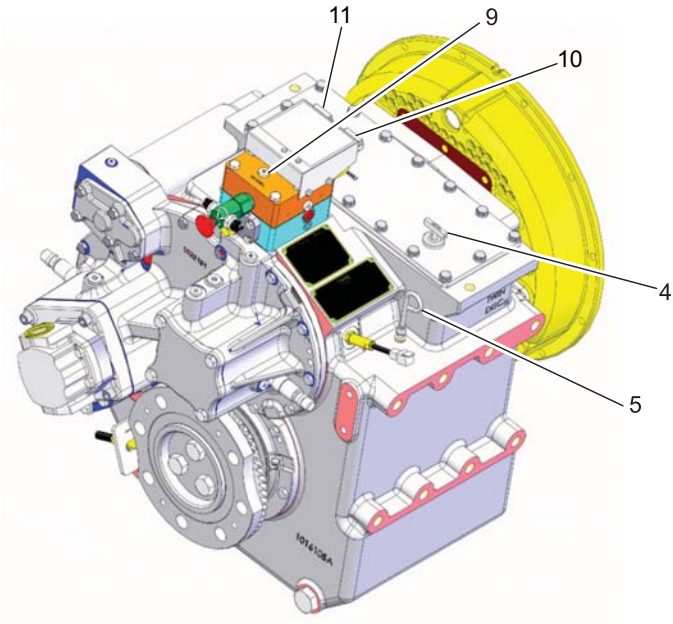
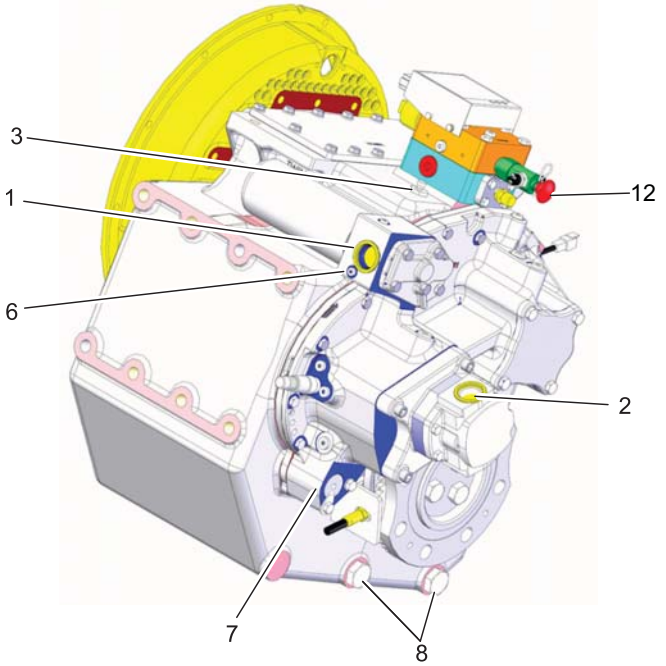
Figure 6-21. MGX-5170DC



MGX-5170DC Callout List - Figure 6-21

Callout	Component
1.	Oil-in from heat exchanger
2.	Oil-out to heat exchanger
3.	Breather and fill port
4.	Oil level gauge
5.	Oil strainer
6.	Filter drain
7.	Oil drain plug
8.	Main pressure port
9.	Primary solenoid
10.	Secondary solenoid
11.	Manual override valve

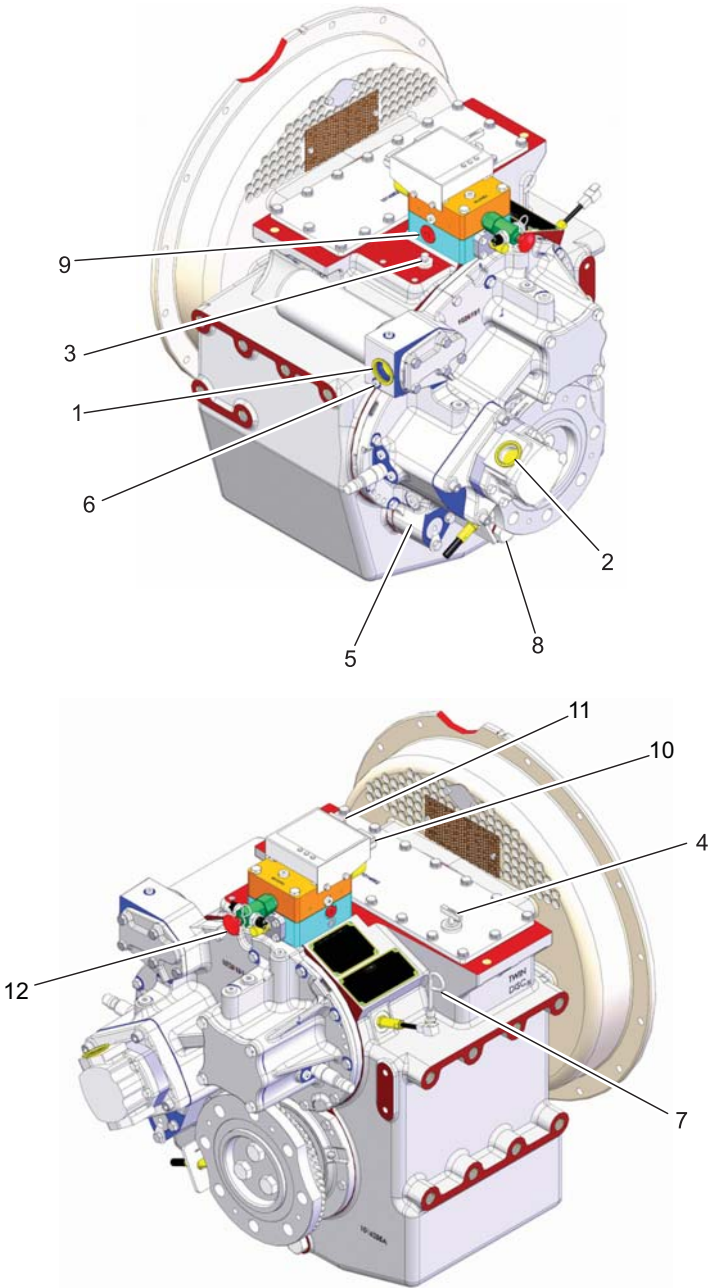
Figure 6-22. MGX-5202SC



MGX-5202SC Callout List - Figure 6-22

Callout	Component
1.	Oil-in from heat exchanger
2.	Oil-out to heat exchanger
3.	Breather
4.	Oil fill port
5.	Oil level gauge
6.	Filter drain
7.	Oil strainer
8.	Oil drain plug
9.	Main pressure port
10.	Primary solenoid
11.	Secondary solenoid
12.	Manual override valve

Figure 6-23. MGX-5204SC



MGX-5204SC Callout List - Figure 6-23

Callout	Component
1.	Oil-in from heat exchanger
2.	Oil-out to heat exchanger
3.	Breather
4.	Oil fill port
5.	Oil strainer
6.	Filter drain
7.	Oil level gauge
8.	Oil drain plug
9.	Main pressure port
10.	Primary solenoid
11.	Secondary solenoid
12.	Manual override valve

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Figure 6-24. MGX-5222DC, MGX-5225DC (1 of 2)

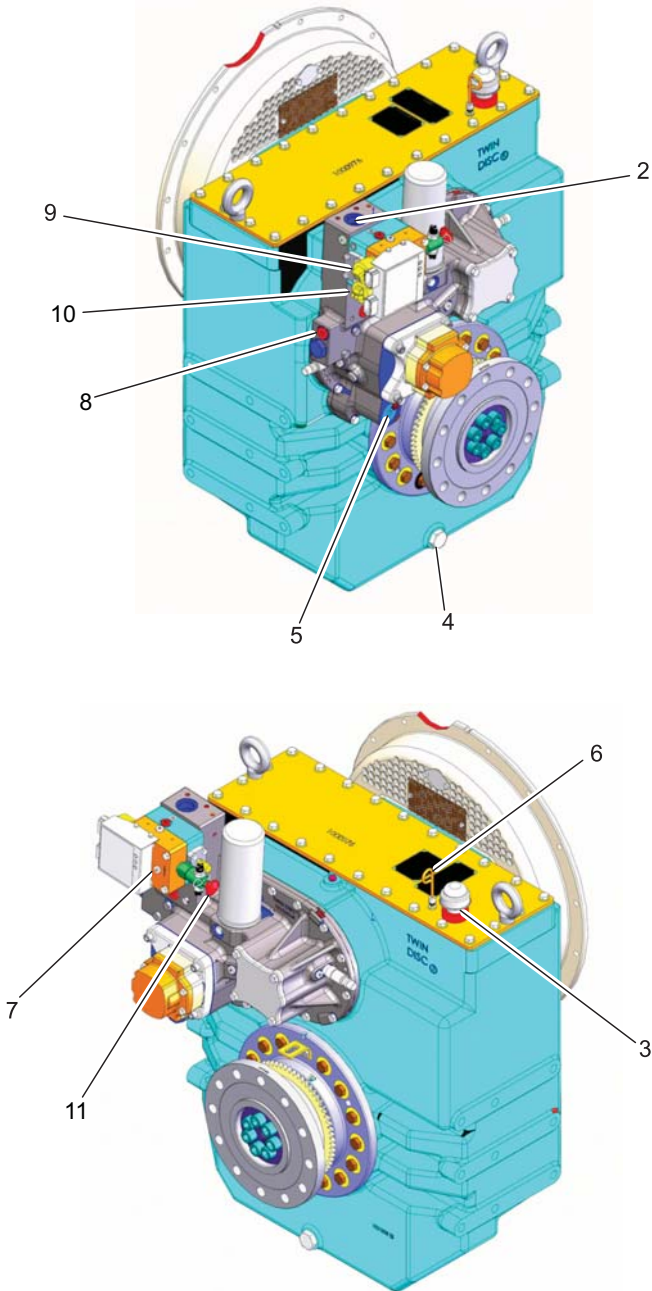
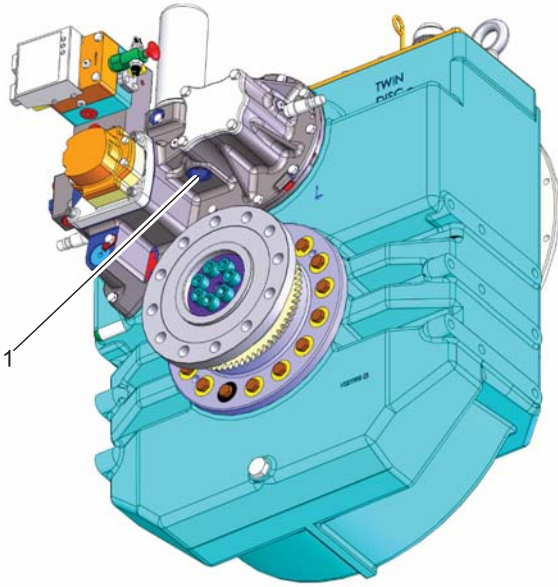


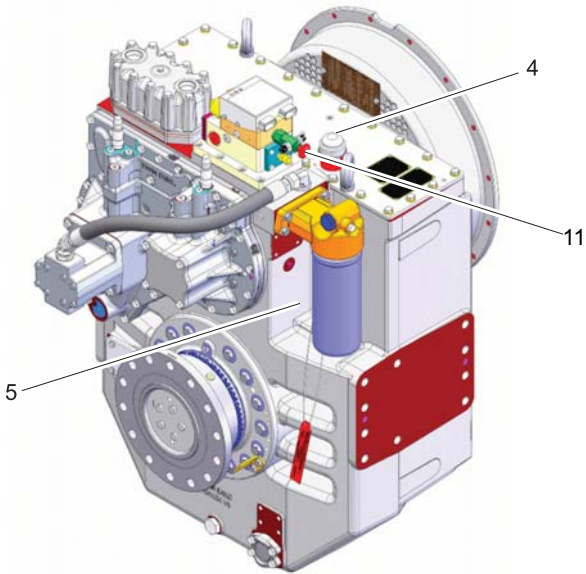
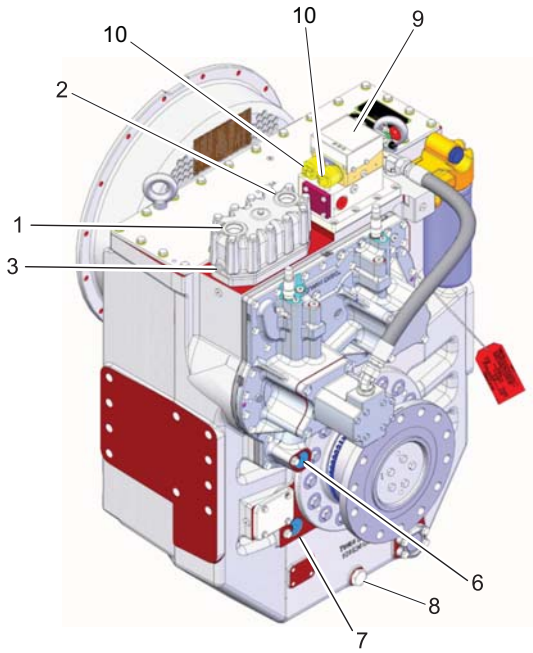
Figure 6-24. MGX-5222DC, MGX-5225DC (2 of 2)



MGX-5222DC, MGX-5225DC Callout List - Figure 6-24

Callout	Component
1.	Oil-in from heat exchanger
2.	Oil-out to heat exchanger
3.	Breather and fill port
4.	Oil drain
5.	Oil strainer
6.	Oil level gauge
7.	Main pressure port
8.	Oil filter drain
9.	Primary clutch valve coil
10.	Secondary clutch valve coil
11.	Manual override valve

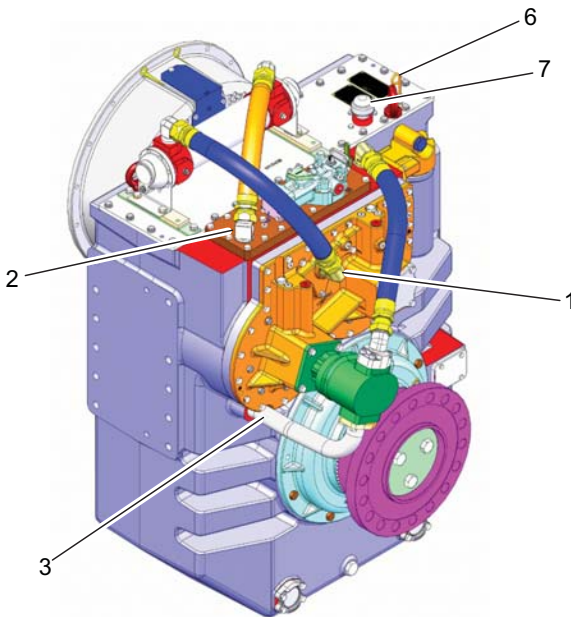
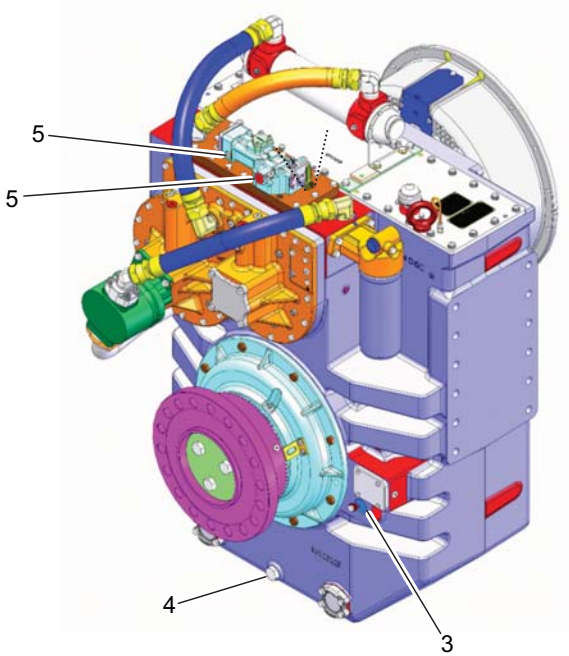
Figure 6-25. MGX-5321DC



MGX-5321DC Callout List - Figure 6-25

Callout	Component
1.	Water in to heat exchanger
2.	Water out from heat exchanger
3.	Water drain
4.	Breather and oil filler
5.	Oil level gauge
6.	Oil strainer
7.	Oil strainer
8.	Oil drain
9.	Main pressure port
10.	Primary solenoid (closest to input)
11.	Secondary solenoid (closest to output)

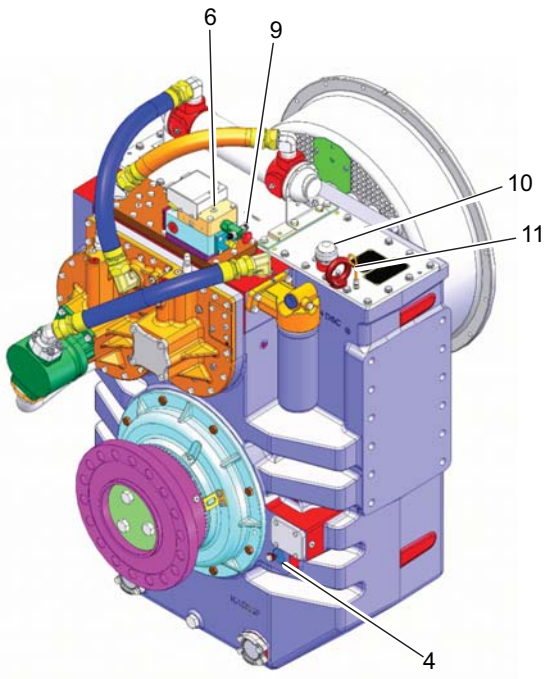
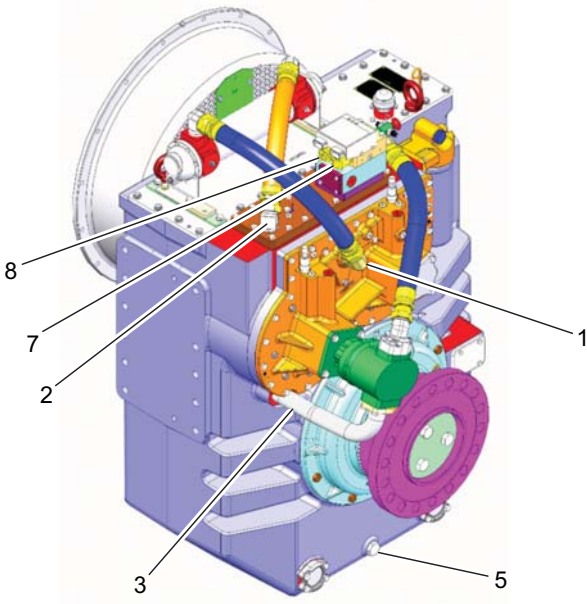
Figure 6-26. MG-5600



MG-5600 Component List - Figure 6-26

Callout	Component
1.	Oil-in from heat exchanger
2.	Oil-out to heat exchanger
3.	Oil strainer
4.	Oil drain
5.	Main pressure port
6.	Oil level gauge
7.	Breather, Oil fill

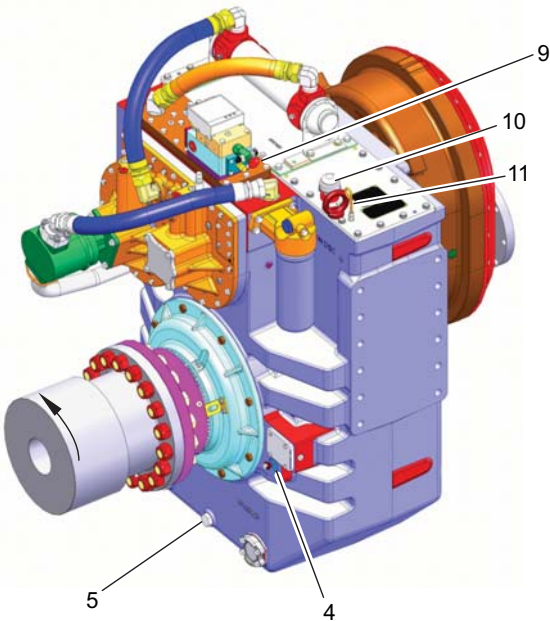
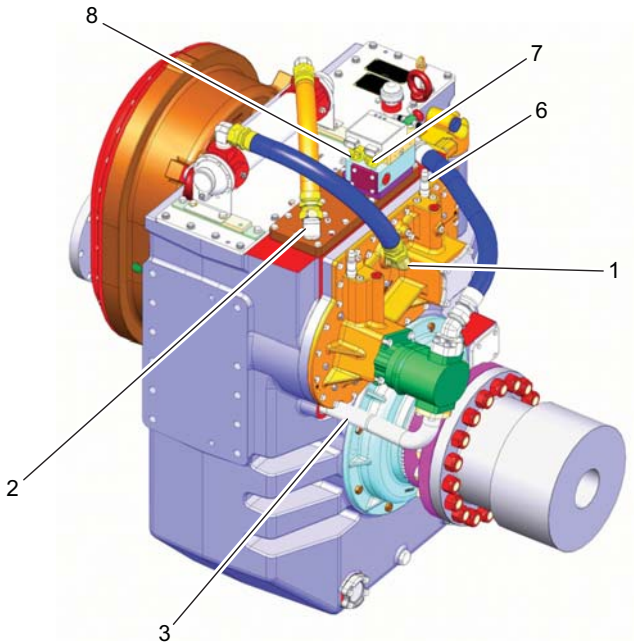
Figure 6-27. MGX-5600



MGX-5600 Component Callout List - Figure 6-27

Callout	Component
1.	Oil-in from heat exchanger
2.	Oil-out to heat exchanger
3.	Oil strainer
4.	Oil strainer for use with optional trailing pump
5.	Oil drain
6.	Main pressure port
7.	Primary solenoid
8.	Secondary solenoid
9.	Manual override valve
10.	Breather, Oil fill
11.	Oil level gauge

Figure 6-28. MGX-5600DR



MGX-5600DR Component Callout List - Figure 6-28

Callout	Component
1.	Oil-in from heat exchanger
2.	Oil-out to heat exchanger
3.	Oil strainer
4.	Oil strainer for use with optional trailing pump
5.	Oil drain
6.	Main pressure port
7.	Primary solenoid
8.	Secondary solenoid
9.	Manual override valve
10.	Breather, Oil fill
11.	Oil level gauge

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Figure 6-29. MGX-6598DC (1 of 2)

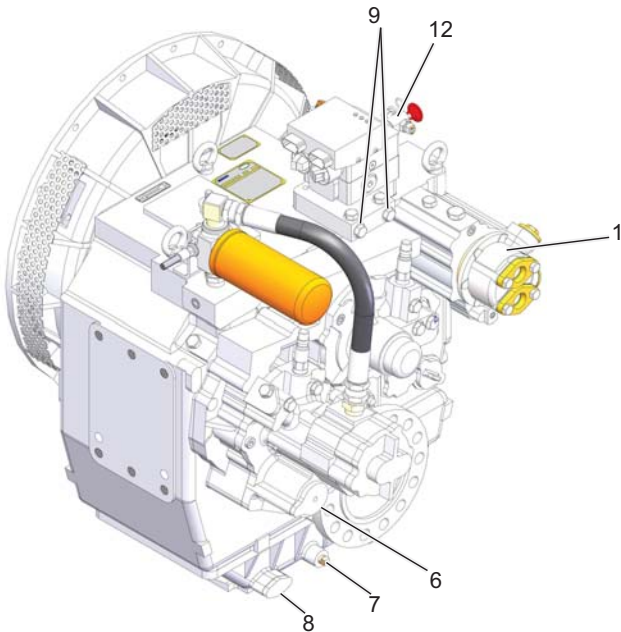
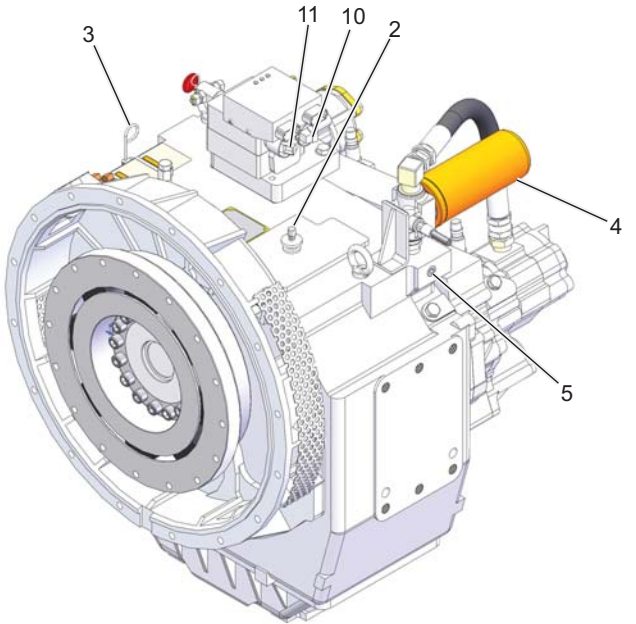
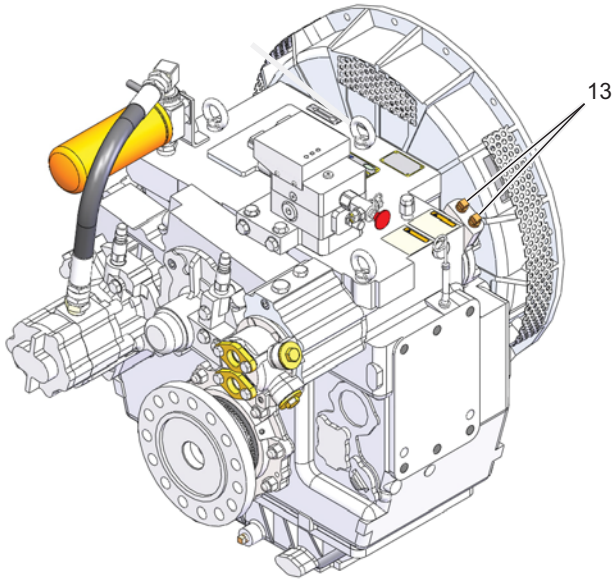


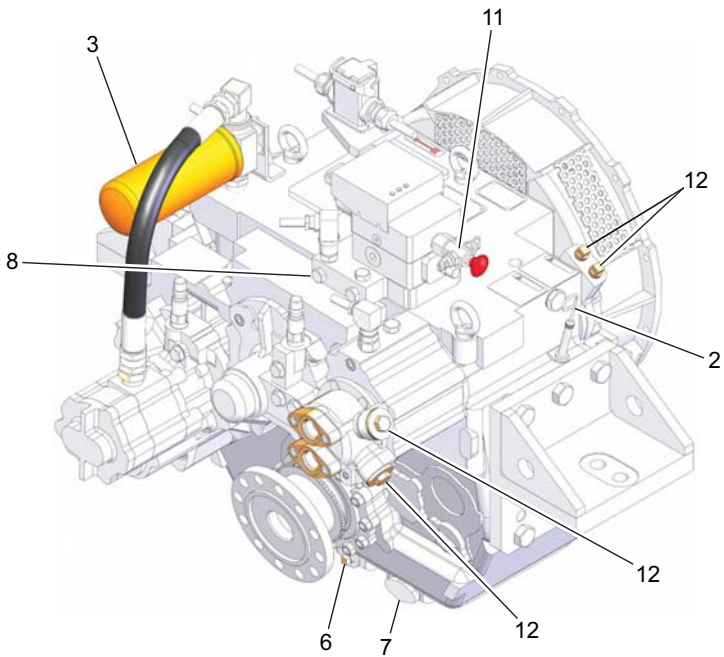
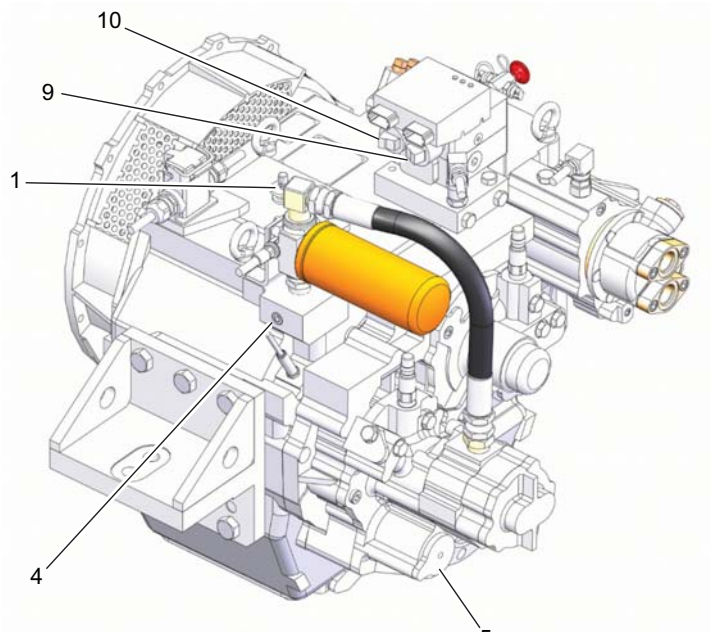
Figure 6-29. MGX-6598DC (2 of 2)



MGX-6598DC Callout List - Figure 6-29

Callout	Component
1.	Heat exchanger
2.	Breather and oil fill port
3.	Oil level gauge
4.	Oil filter
5.	Filter drain
6.	Oil strainer
7.	Oil drain plug
8.	Oil drain flange
9.	Main pressure port
10.	Primary solenoid
11.	Secondary solenoid
12.	Manual override valve
13.	Zinc stick for corrosion protection

Figure 6-30. MGX-6599A



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MGX-6599A Callout List - Figure 6-30

Callout	Component
1.	Breather and oil fill port
2.	Oil level gauge
3.	Oil filter
4.	Filter drain
5.	Oil strainer
6.	Oil drain plug
7.	Oil drain flange
8.	Main pressure port
9.	Primary solenoid
10.	Secondary solenoid
11.	Manual override valve
12.	Zinc stick for corrosion protection

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Figure 6-31. MGX-6599RV (1 of 2)

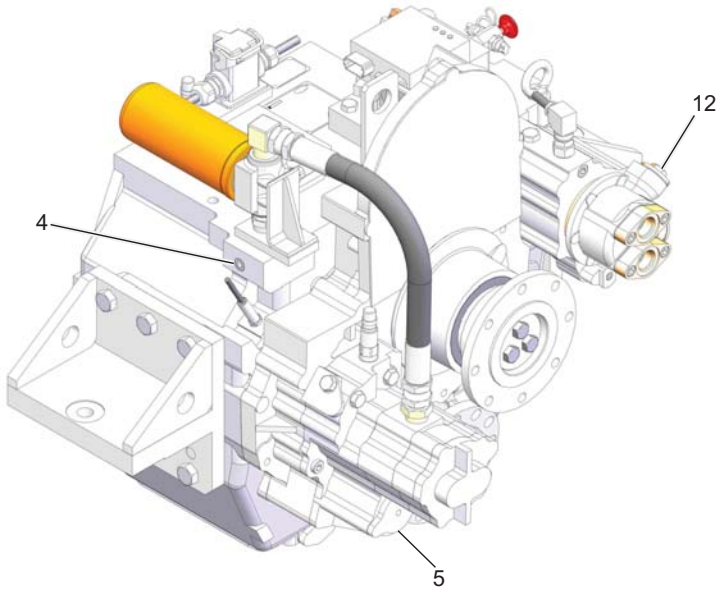
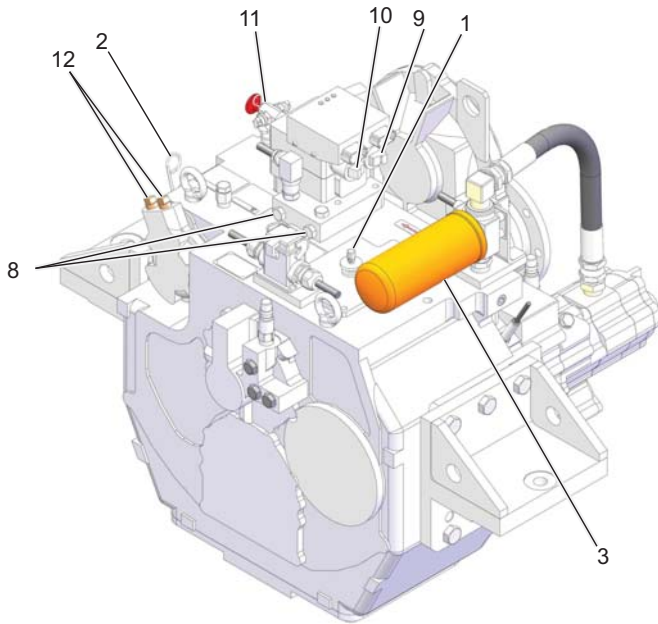
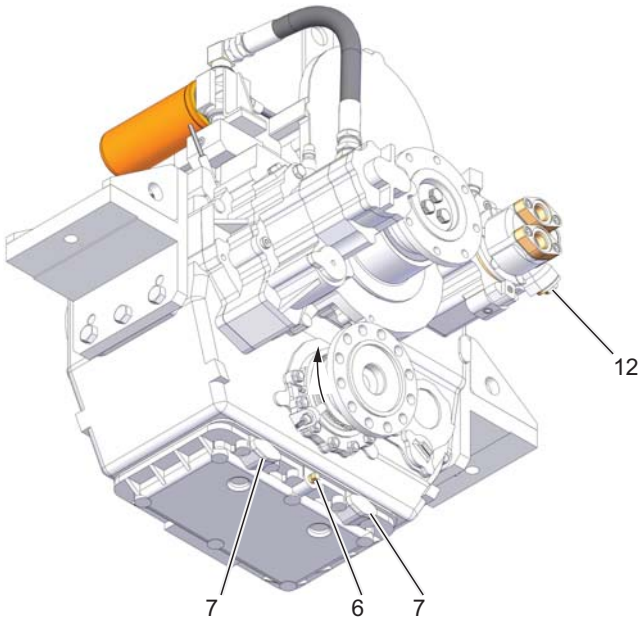


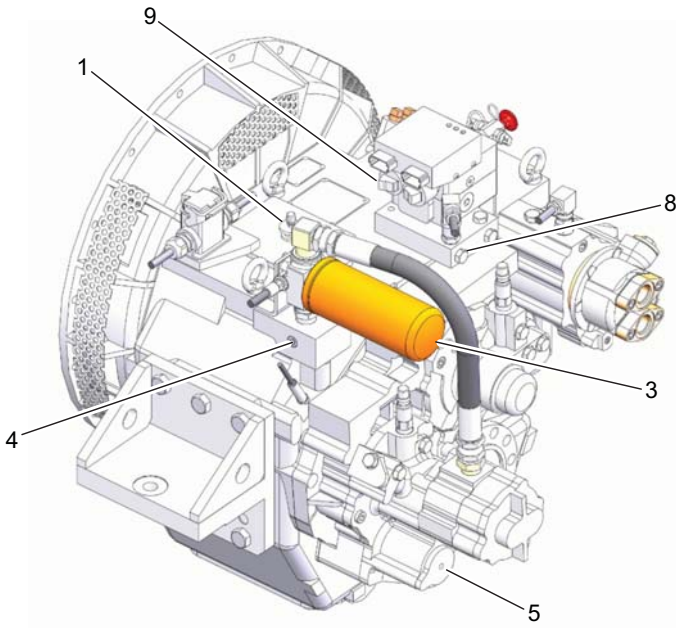
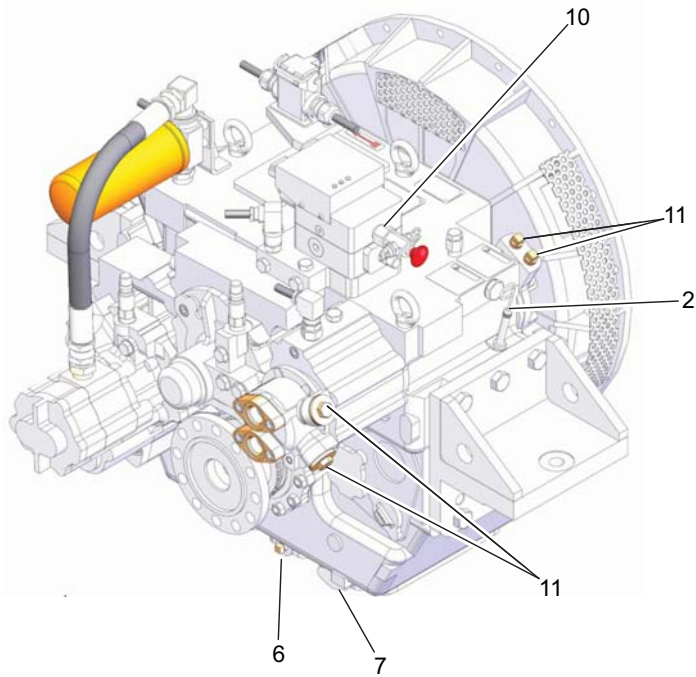
Figure 6-31. MGX-6599RV (2 of 2)



MGX-6599RV Callout List - Figure 6-31

Callout	Component
1.	Breather and oil fill port
2.	Oil level gauge
3.	Oil filter
4.	Filter drain
5.	Oil strainer
6.	Oil drain plug
7.	Oil drain flange
8.	Main pressure port
9.	Primary solenoid
10.	Secondary solenoid
11.	Manual override valve
12.	Zinc stick for corrosion protection

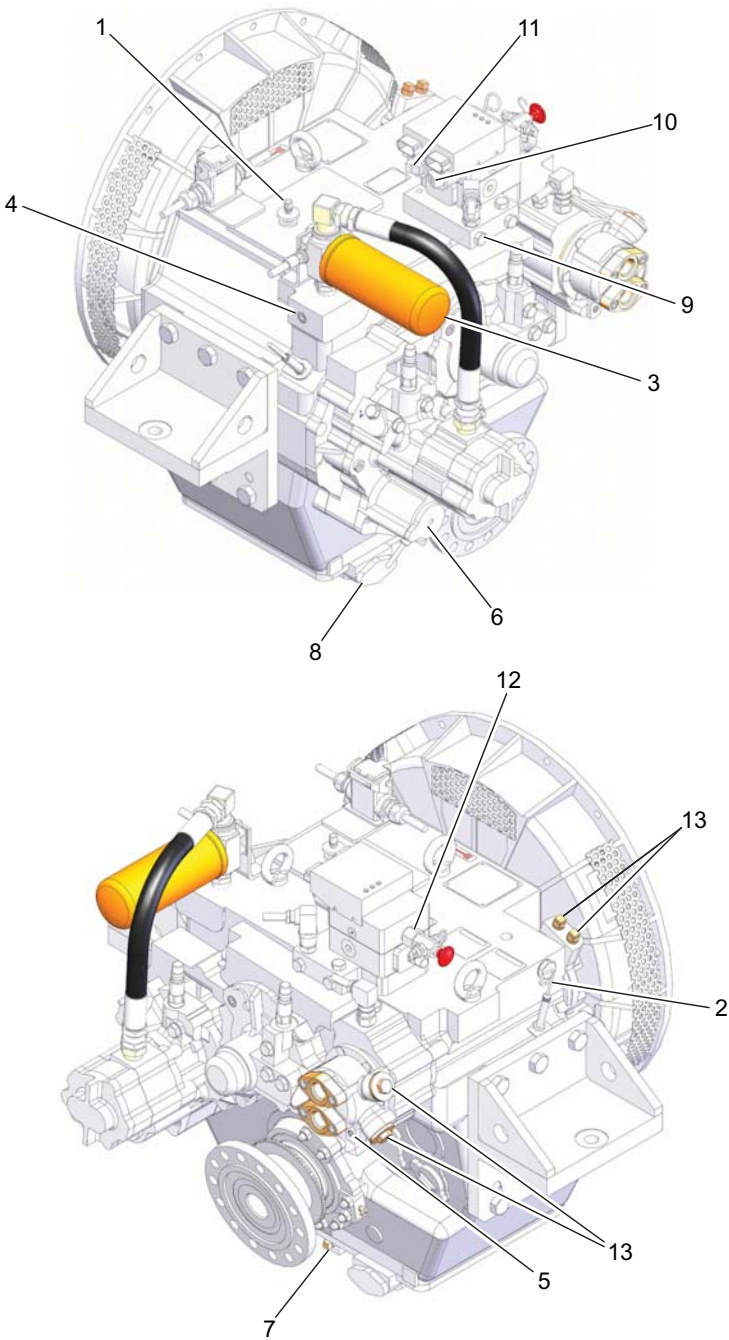
Figure 6-32. MGX-6599SC



MGX-6599SC Callout List - Figure 6-32

Callout	Component
1.	Breather and oil fill port
2.	Oil level gauge
3.	Oil filter
4.	Filter drain
5.	Oil strainer
6.	Oil drain plug
7.	Oil drain flange
8.	Main pressure port
9.	Secondary solenoid
10.	Manual override valve
11.	Zinc stick for corrosion protection

Figure 6-33. MGX-6620A

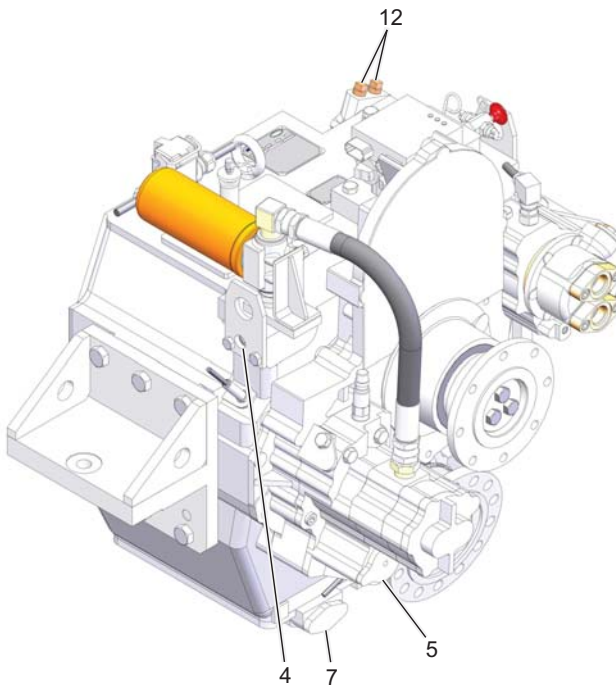
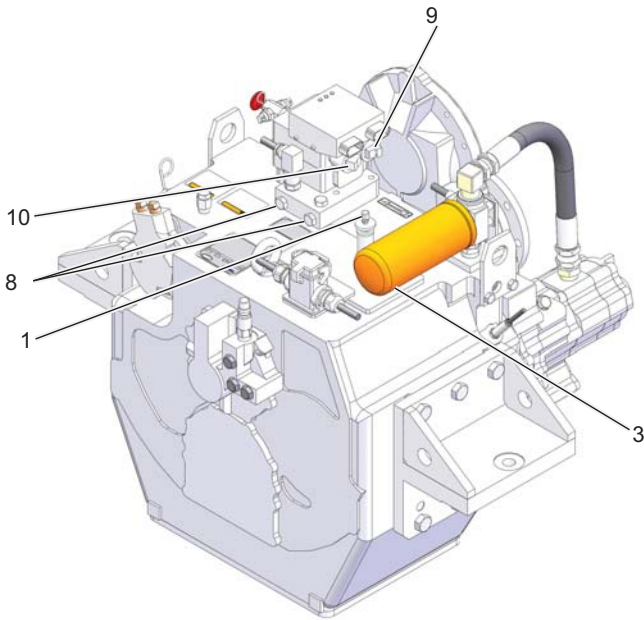


MGX-6620A Callout List - Figure 6-33

Callout	Component
1.	Breather and oil fill port
2.	Oil level gauge
3.	Oil filter
4.	Filter drain
5.	Oil drain for heat exchanger
6.	Oil strainer
7.	Oil drain plug
8.	Oil drain flange
9.	Main pressure port
10.	Primary solenoid
11.	Secondary solenoid
12.	Manual override valve
13.	Zinc stick for corrosion protection

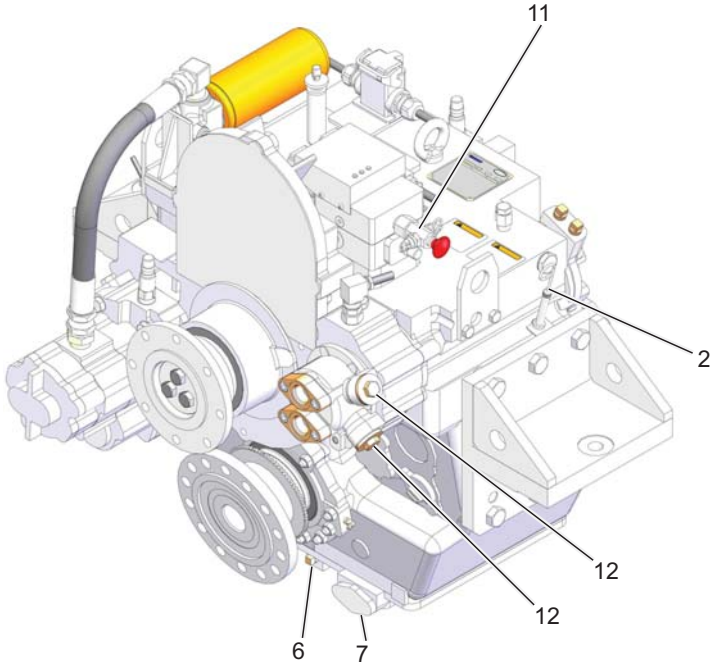
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Figure 6-34. MGX-6620RV (1 of 2)



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Figure 6-34. MGX-6620RV (2 of 2)



MGX-6620RV Callout List - Figure 6-34

Callout	Component
1.	Breather and oil fill port
2.	Oil level gauge
3.	Oil filter
4.	Filter drain
5.	Oil strainer
6.	Oil drain plug
7.	Oil drain flange
8.	Main pressure port
9.	Primary solenoid
10.	Secondary solenoid
11.	Manual override valve
12.	Zinc stick for corrosion protection

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Figure 6-35. MGX-6620SC (1 of 2)

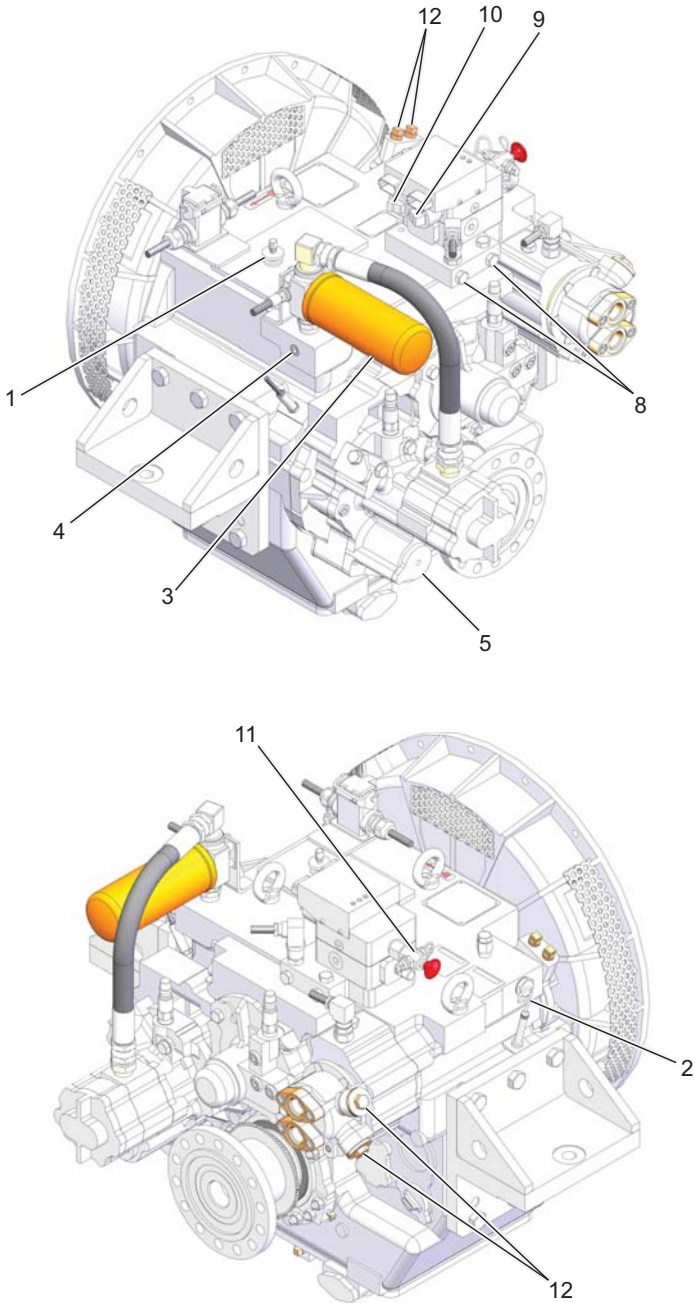
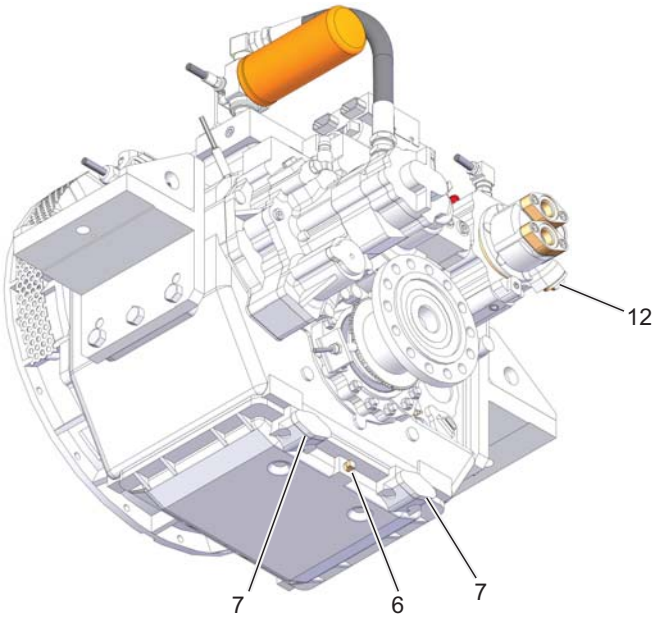


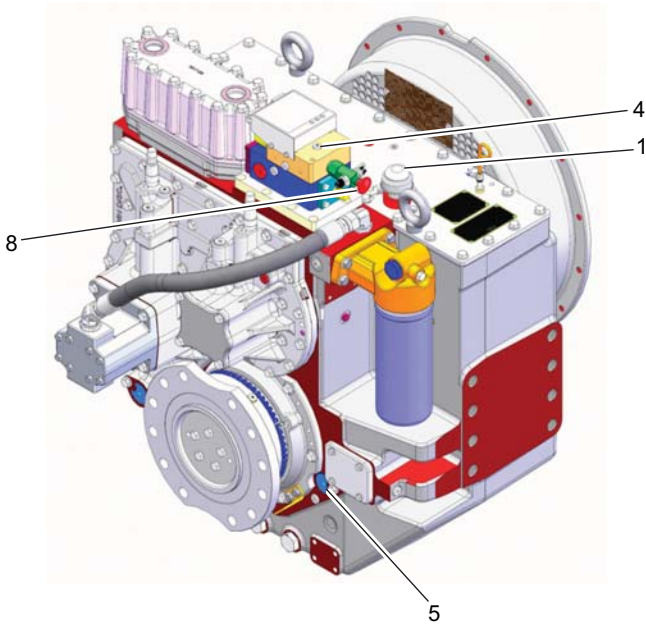
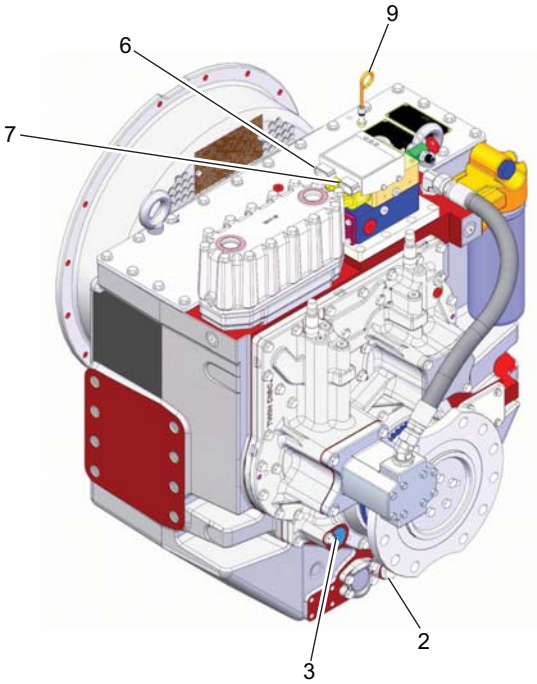
Figure 6-35. MGX-6620SC (2 of 2)



MGX-6620SC Callout List - Figure 6-35

Callout	Component
1.	Breather and oil fill port
2.	Oil level gauge
3.	Oil filter
4.	Filter drain
5.	Oil strainer
6.	Oil drain plug
7.	Oil drain flange
8.	Main pressure port
9.	Primary solenoid
10.	Secondary solenoid
11.	Manual override valve
12.	Zinc stick for corrosion protection

Figure 6-36. MGX-6690SC, MGX-6848SC

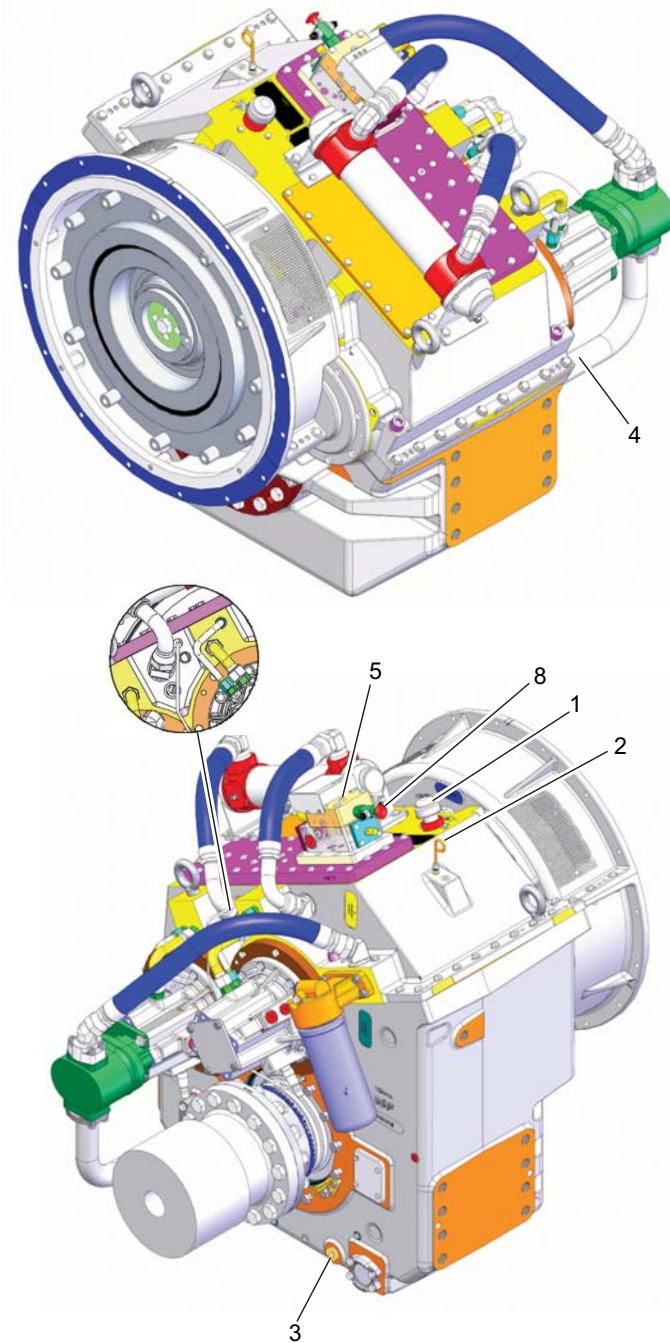


MGX-6690SC, MGX-6848SC Callout List - Figure 6-36

Callout	Component
1.	Breather, oil fill
2.	Oil drain
3.	Oil strainer
4.	Main pressure port
5.	Oil strainer for use with optional trailing pump
6.	Primary solenoid (towards the output side)
7.	Secondary solenoid (towards the input side)
8.	Manual override valve
9.	Oil Gauge

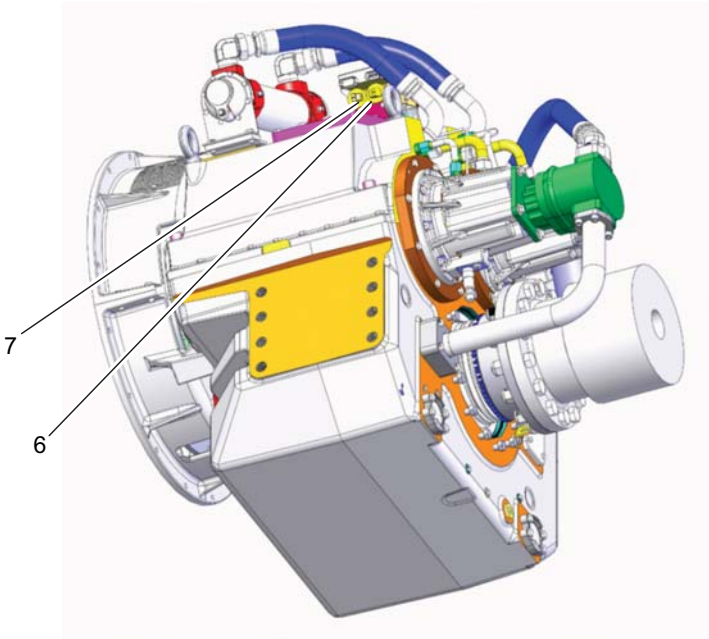
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Figure 6-37. MGX-61000SC (1 of 2)



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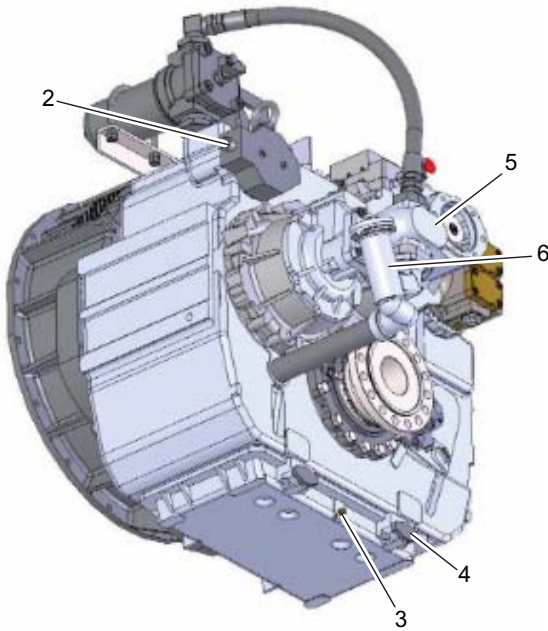
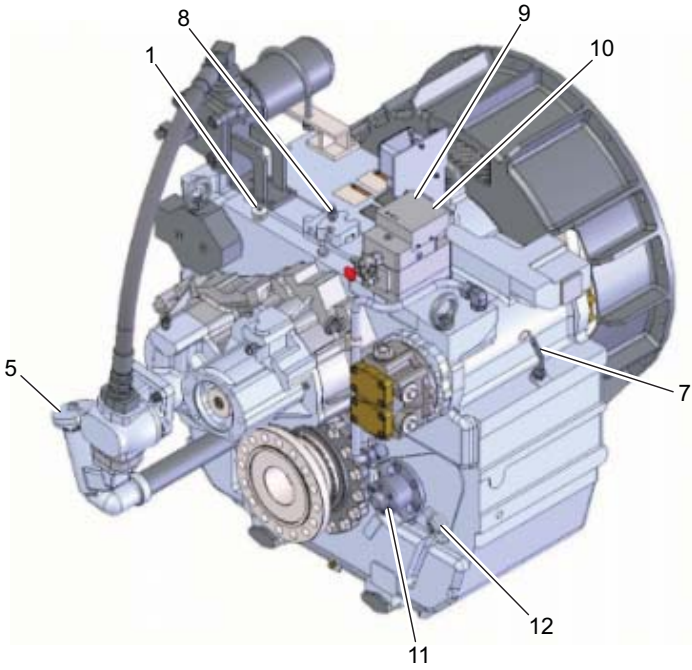
Figure 6-37. MGX-61000SC (2 of 2)



MGX-61000SC Callout List - Figure 6-37

Callout	Component
1.	Breather (remove for oil fill)
2.	Oil level gauge
3.	Oil drain plug
4.	Oil strainer
5.	Main pressure port
6.	Primary solenoid
7.	Secondary solenoid
8.	Manual override valve

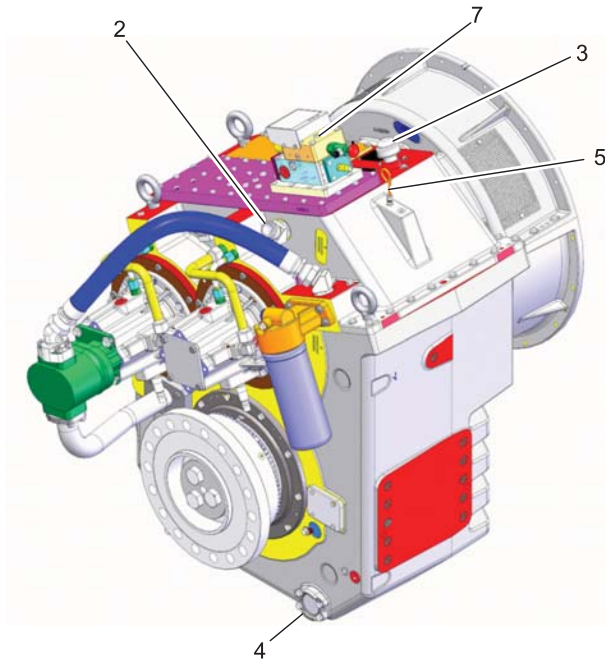
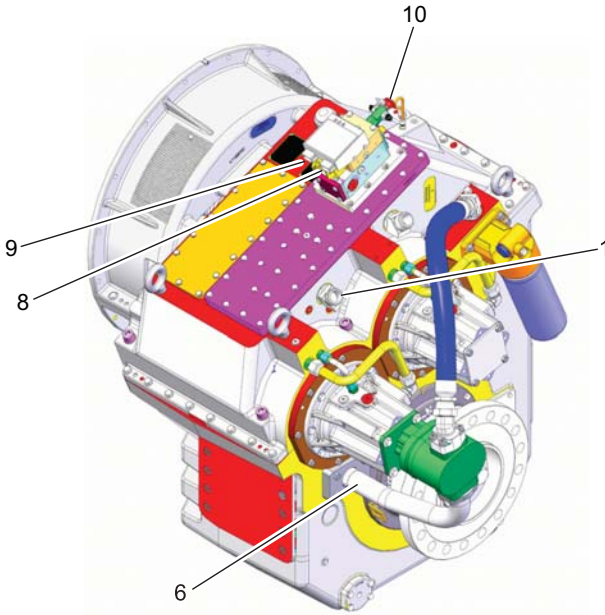
Figure 6-38. MG-61242SC



MG-61242SC Component List - Figure 6-38

Callout	Component
1.	Oil filling hole and breather
2.	Filter oil drain plug with magnet
3.	Unit oil drain plug with magnet
4.	Oil drain flange
5.	Gear pump
6.	Main pump strainer
7.	Oil level gauge
8.	Main pressure port
9.	Primary shaft clutch solenoid
10.	Secondary shaft clutch solenoid
11.	Trailing pump
12.	Trailing pump strainer

Figure 6-39. MGX-61500SC



MGX-61500SC Callout List - Figure 6-39

Callout	Component
1.	Oil-in from heat exchanger
2.	Oil-out to heat exchanger
3.	Breather, oil fill
4.	Oil drain
5.	Oil level gauge
6.	Oil strainer
7.	Main pressure port
8.	Primary solenoid
9.	Secondary solenoid
10.	Manual override valve

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Figure 6-40. MGX-61500SC-HL, MGX-62000SC-HL (1 of 2)

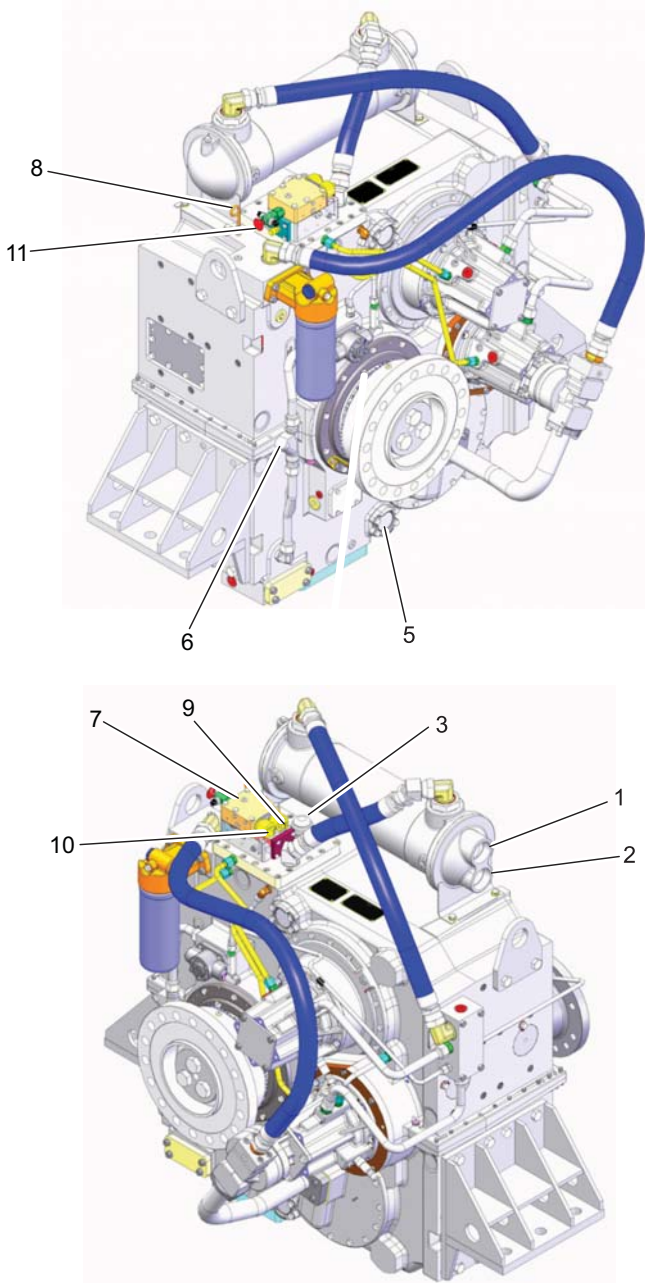
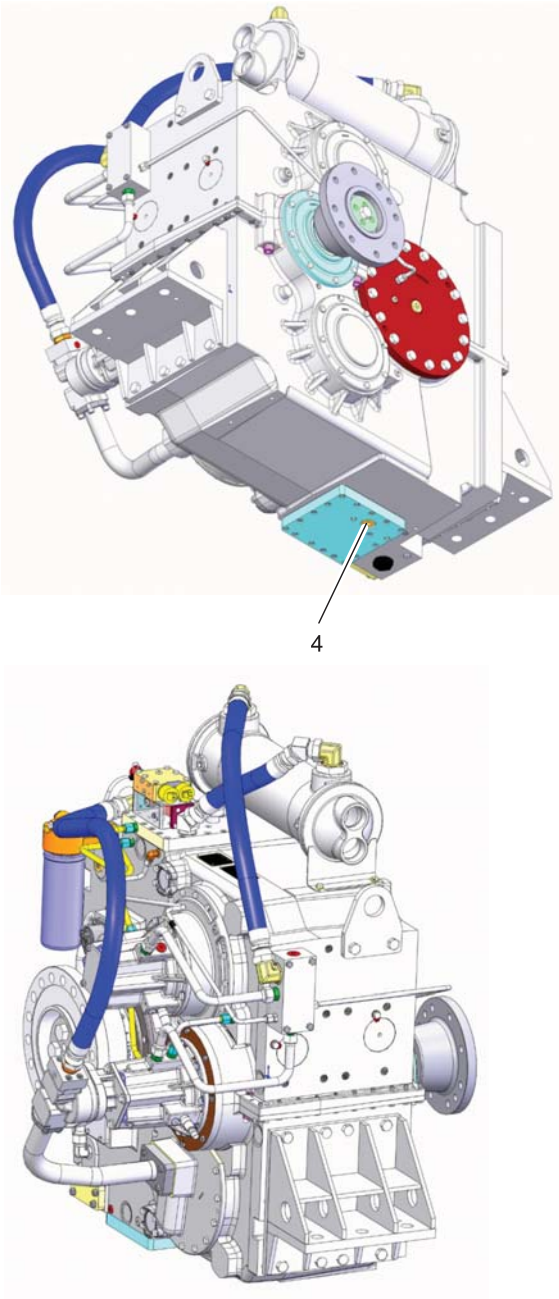


Figure 6-40. MGX-61500SC-HL, MGX-62000SC-HL (2 of 2)

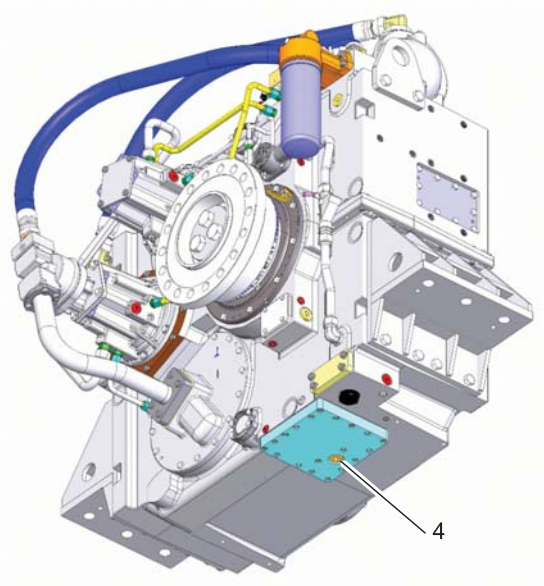
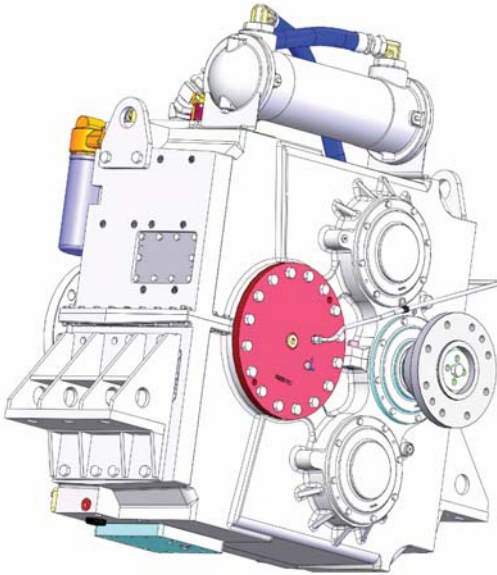


MGX-61500SC-HL, MGX-62000SC-HL Callout List - Figure 6-40

Callout	Component
1.	Water inlet to heat exchanger
2.	Water outlet from heat exchanger
3.	Breather, oil fill
4.	Oil drain
5.	Oil drain
6.	Trailing pump oil strainer
7.	Main pressure port
8.	Oil gauge
9.	Primary solenoid
10.	Secondary solenoid
11.	Manual override valve

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Figure 6-41. MGX-61500SC-HR, MGX-6200SC-HR (2 of 2)



MGX-61500SC-HR, MGX-6200SC-HR Callout List - Figure 6-41

Callout	Component
1.	Water inlet to heat exchanger
2.	Water outlet from heat exchanger
3.	Breather, oil fill
4.	Oil drain
5.	Oil drain
6.	Oil gauge
7.	Oil strainer
8.	Trailing pump oil strainer
9.	Main pressure port
10.	Primary solenoid
11.	Secondary solenoid
12.	Manual override valve

6.3 TWIN DISC, INCORPORATED

EXCLUSIVE LIMITED WARRANTY
COMMERCIAL MARINE
TRANSMISSION,
SURFACE DRIVE
ELECTRONIC CONTROL SYSTEMS

A. Twin Disc, Incorporated warrants all assembled products and parts, (except component products or parts on which written warranties issued by the respective manufacturers thereof are furnished to the original customer, as to which Twin Disc, Incorporated makes no warranty and assumes no liability) against defective materials or workmanship *for a period of twenty-four (24) months from the date of shipment by Twin Disc, Incorporated to original customer, but not to exceed twelve (12) months of service, whichever occurs first.* **This is the only warranty made by Twin Disc, Incorporated and is in lieu of any and all other warranties, express or implied, including the warranties of merchantability or fitness for a particular purpose and no other warranties are implied or intended to be given by Twin Disc, Incorporated.**

The original customer does not rely upon any tests or inspections by Twin Disc, Incorporated or on Twin Disc, Incorporated's application engineering. Twin Disc, Incorporated is not responsible for any specific application, installation or performance standard. Any analysis program by Twin Disc, Incorporated based upon customer supplied information is done solely as an accommodation to the customer and is not to be interpreted or construed as an approval for specific application or installation or a guarantee of performance.

B. The exclusive remedy provided by Twin Disc, Incorporated whether arising out of warranty within the applicable warranty period as specified, or otherwise (including tort liability), shall at the sole option of Twin Disc, Incorporated be either the repair or replacement of any Twin Disc, Incorporated part or product found by Twin Disc, Incorporated to be defective and the labor to perform that work and to remove and reinstall (or equivalent credit). In this context, labor is defined as the flat rate labor hours established by Twin Disc, Incorporated in the published Twin Disc Flat Rate Schedule, required to remove, disassemble, inspect, repair, reassemble, reinstall and test the Twin Disc, Incorporated product only. Authorized reasonable travel and living expenses will be considered for payment on all Commercial Marine Products except on Electronic Control Systems. . . Under no circumstances, including a failure of the exclusive remedy, shall Twin Disc, Incorporated be liable for economic loss, consequential, incidental or punitive damages.

The above warranty and remedy are subject to the following terms and conditions:

1. Complete parts or products upon request must be returned transportation prepaid and also the claims submitted to Twin Disc, Incorporated within sixty (60) days after completion of the in warranty repair.

2. The warranty is void if, in the opinion of Twin Disc, Incorporated, the failure of the part or product resulted from abuse, neglect, improper maintenance or accident.
3. The warranty is void if any modifications are made to any product or part without the prior written consent of Twin Disc, Incorporated.
4. The warranty is void unless the product or part is properly transported, stored and cared for from the date of shipment to the date placed in service.
5. The warranty is void unless the product or part is properly installed and maintained within the rated capacity of the product or part with installations properly engineered and in accordance with the practices, methods and instructions approved or provided by Twin Disc, Incorporated.
6. The warranty is void unless all required replacement parts or products are of Twin Disc origin or equal, and otherwise identical with components of the original equipment. Replacement parts or products not of Twin Disc origin are not warranted by Twin Disc, Incorporated.

C. As consideration for this warranty, the original customer and subsequent purchaser agree to indemnify and hold Twin Disc, Incorporated harmless from and against all and any loss, liability, damages or expenses for injury to persons or property, including without limitation, the original customer's and subsequent purchaser's employees and property, due to their acts or omissions or the acts or omissions of their agents, and employees in the installation, transportation, maintenance, use and operation of said equipment.

D. Only a Twin Disc, Incorporated authorized factory representative shall have authority to assume any cost or expense in the service, repair or replacement of any part or product within the warranty period, except when such cost or expense is authorized in advance in writing by Twin Disc, Incorporated.

E. Twin Disc, Incorporated reserves the right to improve the product through changes in design or materials without being obligated to incorporate such changes in products of prior manufacture. The original customer and subsequent purchasers will not use any such changes as evidence of insufficiency or inadequacy of prior designs or materials.

F. If failure occurs within the warranty period, and constitutes a breach of warranty, repair or replacement parts will be furnished on a no charge basis and these parts will be covered by the remainder of the unexpired warranty which remains in effect on the complete unit.

6.4 TWIN DISC, INCORPORATED

EXCLUSIVE LIMITED WARRANTY PLEASURE CRAFT MARINE TRANSMISSION, SURFACE DRIVE ELECTRONIC CONTROL SYSTEMS

A. Twin Disc, Incorporated warrants all assembled products and parts, (except component products or parts on which written warranties issued by the respective manufacturers thereof are furnished to the original customer, as to which Twin Disc, Incorporated makes no warranty and assumes no liability) against defective materials or workmanship *for a period of thirty six (36) months from the date of original shipment by Twin Disc, Incorporated to the original customer, but not to exceed twenty four (24) months or one thousand (1,000) hours of service, whichever occurs first.* **This is the only warranty made by Twin Disc, Incorporated and is in lieu of any and all other warranties, express or implied, including the warranties of merchantability or fitness for a particular purpose and no other warranties are implied or intended to be given by Twin Disc, Incorporated. This warranty applies only to private, non commercial (non revenue earning) marine pleasure craft applications.**

The original customer does not rely upon any tests or inspections by Twin Disc, Incorporated or on Twin Disc, Incorporated's application engineering. Twin Disc, Incorporated is not responsible for any specific application, installation or performance standard. Any analysis program by Twin Disc, Incorporated based upon customer supplied information is done solely as an accommodation to the customer and is not to be interpreted or construed as an approval for specific application or installation or a guarantee of performance.

B. The exclusive remedy provided by Twin Disc, Incorporated whether arising out of warranty within the applicable warranty period as specified, or otherwise (including tort liability), shall at the sole option of Twin Disc, Incorporated be either the repair or replacement of any Twin Disc, Incorporated part or product found by Twin Disc, Incorporated to be defective. For all models except MG340 and MG360 this include the labor to perform that work and to remove and reinstall (or equivalent credit). In this context, labor is defined as the flat rate labor hours established by Twin Disc, Incorporated in the published Twin Disc Flat Rate Schedule, required to remove, disassemble, inspect, repair, reassemble, reinstall and test the Twin Disc, Incorporated product only. Authorized reasonable travel and living expenses will be considered for payment in all model except MG340, MG360 and Electronic Control Systems. Under no circumstances, including a failure of the exclusive remedy, shall Twin Disc, Incorporated be liable for economic loss, consequential, incidental or punitive damages.

The above warranty and remedy are subject to the following terms and conditions:

1. Complete parts or products upon request must be returned transportation prepaid and also the claims submitted to Twin Disc, Incorporated within sixty (60) days after completion of the in warranty repair.

2. The warranty is void if, in the opinion of Twin Disc, Incorporated, the failure of the part or product resulted from abuse, neglect, improper maintenance or accident.
3. The warranty is void if any modifications are made to any product or part without the prior written consent of Twin Disc, Incorporated.
4. The warranty is void unless the product or part is properly transported, stored and cared for from the date of shipment to the date placed in service.
5. The warranty is void unless the product or part is properly installed and maintained within the rated capacity of the product or part with installations properly engineered and in accordance with the practices, methods and instructions approved or provided by Twin Disc, Incorporated.
6. The warranty is void unless all required replacement parts or products are of Twin Disc origin or equal, and otherwise identical with components of the original equipment. Replacement parts or products not of Twin Disc origin are not warranted by Twin Disc, Incorporated.

C. As consideration for this warranty, the original customer and subsequent purchaser agree to indemnify and hold Twin Disc, Incorporated harmless from and against all and any loss, liability, damages or expenses for injury to persons or property, including without limitation, the original customer's and subsequent purchaser's employees and property, due to their acts or omissions or the acts or omissions of their agents, and employees in the installation, transportation, maintenance, use and operation of said equipment.

D. Only a Twin Disc, Incorporated authorized factory representative shall have authority to assume any cost or expense in the service, repair or replacement of any part or product within the warranty period, except when such cost or expense is authorized in advance in writing by Twin Disc, Incorporated.

E. Twin Disc, Incorporated reserves the right to improve the product through changes in design or materials without being obligated to incorporate such changes in products of prior manufacture. The original customer and subsequent purchasers will not use any such changes as evidence of insufficiency or inadequacy of prior designs or materials.

F. If failure occurs within the warranty period, and constitutes a breach of warranty, repair or replacement parts will be furnished on a no charge basis and these parts will be covered by the remainder of the unexpired warranty which remains in effect on the complete unit.

6.5 Patent List

Country	Patent No.
JP	4,342,955
JP	4,004,406
KR	0922713
EP	1,499,527
EP	1,352,178
AU	2003211144
AU	2002236785
US	6,443,286
US	6,666,312
BR	PI 0206447-2
CN	ZL 02 8 03289.6
CN	ZL03809014.7
IN	233713

NOTES

