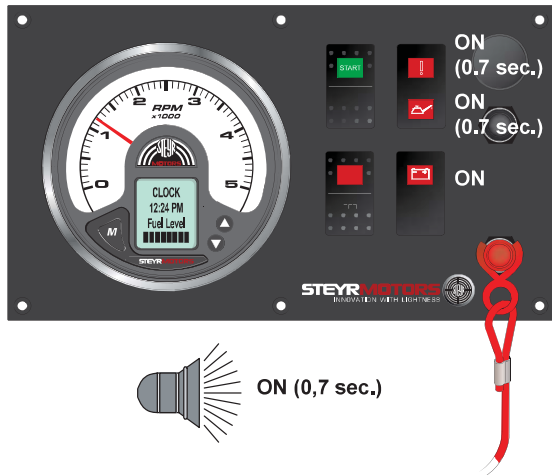


Instrument indication during normal operation (push button version)

1. ignition ON (... before starting)

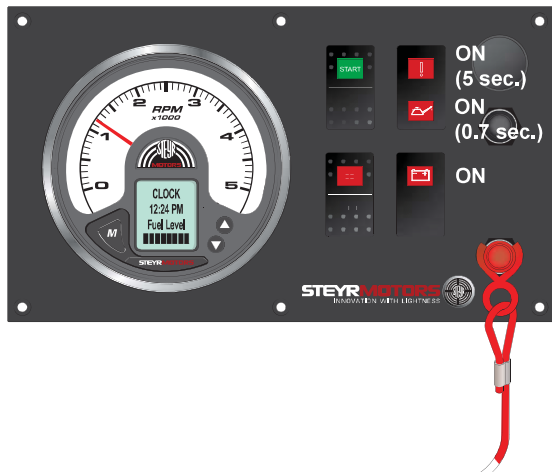


System check – see light indication

NOTE:

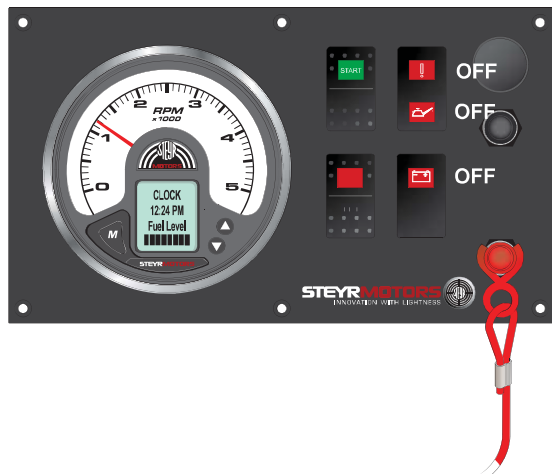
At low temperature condition (cold weather) the combined light for glow plug preheating & warning light engine oil pressure will not extinguish after 0,7 sec. (glow plug preheating phase). In this case start engine immediately after the light extinguishes.

2. ignition ON (... before starting)



Indication active error

3. engine running (after start)

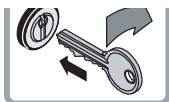


Normal condition

NOTE:

For further information see:

“Table – Error indication on Instrument Panel”



Emergency cut off switch (Lanyard)

An emergency cut off switch is a feature on the instrument panel. Use of this switch is highly recommended. To properly use this feature, attach the lanyard securely to your clothing. Do not attach the lanyard to clothing that will tear away before the lanyard is pulled from switch to stop the engine. Using this switch is simple and should not interfere with normal operation of the boat. Care must be taken to avoid accidental pulling of lanyard during normal operation. Unexpected loss of forward motion will occur. This could allow occupants to be thrown forward. In case the emergency cut off switch had been activated (lanyard pulled) the engine can be restarted by a person if; the pull knob (ill. pos. 1) of the emergency switch is being pulled and held in this position. While holding the pull knob proceed with the normal start procedure and start engine. The engine will immediately stop if the pull knob is released under this circumstances.

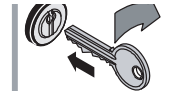


ATTENTION: The emergency cut off switch can only be effective when in good working condition.



Observe the following:

- * Lanyard must always be free of entanglements that could hinder its operation.
- * Once a month, check switch for proper operation. With engine running, pull lanyard. If engine does not stop, see your **STEYR MOTORS** DEALER for replacement of switch.



Warning lights and audible alarm

Your boat with the **STEYR MOTORS Marine Engine** engine is equipped with three warning lights and one audible alarm (mounted behind the instrument panel) to indicate the following operation condition or system deficiencies. (The ECU will also reduce the engine power in case an important operating parameter limit has been exceeded).

- * Indication Pre-warming Phase (combined indication through oil pressure light. Becomes affective if ambient engine coolant temperature is below 20 °C/68 °F)
- * Break – In; over load warning
- * Engine oil pressure too low
- * High coolant temperature
- * Sensors or sensor circuit defect

After ignition is turned "ON" the indication/warning lights are illuminated and the warning horn will sound for less then a second (0,7 sec.) this serves as a functional check for the optical/audible warning system.

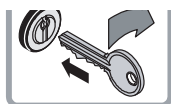
The indication light and the warning horn remain switched on for 5 sec. after ignition "ON" if a sensor or sensor circuit defect have been detected and stored in the Engine Control Unit (ECU) (see section Instrument Panel). Please contact your nearest **STEYR MOTORS** Marine Dealer to get professional assistance to verify the deficiency and to correct any possible failure.

If the engine oil pressure is too low, the warning light "engine oil pressure" lights and the audible alarm sounds. The engine power will be limited. In this case proceed as follows:

- * Check engine oil level, respectively add engine oil if necessary (refer to chapter Fuel and Lubricants)
- * Restart engine and watch the oil pressure light. The warning light has to extinguish within 3 or 4 second after the start. If this does not happen **the engine must be stopped immediately**. (Ignition "OFF")

In case of an overheating of the exhaust gas cooling system, the warning light "engine control" flashes and the audible alarm sounds (2 times per second); the engine power is reduced. In this case, proceed as follows:

- * **IMMEDIATELY** reduce the engine to idle speed.
- * Check and clean the raw water filter.
- * Check the coolant temperature gauge for overheating of engine coolant. If the coolant temperature gauge indicates overheating of engine coolant, switch for a short time to REVERSE to remove a possible clogging of the raw water inlet through large plastic parts etc., and then to FORWARD. Let the engine run at idle speed for some minutes. If the temperature gauge still indicates an overheating of the engine, the engine is to be stopped. Restart the engine only after having found and eliminated the cause for alarm. See **"loss of power"** in **Trouble Shooting Chart, Technical Data and in section Maintenance**. Check coolant level and if necessary, refill coolant until an adequate coolant level is achieved. If the cause for optical/audible alarm cannot be found, consult your **STEYR MOTORS** Marine dealer.



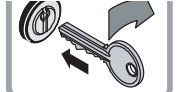
Electronic Engine Control Unit (ECU)

The **STEYR MOTORS Marine engine** is equipped with an Electronic Engine Control Unit (ECU) that performs the following:

- * controls engine functions to ensure maximum efficiency.
- * self-diagnostic to protect the engine from damage if operating parameter are exceeded.
- * stores diagnostic data of ECU server circuits for maintenance and service.
- * stores abuse data

Engine power is reduced if:

Operating Parameter	Effect noticed	Panel Indication	Additional Tool-Readings	Action or possible reason
High engine coolant temperature limit exceeded	Reduction of engine speed	Horn ON 2x p. sec. Gauge reading >107 °C	Steyr Diag Power limitation	See table trouble shooting: Cooling system
Defect – engine coolant sensor or sensor connection	Reduction of engine speed	Horn ON 2x p. sec. Gauge reading >120 °C	Steyr Diag Service code	Sensor or connector failure; see service code table
Exhaust temperature limit exceeded	Reduction of engine speed	Horn and indication light “CEL” ON 2x p. sec.	Steyr Diag Power limitation	See table trouble shooting: Raw water cooling system
Defect – Exhaust temperature sensor or sensor connection	Reduction of engine speed	Horn and indication light “CEL” ON 2x p. sec	Steyr Diag Service code	Sensor or connector failure; see service code table
Oil pressure below limit	Reduction of engine speed	Horn continuous and Oil indication light continuous switched ON	Steyr Diag Power limitation	See table trouble shooting: Engine oil system
Defect – Oil pressure sensor or sensor connection	Reduction of engine speed	Oil pressure indication light switched ON 1x p. sec.	Steyr Diag Service code	Sensor or connector failure; see service code table
Insufficient boost pressure or defective sensor	Reduction of engine speed		Steyr Diag Power limitation	See table trouble shooting: Air charge system
Engine speed sensor fault	Higher or unstable idle speed, limited performance	No RPM indication on tachometer	Steyr Diag Service code	See table trouble shooting: Speed sensor
Engine speed remains at idle	No increase of engine speed if throttle is moved to max.		Steyr Diag Service code	See table trouble shooting: Accelerator potentiometer failure
Governor position system	Irregular engine speed or stalled engine		Steyr Diag Service code	See table trouble shooting: Governing system



Diagnostic system

The electronic engine control unit monitors the following engine parameters:

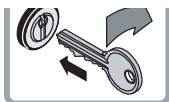
oil pressure, boost pressure, coolant temperature, exhaust pipe temperature (Hi-riser), sensor control rack, potentiometer accelerator, speed signal

The ECU carries out self-diagnostic and/or plausibility checks for all input values and sensor connections. In case of irregularities, there is an optical or audible warning signal. (see page 74)

Stored service codes can be selected and cleared after elimination of deficiency via SCC P/No: 2179497-0

Please consult authorized **STEYR MOTORS** service partners to assist in faultfinding procedure if necessary.

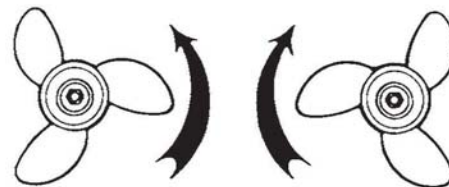
Malfunction during operation is ranked in three different categories intermittent failure, non essential failure and essential failure.



Twin Installations

All **STEYR MOTORS Marine Engine** inboard models can also be set up for counter-rotation for twin installation. This is done by inverting direction of cable lines on shift lever in order to achieve a counter-rotation of propeller.

Counter-rotation is accomplished in the gearbox. The propeller, propeller shaft and output gear are the only parts that counter-rotate. The engine always has standard rotation.



- 4** It is customary to operate your propeller as shown on this illustration for twin installation.

Some boat manufacturers may set up twin installations the opposite way. When propellers and/or cable lines are removed, care must be taken to attach them at the same position as before, and that the propellers are not exchanged.

Optional Propellers

Propellers are available in all regular sizes for both right- and left-hand rotation. Stainless steel has greater strength and durability than aluminium. This allows the stainless steel propeller blades to be thinner and still maintain more beam strength than aluminium propellers. The result is a more efficient propeller that gives better performance and more fuel economy.

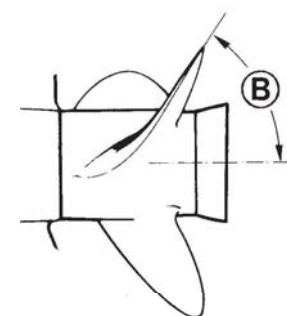
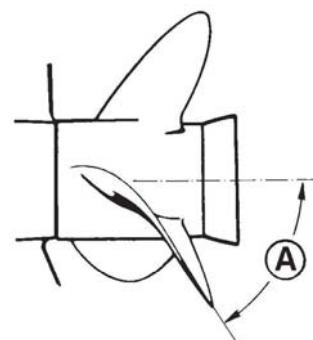
Propellers

- 5** Right-hand propellers rotate clockwise to propel a boat forward. Right-hand propellers are considered standard-rotation propellers. To identify a right-hand propeller, note the angle **(A)** of the blade as seen from portside.

- 6** Left-hand propellers rotate counterclockwise to propel a boat forward. Left-hand propellers are considered counter-rotation propellers. To identify a left-hand propeller, note the angle **(B)** of the blade as seen from portside.

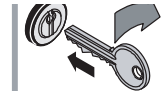
NOTE: Never interchange a right-hand propeller with a left-hand propeller. This would result in the boat being propelled in reverse when propulsion units are operated in forward gear, and forward when propulsion units are operated in reverse gear. To help you better understand and show the difference between left-hand and right-hand propellers, see illustrations.

After having the propellers serviced, always shift into FORWARD or REVERSE at idle speed and determine whether the boat moves in the right direction. If the boat moves in the OPPOSITE direction, the propellers have not been installed properly.



ATTENTION: Failure to perform above test could result in loss of control.





Propeller Torque

The torque of the propeller creates forces that are transmitted to the boat. This can cause the boat to lean to one side (list).

The forces created by the counter-rotating propeller are opposite to the forces created by the standard rotating propeller. When the vertical drives are trimmed equal, these opposite forces balance each other.

Propeller care

A damaged or unbalanced propeller will cause excessive vibration and a loss of boat speed. Under these conditions, stop the engine and check the propeller for damage. If the propeller seems to be damaged, have it checked and repaired by your local **STEYR MOTORS** Marine dealer. Always carry a spare propeller and replace the damaged propeller as soon as possible.

NOTE: Never run with a damaged propeller. Running with a damaged propeller can result in damage to drive components and engine.

Water Jet

When using water jet drives, please contact your **STEYR MOTORS** Marine dealer. As to information on function and application, please refer to respective documents and documentation of the drive manufacturer.

Operating Procedure for Freezing Temperatures

When freezing temperatures are forecast and the boat will be operated and left in the water, the propeller must remain in the tilted down (submerged) position at all times to prevent water in the vertical drive from freezing. Upon completion of engine operation, drain the engine as described in **Off-Season Storage Preparations**.

Salt Water Operation

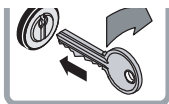
Fresh water to flush the raw water circuit is recommended after use in salt, polluted, or brackish water to prevent deposits from clogging and corroding the cooling passages. Contact your **STEYR MOTORS** Marine dealer to obtain an Engine Flushing Kit that allows flushing of the engine when in or out of the water.

NOTE: Use in salt or brackish water may require additional anti-corrosion protection.

NOTE: START and RUN Diesel-Engine while raw water circuit is flushed with fresh water!

High Altitude Operation

Your **STEYR MOTORS** Marine Engine is specified to operate within an altitude from a sea level of 1000 meters without any performance loss. Operation in altitude above 1000 meter are not recommended.



Fuel Pump

The **STEYR MOTORS Marine Engine** is equipped with an electric fuel pump. It is turned “ON” and “OFF” with the key switch. If the engine is not started within 10 seconds after turning the key switch “ON”, the fuel pump is automatically turned off.

Fuel System Checks

Fill the tank with the recommended fuel. Keeping tanks full reduces water condensation and helps keep fuel cool, which is important to engine performance.

Make sure that fuel supply valves (if used) are open, and valve cock seals are absolutely (gas) tight.

To insure a prompt start and an even run of the engine, the fuel system is to be rinsed by means of the electric fuel pump (ignition “ON” several times for app. 10 sec.) before starting the engine the first time and/or after every replacement of a fuel filter.

Refill fuel at the end of each day's operation to prevent condensation build up in tank. Condensation formed in a partially filled tank contaminates the fuel and promotes the growth of microbial organisms that can block fuel filters and restrict fuel flow.

If the engine is equipped with a fuel/water separator, drain off any water that has accumulated. Water in fuel can seriously affect engine performance and damage injection equipment reducing engine life expectancy.

STEYR MOTORS recommends installing a pre-fuel filter with water separating capability. The filter flow rate must allow a flow rate of 350 l/h with a maximum permissible pressure drop rate of less than 200 mBar.

Fuel Contamination

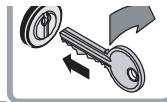
In the marine environment, the most likely fuel contaminants are water and microbial growth (black “slime”). Generally, this type of contamination is the result of poor fuel handling practices. Black “slime” requires water in the fuel to form and grow; the best prevention is to keep water content in storage tank to a minimum.

Treating fuel with microbial growth requires the use of fuel additive.

STEYR MOTORS does recommend the use of fuel additives such as Biobor JF, or equivalent, for treatment of microbiological fuel contamination. Follow the manufacturers instructions for use. If treating fuel, frequent fuel filter changes will be necessary until fuel system is purged.

NOTE: A galvanized steel tank should never be used for fuel storage, because the fuel reacts chemically with the zinc coating forming powdery flakes which can quickly clog the fuel filters and damage the fuel pump and injectors.

NOTE: Do not dry run fuel pump.



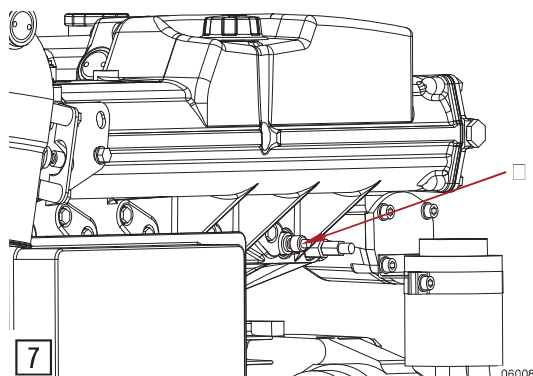
Cooling System (Function Description 4 Cylinder Marine Engine)

STEYR MOTORS Marine Engines are equipped with a closed (internal) and an open (external cooling circuit).

7 Closed Cooling Circuit

The closed cooling circuit includes monoblock as well as exhaust manifold, heat exchanger and expansion tank. Temperature in the closed cooling circuit is precisely controlled by means of thermostat. The thermostat determines the amount of coolant circulating through the heat exchanger, thus controlling the operating temperature of the engine.

A temperature sensor **(7/A)** controls the cooling temperature. An excessive temperature rise of the coolant will cause an optical and audible alarm (see table "Error indication on Panel Section"). In this case, engine power will be reduced.

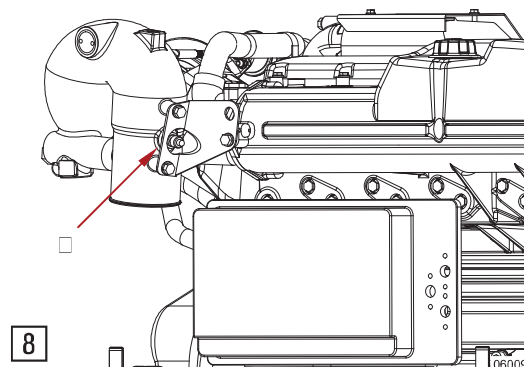


The temperature gauge on the instrument panel indicates the coolant temperature of the engine.

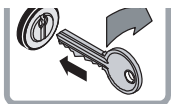
8 Open Cooling Circuit (Raw Water Circuit)

Thermal energy transferred by the engine and absorbed by the engine coolant is drained via the (external) raw water circuit. Raw water is sucked by the pump via the raw water intake, constantly pumped through intercooler and heat exchanger, and discharged together with the exhaust gas inside the exhaust elbow. In this passage the raw water exits through the exhaust pipe system.

A temperature sensor **(8/A)** monitors the raw water- and exhaust gas mix-temperature. An excessive rise will cause an optical and audible alarm (see table "Error indication on Panel Section"). In this case, the engine power will be reduced.



NOTE: Should engine overheat at high speeds, slowly reduce RPM to idling to prevent damages to the engine. In case of overheating problems, contact your **STEYR MOTORS** Marine dealer.



Cooling System (Function Description 6 cylinder SE Marine Engine)

STEYR MOTORS Marine Engines are equipped with a closed (internal) and an open (external cooling circuit).

9 Closed Cooling Circuit

The closed cooling system consist of pressurized circuit and a non pressurized expansion vessel. The pressurized circuit consists of coolant distribution manifold, monoblock coolant jacket, exhaust manifold with thermostat and heat exchanger. The system pressure is controlled by a pressure cap on the rear top part of the exhaust manifold. A hose mounted to this pressure cap nipple connects up to the expansion vessel, allowing an exchange of coolant liquid depending of engine operation condition. The level of coolant in the expansion vessel differs between cold and warmed up engine in a range of the min- & max-indicating marks. Temperature in the closed cooling circuit is controlled by means of thermostat. The thermostat determines the amount of coolant circulating through the heat exchanger, thus controlling the operating temperature of the engine.

A temperature sensor (**9/A**) controls the cooling temperature. An excessive temperature rise of the coolant will cause an optical and audible alarm (see table "Error indication on Panel Section"). In this case, engine power will be reduced.

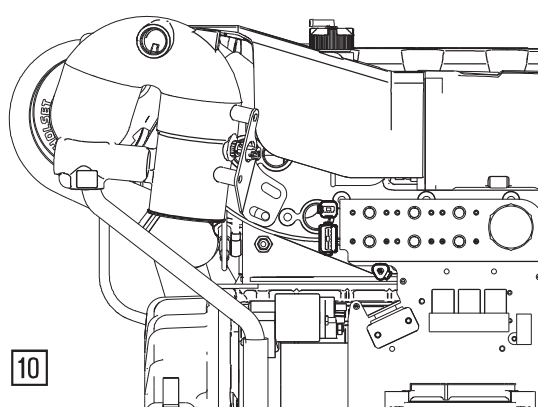
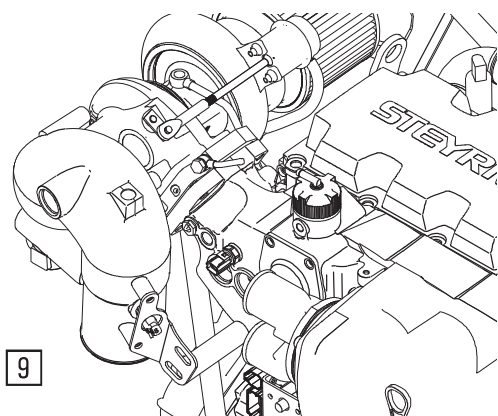
The temperature gauge on the instrument panel indicates the coolant temperature of the engine.

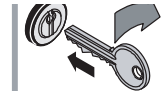
10 Open Cooling Circuit (Raw Water Circuit)

Thermal energy transfered by the engine and absorbed by the engine coolant is drained via the (external) raw water circuit. Raw water is sucked by the pump via the raw water intake, constantly pumped through intercooler and heat exchanger, and discharged together with the exhaust gas inside the exhaust elbow. In this passage the raw water exits through the exhaust pipe system.

A temperature sensor (**10/A**) monitors the raw water- and exhaust gas mix-temperature. An excessive rise will cause an optical and audible alarm (see table "Error indication on Panel Section"). In this case, the engine power will be reduced.

NOTE: Should engine overheat at high speeds, slowly reduce RPM to idling to prevent damages to the engine. In case of overheating problems, contact your **STEYR MOTORS** Marine dealer.





Electrical Equipment

The electrical equipment of your **STEYR MOTORS Marine engine** primarily consists of an alternator with transistorized voltage regulator, battery and all necessary connecting cables and leads.

NOTE: 24 V on board system requires a specified dc/dc-converter to supply the entire Engine Management System EMS with 12V. For detailed instructions consult your authorized STEYR MOTORS Service Partner.

Alternator

The alternator is driven via a **poly-V-belt** resp. serpentine belt charges the battery at all engine speeds. Output at idle speed is limited to low amparage/voltage values and will rise with an engine speed to maximum output above 3000revs.

Optional:

Alternators are available with different outputs and voltages.

Battery

FOR ALL 4 CYL. MARINE ENGINES

Use a 12-volt battery with a cold testing circuit of 450 A at -18°C and a **minimum capacity of 92 Ah** at 27°C , to ensure the supply of the electric and electronic components at all operating conditions.

FOR ALL 6 CYL. MARINE ENGINES

Use a 12-volt battery with a cold testing circuit of 650 A at -18°C and a **minimum capacity of 115 Ah** at 27°C , to ensure the supply of all electric and electronic components.

ATTENTION: * Do not use jumper cables and a booster battery to start engine. Remove battery from boat and recharge.



– WRONG CONNECTION WILL DESTROY ELECTRONIC SYSTEM –

* Do not charge battery in boat. Fumes vented during battery charging can lead to an explosion.

* **Battery electrolyte is a corrosive acid and should be handled with care.**

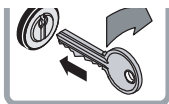
If electrolyte is spilled or splashed on any part of the body, immediately flush the exposed area with liberal amounts of water and obtain medical aid as soon as possible.

High resistance in the charging circuit can seriously affect the operation of the electrical system. Unless there is definite malfunction in the electrical system, high resistance is sometimes caused by corroded or loose connections. Wherever practical, the electrical connections on your engine have been sealed. However, we recommend that you make periodic inspections to ensure clean, tight connections throughout the electrical system.

NOTE: It is important that the battery connections are correct. The negative battery cable must be attached to the negative terminal (–) on the battery and the engine's positive cable must be attached to the positive terminal (+) on the battery. **If these connections are reversed, the regulating unit may be immediately damaged.**

Inspect your battery at regular intervals for specific gravity (state of charge), individual cell water level, cleanliness and clean, tight connections.

If the battery has become discharged for no apparent reason, check all electrical system components for malfunction, or a switch left in ON position prior to installing recharged battery.



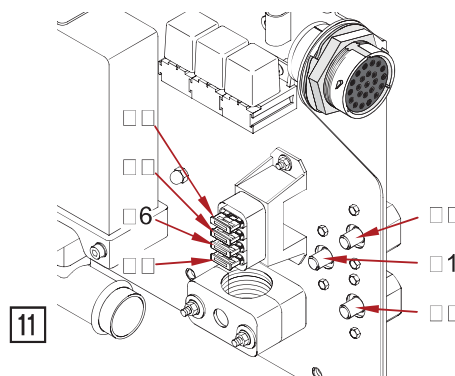
Circuit Breakers & Fuses 4 Cylinder Marine Engine

STEYR MOTORS Marine Engine models are protected against overload by circuit breakers.

- 11** On the base plate of the E-box three thermal triggered 50 amp. circuit breakers are installed. **(F2)** protects the electric circuit of the glow plugs of cylinder 1 & 2 ; **(F3)** protects the electric circuit for the glow plugs of cylinder 3 & 4 ; **(F1)** protects electric system and electronic management. The ignition key and instruments are protected by a 10 amp. Fuse located in the main wiring harness **beneath instrument panel** (location ignition key).

- F4** Fuse supply module
- F5** Fuse main circuit supply
- F6** Fuse fuel-pump circuit
- F7** Fuse glow-plug circuit
- F9** Fuse ignition switch circuit (instrument panel)

NOTE: Fuses for fuel, ECU-supply, glow plug-relay are inside the E-box cover.



06011

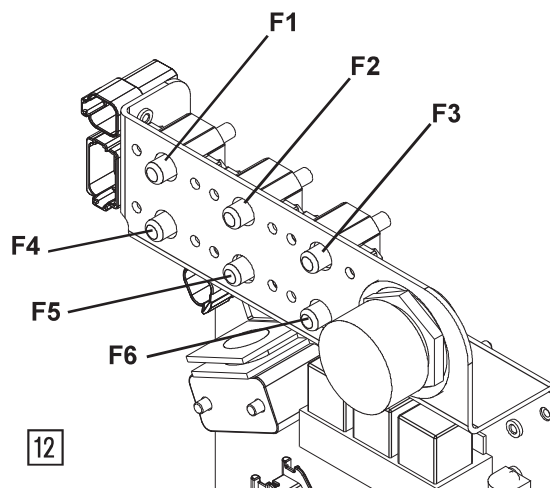
Circuit Breakers & Fuses 6 Cylinder SE Marine Engine

STEYR MOTORS Marine Engine models are protected against overload by circuit breakers.

- 12** The base plate of the E-box carries 6 different thermal triggered circuit breakers.

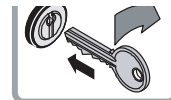
Fuse Protection Level and Function

- F1** 20 Amp Fuse VBatt Main Relay
- F2** 25 Amp Fuse fuel-pump circuit
- F3** 20 Amp Fuse ECU circuits
- F4** 50 Amp Fuse glow-plug circuit
- F5** 50 Amp Fuse glow-plug circuit
- F6** 12,5 Amp Fuse D+ Alternator Terminal



NOTE: Avoid sparks that will damage the alternator or ECU. Do not attempt to connect or disconnect any part of the electrical system while the engine is running.

NOTE: The installation of any additional electrical accessories requires the protection of individual circuits. Consumption of current should occur directly at the battery.



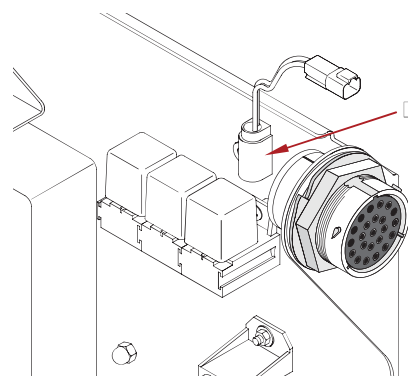
Inversion Switch

- 13** The inversion switch is a mercury switch **(A)** which is actuated in case of an inclination of the boat in any direction over 70°. Via the main circuit relay the engine is shut down.
For safe guarding reasons the inversion switch is to be checked every 50 hrs or 6 months.
(See service- and maintenance chart page 64).

ATTENTION: After such an event, this temporarily stored operating condition is to be cancelled from the engine management system by ignition "OFF" = "Reset". Without "Reset", a new start of the engine is not possible.

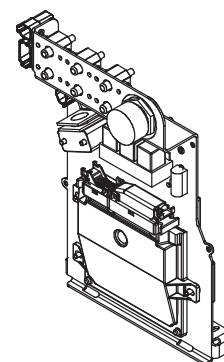


13



06012

- 14** **NOTE:** 6 cylinder SE Engines carry the inversion switch inside the E-box cover.



14

Interrupt crankshaft housing ventilation

- 15** During possible vessel inversion, the by-pass valve **(B)** for crankshaft housing ventilation is closed too. This avoids a possible oil outlet via suction through the air filter.

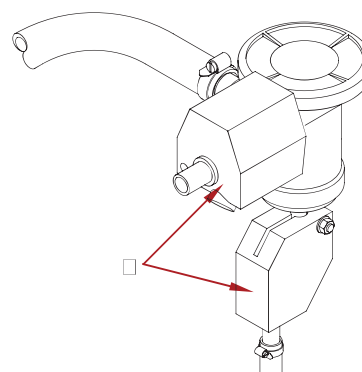
Instrument Panel

The engines are supplied with the standard instrument panel. The respective customer may use a self-adapted **STEYR MOTORS** instrument panel or one which corresponds to his own ideas and requirements.

ATTENTION: For not approved alterations which lead to engine failure, no liability can be undertaken.



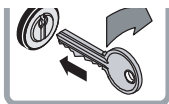
15



06010

Dry Operation

After a dry operation of the engine (without raw water cooling), check the impeller of the raw water pump for damages. Replace if necessary. Grease the impeller, use grease from special impeller kit Z011753/2.





FUEL AND LUBRICANTS

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Filter Maintenance & Service	48
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Motor Oil	49
Oil Identification Symbol	49
Disposal of Automotive Waste Products	50



Fuel Requirements

The **STEYR MOTORS Marine Engines** are designed for maximum fuel economy. To maintain specified performance, use diesel fuel according to EN590 or equivalent.

How to Select Fuel

Fuel quality is an important factor in obtaining satisfactory engine performance, long engine life, and acceptable exhaust emission levels. Direct injected diesel engines are designed to operate with most diesel fuels marketed today.

For more details refer to our downloadlink:

<http://www.steyr-motors.com/marine-diesel-engines/2-4-and-6-cylinder>

Click to "here" in the sentence:

"Click here to learn more about the STEYR MOTORS M1 multi fuel capability"

Filter Maintenance & Service

Check for Service Intervals on pre- & finefilter as specified on the maintenance table or if necessary due to fuel contamination.

Pre-Filter Specification:

Flow rate: 350 l/h

Suction Line: min. 16 mm

Min Water separation efficiency: 93 % (acc. ISO 4020, out of emulsified water, at max. flow rate)

Min particle filtration efficiency: 10 % (acc. ISO TR13353:1994 3-5µm @ max. pump flow rate)

max pressure loss at filter(new): 50 mbar

max pressure loss at filter(used): 200 mbar

Engine Lubrication

If you choose to lubricate your **STEYR MOTORS Marine Engine** yourself, refer to the **Lubrication and Inspection Chart** for lubrication points and recommended lubricants. Use only STEYR MOTORS recommended lubricants or lubricants of equivalent quality and viscosity. See your STEYR MOTORS dealer for recommended lubricants.

If you choose to have your **STEYR MOTORS Marine Engine** lubricated, see your local dealer. He will gladly lubricate it at the required intervals.

Motor Oil

To obtain the best engine performance and engine life, **STEYR MOTORS TURBO Diesel Engine Oil SAE 10 W-40 (Z010058/0)** is recommended. Motor oils are specified by **ACEA**, **API** service codes and SAE viscosity numbers. If **STEYR MOTORS TURBO Diesel Engine Oil** is not available, you are required to use a reputable brand of motor oil labelled for **ACEA E7 or E4**, **API CF** Service codes and SAE viscosity number 10 W-40. Refer to oil identification symbol on the container.

Initial factory fill is a full synthetic high quality break-in oil specified **ACEA E7, E4, API CF, SAE 10 W-40**. During the break-in period (initial 20 hours), frequently check the oil level. Somewhat higher oil consumption is normal until piston rings are seated. The oil level should be maintained between the minimum and maximum marks on the dipstick. The space between the marks represents approximately 3.7 quarts (3.5 litres). For **oil level dipstick location**, refer to your **authorized STEYR MOTORS-dealer**.

NOTE:

You can place the oil dip stick on the left- and on the right side of the engine.

There are two different oil dip sticks available according to the engine inclination.

After first 50 hours of operation change the motor oil and replace the oil filter. Refer to Service and Maintenance Schedule.

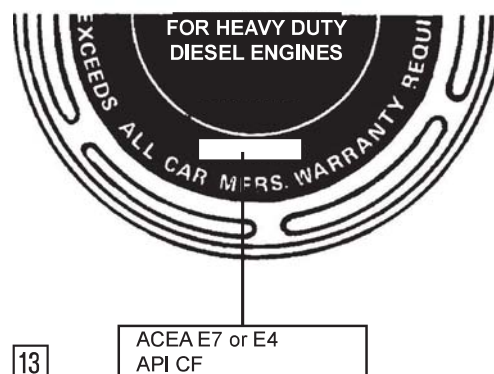
Oil Identification Symbol

Motor oils are specified by **ACEA**, **API** service codes, and SAE viscosity numbers. These may be found on the label, top of can, or oil identification symbol.

NOTE: Some oils meet more than one ACEA or API service rating. The recommended ACEA or API service codes must be among these service ratings.

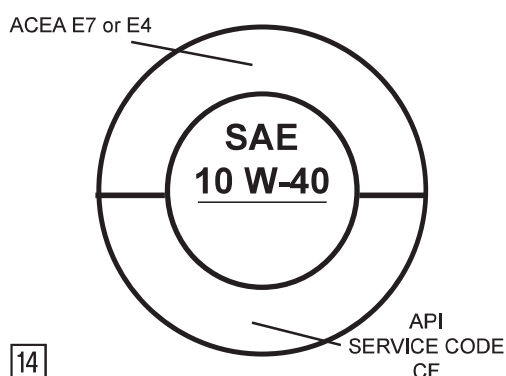


13.03 ill.3



13

ACEA E7 or E4
API CF



14

13 Top of Can

14 Oil Identification Symbol



Disposal of Automotive Waste Products

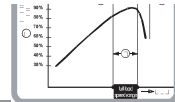
Used fuel and oil is to be collected in separate containers to permit an eventual subsequent treatment.



The disposal of any fuel and oil for the engine is subject to the special waste act. The “special waste catalogue” önorm s2100 refers to the necessary disposal in Austria. Please follow the local regulations of your country.

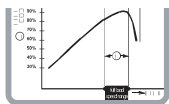
The operating and maintenance personnel has to take care that fuel and oil as well as other material ranking as special waste are deposited at the respective collecting points.

Code No.	Designation
31 423	oil contaminated ground or oil binder
54 102	waste oil
54 104	fuel
54 202	grease
54 207	vaseline
54 917	compact sealing material
54 927	oil contaminated scouring cloth
54 928	used oil- and air filters
55 510	colour- or varnish containing waste



TECHNICAL DATA

Model and Serial Numbers	52
Technical Data and Overview MO54NA33	53
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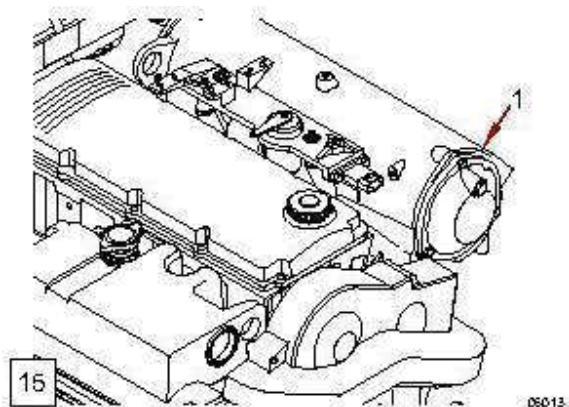


Model and Serial Numbers

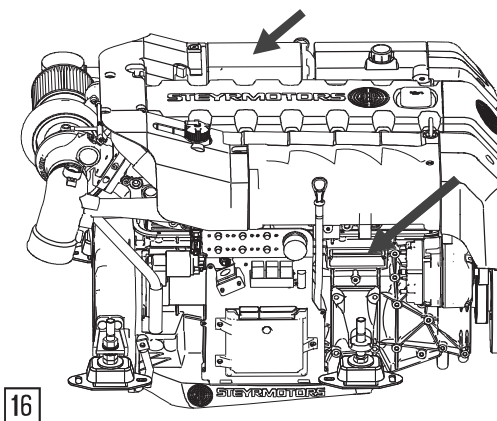
The model and serial number (see ill. 15/16) is located on the engine as illustrated.

These numbers are required for warranty claims and ordering parts.

FOR ALL 4 CYL. MARINE ENGINES



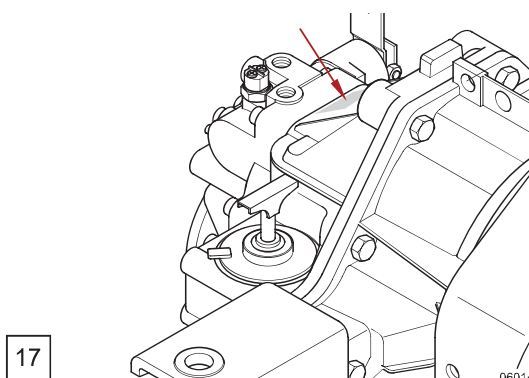
FOR ALL 6 CYL. MARINE ENGINES

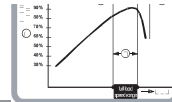


- 17** The model and serial number of the marine gearbox is located on the marine gearbox housing as illustrated.



To obtain instructions regarding marine gearbox operation, refer to marine gearbox owners manual.



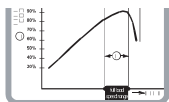


Technical Data and Overview MO54NA33

MAKE	STEYR MOTORS M 14 TCM, TCAM
type	MO54NA33
displacement	2133 cm ³
piston displacement	85,0 x 94,0 mm
rated power acc. EN ISO 8665:2006 (impeller*) KW/HP Jet – Drive/Inboard Z – Drive	39/52 38/52
number of cylinders	4-cylinder in-line engine (position of cyl. 1 at vibration damper side)
ignition order	1 – 3 – 4 – 2
sense of rotation, seen from front	right
compression ratio	17,0:1
full-load speed range (rpm)	3300 rpm (+0 rpm/–200 rpm)
idle speed	700 rpm (adjustable)
injection	Plunger activated, two stage, high pressure with electronically controlled injection rate
fuel	acc. to CEC RF-03-A-84 (DIN 51601) Cetan >45; diesel fuel No. 2-D, temperature above –7 °C; No.1-D, temperature below –7 °C
fuel filter	refer to spare part catalogue
fuel filter location	intake-sided
air filter	refer to spare part catalogue
oil pressure above 2000 rpm	400 – 700 kPa (58 – 101 PSI) microprocessor controlled
filling capacity motor oil	approx. 8,0 l engine housing (incl. approx. 1 l oil filter contents)
specification motor oil	SAE 5W-50/ACEA B4-02/API CF or 10W-40/ACEA E4, E5, E7/API CF P/N0. Z010058/0
oil and oil filter change intervals**)	every 150 operating hours and/or once per season
oil filter	refer to spare part catalogue
oil filter location	pressure-sided
electric charging system	14 V/90 A alternator with transistorized voltage regulator
cooling system	dual cooling circuit; thermostat-controlled, pressurized cooling circuit; circulating pump with heat exchanger on engine; governor pump, external raw water circuit to heat exchange
coolant capacity	11,5 liters
coolant	STEYR MOTORS engine coolant –36 °C P/No. Z011785/0

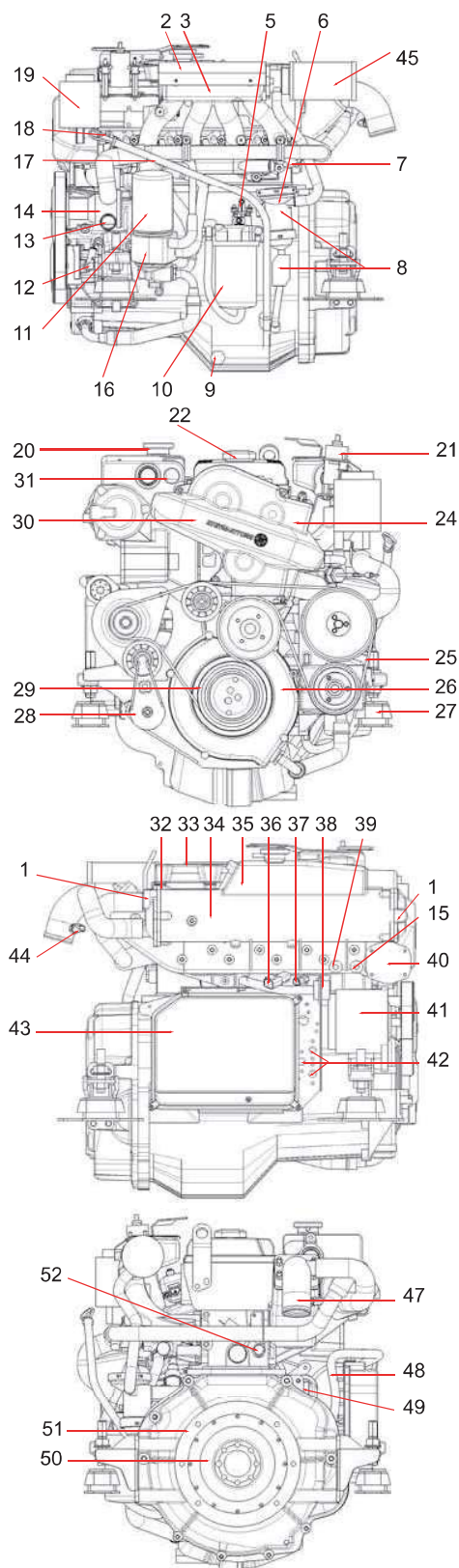
*) Efficiency of gearbox = 97,0 %, efficiency of Z-Drive = 95,5 %

**) Extended periods to be evaluated upon application and type of usage STEYR MOTORS GmbH.
Reserves the right to make changes without notice or obligations.

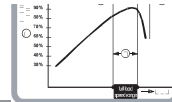


Overview for all STEYR MOTORS 4 Cyl. Marine Engines

Item	Designation
1	Zinc Anode (2 Units)
2	Model and Serial Number
3	Intake Manifold
5	Fuel Pump
6	Oil Separator
7	Raw Water Drain Plug
8	Valve Crankshaft Housing Ventilation (only SOLAS)
9	Oil Drain Plug
10	Fuel Filter1
11	Oil Filter
12	Hydraulic Pump
13	Raw Water Inlet Fitting
14	Raw Water Pump
15	Coolant Drain Plug (2 Units)
16	Engine Oilcooler
17	Oil Suction Pipe
18	Oil Dipstick
19	Hydraulic Oil Tank
20	Cooler Cap
21	Potentiometer Accelerator
22	Motor Oil Filler Cap
24	Rack Position Sensor*)
25	Drive Belt
26	Cover T-Belt, Lower
27	Engine Mount
28	Drive Belt Tensioner
29	Vibration Damper
30	Cover T-Belt, Upper
31	Engine Lifting Eye
32	Speed Sensor
33	Valve Cover
34	Heat Exchanger
35	Coolant Expansion Tank
36	Diagnostic Outlet
37	Inversion Switch (only for SOLAS)
38	Connector Instrument Panel
39	Coolant Temperature Sensor
40	Thermostat Housing
41	Alternator
42	Circuit Breakers
43	Engine Management System/Fuses
44	Exhaust Temperature Sensor
45	Air Filter
47	Exhaust Elbow
48	Starter Relais (Backside E-Box Ground Plate)
49	Starter Motor
50	Flywheel
51	Flywheel Housing
52	Oil Pressure Sensor



*) This sensor is magnetism sensitive. All external magnets must be kept away.

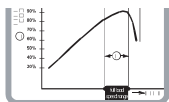


Technical Data and Overview MO84K32, MO94K33, MO114K33

MAKE	STEYR MOTORS M 14 TCM, TCAM		
type	MO84K32	MO94K33	MO114K33
displacement	2133 cm ³		
piston displacement	85,0 x 94,0 mm		
rated power acc. EN ISO 8665:2006 (impeller*) KW/HP Jet – Drive/Inboard Z – Drive	53/71 52/70	64/86 63/84	78/105 77/104
number of cylinders	4-cylinder in-line engine (position of cyl. 1 at vibration damper side)		
ignition order	1 – 3 – 4 – 2		
sense of rotation, seen from front	right		
compression ratio	17,5:1		
full-load speed range (rpm)	3200 rpm (+0 rpm/–200 rpm)	3300 rpm (+0 rpm/–200 rpm)	3800 rpm (+0 rpm/–200 rpm)
idle speed	700 rpm (adjustable)		
injection	Plunger activated, two stage, high pressure with electronically controlled injection rate		
fuel	acc. to CEC RF-03-A-84 (DIN EN 590) Cetan >49; diesel fuel No. 2-D, temperature above –7 °C; No.1-D, temperature below –7 °C		
fuel filter	refer to spare part catalogue		
fuel filter location	intake-sided		
air filter	refer to spare part catalogue		
oil pressure above 2000 rpm	400 – 700 kPa (58 – 101 PSI) microprocessor controlled		
filling capacity motor oil	approx. 8,0 l engine housing (incl. approx. 1 l oil filter contents)		
specification motor oil	SAE 5W-50/ACEA B4-02/API CF or 10W-40/ACEA E4, E5, E7/API CF P/N0. Z010058/0		
oil and oil filter change intervals**)	every 150 operating hours and/or once per season		
oil filter	refer to spare part catalogue		
oil filter location	pressure-sided		
electric charging system	14 V/90 A alternator with transistorized voltage regulator		
cooling system	dual cooling circuit; thermostat-controlled, pressurized cooling circuit; circulating pump with heat exchanger on engine; governor pump, external raw water circuit to heat exchange		
coolant capacity	11,5 liters		
coolant	STEYR MOTORS engine coolant –36 °C P/No. Z011785/0		

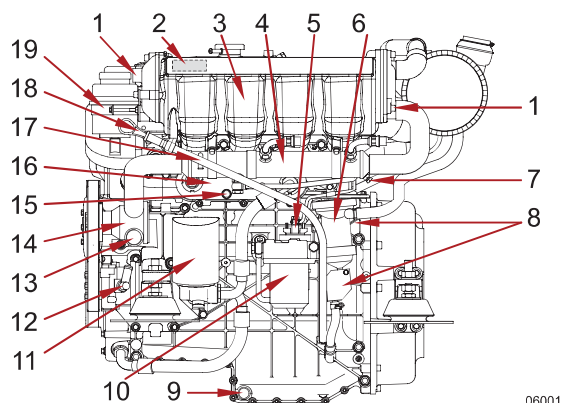
*) Efficiency of gearbox = 97,0 %, efficiency of Z-Drive = 95,5 %

**) Extended periods to be evaluated upon application and type of usage STEYR MOTORS GmbH.
Reserves the right to make changes without notice or obligations.

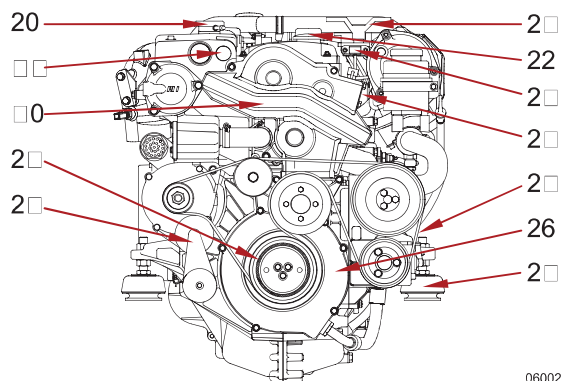


Overview for all STEYR MOTORS 4 Cyl. Marine Engines

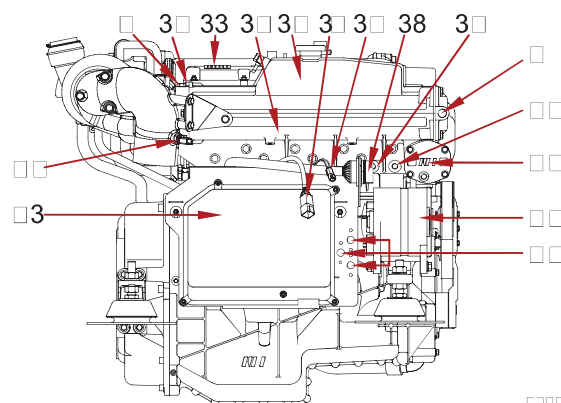
Item	Designation
1	Zinc Anode (4 Units)
2	Model and Serial Number
3	Intercooler
4	Fuel/Oil Cooler with Raw Water Drain Plug
5	Fuel Pump
6	Oil Separator
7	Raw Water Drain Plug
8	Valve Crankshaft Housing Ventilation (only SOLAS)
9	Oil Drain Plug
10	Fuel Filter
11	Oil Filter
12	Hydraulic Pump
13	Raw Water Inlet Fitting
14	Raw Water Pump
15	Coolant Drain Plug (2 Units)
16	Engine Oilcooler
17	Oil Suction Pipe
18	Oil Dipstick
19	Hydraulic Oil Tank
20	Cooler Cap
21	Potentiometer Accelerator
22	Motor Oil Filler Cap
23	Boost Pressure Sensor
24	Rack Position Sensor*)
25	Drive Belt
26	Cover T-Belt, Lower
27	Engine Mount
28	Drive Belt Tensioner
29	Vibration Damper
30	Cover T-Belt, Upper
31	Engine Lifting Eye
32	Speed Sensor
33	Valve Cover
34	Heat Exchanger
35	Coolant Expansion Tank
36	Diagnostic Outlet
37	Inversion Switch (only for SOLAS)
38	Connector Instrument Panel
39	Coolant Temperature Sensor
40	Thermostat Housing
41	Alternator
42	Circuit Breakers
43	Engine Management System/Fuses
44	Exhaust Temperature Sensor
45	Air Filter
46	Turbo Charger
47	Exhaust Elbow
48	Starter Relais (Backside E-Box Ground Plate)
49	Starter Motor
50	Flywheel
51	Flywheel Housing
52	Oil Pressure Sensor



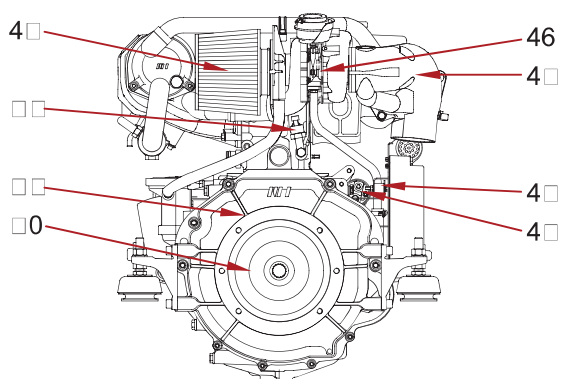
06001



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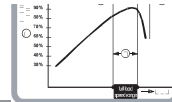


06003



06004

*) This sensor is magnetism sensitive. All external magnets must be kept away.

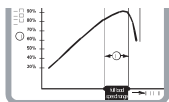


Technical Data and Overview MO144M38, MO164M40, MO174V40

MAKE	STEYR MOTORS M 14 TCM, TCAM		
type	MO144M38	MO164M40	MO174V40
displacement	2133 cm ³		
piston displacement	85,0 x 94,0 mm		
rated power acc. EN ISO 8665:2006 (impeller*) KW/HP Jet – Drive/Inboard Z – Drive	103/138 101/136	116/156 114/154	121/165 119/162
number of cylinders	4-cylinder in-line engine (position of cyl. 1 at vibration damper side)		
ignition order	1 – 3 – 4 – 2		
sense of rotation, seen from front	right		
compression ratio	17.5:1		17.0:1
full-load speed range (rpm)	3800 rpm (+0 rpm/–300 rpm)	4000 rpm (+0 rpm/–300 rpm)	4000 rpm (+0 rpm/–300 rpm)
idle speed	700 rpm (adjustable)		
injection	Plunger activated, two stage, high pressure with electronically controlled injection rate		
fuel	acc. to CEC RF-03-A-84 (DIN EN 590) Cetan >49; diesel fuel No. 2-D, temperature above –7 °C; No.1-D, temperature below –7 °C		
fuel filter	refer to spare part catalogue		
fuel filter location	intake-sided		
air filter	refer to spare part catalogue		
oil pressure above 2000 rpm	400 – 700 kPa (58 – 101 PSI) microprocessor controlled		
filling capacity motor oil	approx. 8,0 l engine housing (incl. approx. 1 l oil filter contents)		
specification motor oil	SAE 5W-50/ACEA B4-02/API CF or 10W-40/ACEA E4, E5, E7/API CF P/N0. Z010058/0		
oil and oil filter change intervals**)	every 150 operating hours and/or once per season		
oil filter	refer to spare part catalogue		
oil filter location	pressure-sided		
electric charging system	14 V/90 A alternator with transistorized voltage regulator		
cooling system	dual cooling circuit; thermostat-controlled, pressurized cooling circuit; circulating pump with heat exchanger on engine; governor pump, external raw water circuit to heat exchange		
coolant capacity	11,5 liters		
coolant	STEYR MOTORS engine coolant –36 °C P/No. Z011785/0		

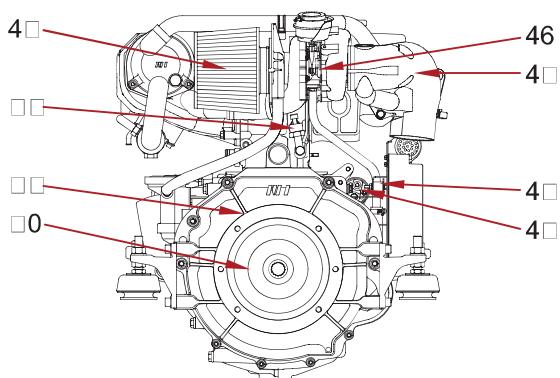
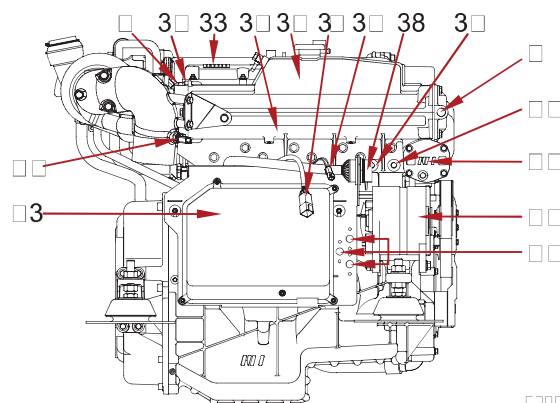
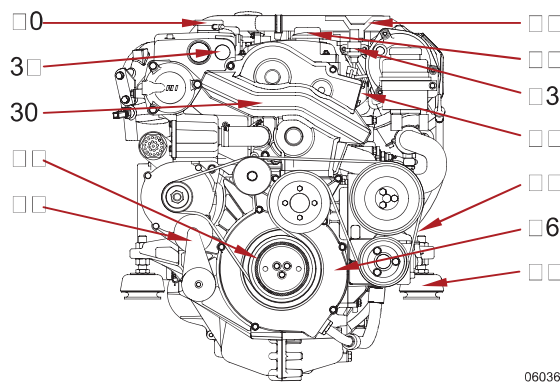
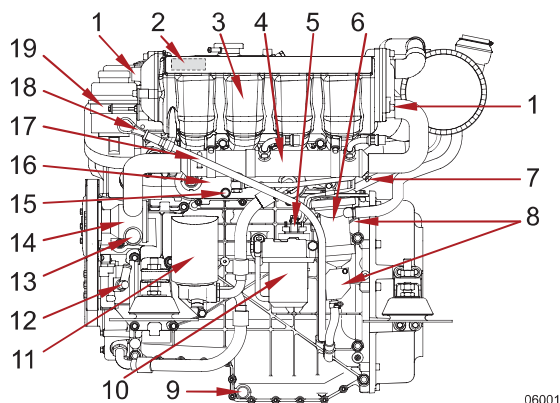
*) Efficiency of gearbox = 97,0 %, efficiency of Z-Drive = 95,5 %

**) Extended periods to be evaluated upon application and type of usage STEYR MOTORS GmbH.
Reserves the right to make changes without notice or obligations.

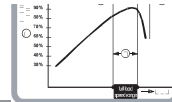


Overview for all STEYR MOTORS 4 Cyl. Marine Engines

Item	Designation
1	Zinc Anode (4 Units)
2	Model and Serial Number
3	Intercooler
4	Fuel/Oil Cooler with Raw Water Drain Plug
5	Fuel Pump
6	Oil Separator
7	Raw Water Drain Plug
8	Valve Crankshaft Housing Ventilation (only SOLAS)
9	Oil Drain Plug
10	Fuel Filter
11	Oil Filter
12	Hydraulic Pump
13	Raw Water Inlet Fitting
14	Raw Water Pump
15	Coolant Drain Plug (2 Units)
16	Engine Oilcooler
17	Oil Suction Pipe
18	Oil Dipstick
19	Hydraulic Oil Tank
20	Cooler Cap
21	Potentiometer Accelerator
22	Motor Oil Filler Cap
23	Boost Pressure Sensor
24	Rack Position Sensor*)
25	Drive Belt
26	Cover T-Belt, Lower
27	Engine Mount
28	Drive Belt Tensioner
29	Vibration Damper
30	Cover T-Belt, Upper
31	Engine Lifting Eye
32	Speed Sensor
33	Valve Cover
34	Heat Exchanger
35	Coolant Expansion Tank
36	Diagnostic Outlet
37	Inversion Switch (only for SOLAS)
38	Connector Instrument Panel
39	Coolant Temperature Sensor
40	Thermostat Housing
41	Alternator
42	Circuit Breakers
43	Engine Management System/Fuses
44	Exhaust Temperature Sensor
45	Air Filter
46	Turbo Charger
47	Exhaust Elbow
48	Starter Relais (Backside E-Box Ground Plate)
49	Starter Motor
50	Flywheel
51	Flywheel Housing
52	Oil Pressure Sensor



*) This sensor is magnetism sensitive. All external magnets must be kept away.

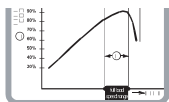


Technical Data and Overview SE-Engines

MAKE	STEYR MOTORS M 16 TCM, TCAM
type	SE-Engines
displacement	3200 cm ³
piston displacement	85,0 x 94,0 mm
number of cylinders	6-cylinder in-line engine (position of cyl. 1 at vibration damper side)
ignition order	1 – 5 – 3 – 6 – 2 – 4
sense of rotation, seen from front	right
compression ratio	17:1
full-load speed range (rpm)	refer to chapter 1 – marine engine overview
idle speed	630 rpm (adjustable)
injection	Plunger activated, two stage, high pressure with electronically controlled injection rate
fuel	acc. to CEC RF-03-A-84 (DIN EN 590) Cetan >49; diesel fuel No. 2-D, temperature above –7 °C; No.1-D, temperature below –7 °C
pre- & main fuel filter	refer to spare part catalogue
fuel filter location	suction-sided
air filter	refer to spare part catalogue
filling capacity motor oil	approx. 16,0 l engine housing (incl. approx. 1 l oil filter contents)
specification motor oil	SAE 5W-50/ACEA B4-02/API CF or 10W-40/ACEA, E7/API CF P/N0. Z010058/0
oil and oil filter change intervals**)	every 300 operating hours and/or once per season
oil filter	refer to spare part catalogue
oil filter location	suction-sided
cooling system	dual cooling circuit; thermostat-controlled, pressurized cooling circuit; circulating pump with heat exchanger on engine; governor pump, external raw water circuit to heat exchange
coolant capacity	13,2 liters
coolant	STEYR MOTORS engine coolant –36 °C P/No. Z011785/0

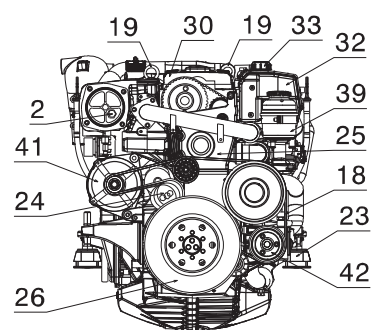
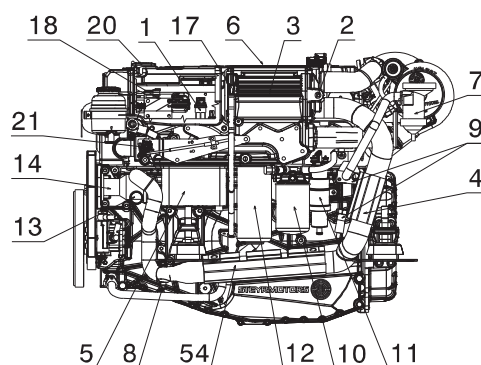
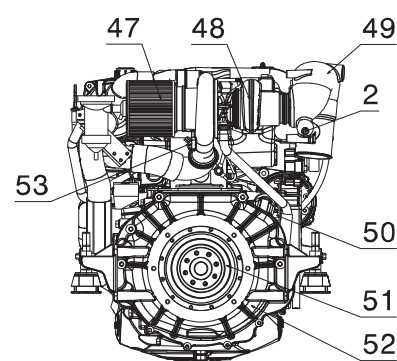
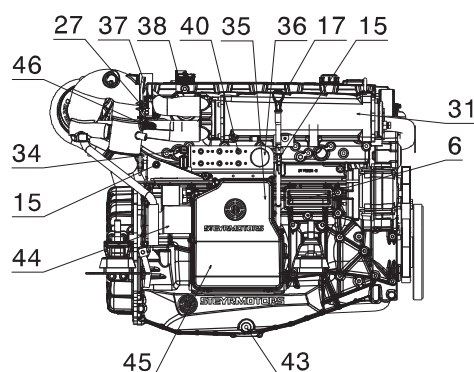
*) Efficiency of gearbox = 97,0 %, efficiency of Z-Drive = 95,5 %

**) Extended periods to be evaluated upon application and type of usage STEYR MOTORS GmbH.
Reserves the right to make changes without notice or obligations.

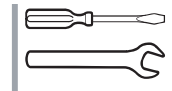


Overview STEYR MOTORS SE-Series

Item	Designation
1	Boost Pressure Sensor
2	Zinc Anode (3 Units)
3	Intercooler
4	Fuel Cooler
5	Engine Oilcooler
6	Model and Serial Number
7	Oil Seperator
8	Raw Water Drain Plug
9	Valve Crankshaft Housing Ventilation
10	Fuel Filter
11	Fuel Pump
12	Oil Filter
13	Raw Water Inlet Fitting
14	Raw Water Pump
15	Coolant Drain Plug (2 Units)
16	Oil Suction Pipe
17	Oil Dipstick
18	Rack Position Sensor *)
19	Engine Lifting Eye
20	Motor Oil Filler Cap
21	Potentiometer Accelerator
22	Drive Belt, Raw Water Pump
23	Engine Mount
24	Drive Belt Tensioner
25	Cover T-Belt, Lower
26	Vibration Damper
27	Speed Sensor
28	Cover T-Belt, Upper
29	Cover Rear
30	Valve Cover
31	Heat Exchanger
32	Coolant Expansion Tank
33	Cooler Cap
34	Diagnostic Outlet
35	Inversion Switch
36	Connector Instrument Panel
37	Coolant Temperature Sensor
38	Thermostat Housing
39	Hydraulic Oil Tank
40	Circuit Breakers
41	Alternator
42	Hydraulic Pump
43	Oil Drain Plug
44	Starter Motor
45	Engine Management System/Fuses
46	Exhaust Temperature Sensor
47	Air Filter
48	Turbo Charger
49	Exhaust Elbow
50	Starter Relais (Backside E-Box Ground Plate)
51	Flywheel
52	Flywheel Housing
53	Oil Pressure Sensor
54	Hydraulic Oil Cooler

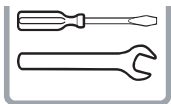


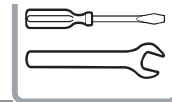
*) This sensor is magnetism sensitive. All external magnets must be kept away.



MAINTENANCE AND TROUBLE SHOOTING

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Owner Service Log

FOREWORD

On receipt of your new **STEYR MOTORS Marine Engine**, the authorised dealer has signed the pre-delivery inspection log thus confirming to have carried out a pre-delivery service according to the manufacturers specifications.

Future service requirements are indicated in this **OWNER SERVICE LOG**. When these services are carried out, the STEYR MOTORS Marine dealer will stamp the respective stubs. This servicing will assist in maintaining the value and satisfactory operation of your **STEYR MOTORS Marine Engine**.

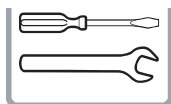
It lies in the owner's interest that for maintaining warranty and best performance of his **STEYR MOTORS Marine Engine** he always insists on the sole utilization of **STEYR MOTORS – ORIGINAL** replacement parts, operational fluids and lubricants as well as STEYR MOTORS proved service procedures!

It is important that you study this booklet carefully as it will assist you in achieving satisfaction from your **STEYR MOTORS Marine Engine**. Please retain this manual in the boat as it **MUST** be presented to the **STEYR MOTORS Marine dealer** whenever you require **WARRANTY** and/or **SERVICE**.

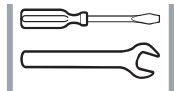
IMPORTANT NOTE

This manual contains all service activities required for your engine. Checks and maintenance for the other parts of a complete drive system still need to be completed. Any such procedures are to be found in separate, attached booklet(s) of the individual manufacturer's literature provided with the gearbox or similar drive components.

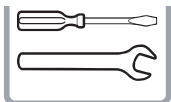
Whenever this manual refers to components like Manual Operation, Hydraulic Pump, etc., such instructions only apply where applicable since they are not used on every engine model.



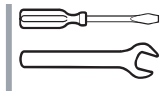
Service- and Maintenance Schedule			Daily	After first 50 hours or 6 months	Every 300 h. or 12 months	Every 600 h. or 24 months	notes
Engine Lubrication	Check	– For leakage	•				
		– oil level	•				
	Change	– oil filter		•	•		
		– motor oil		•	•		
Engine Cooling System	Check	– for leakage	•				
		– fluid level	•				
		– hoses, hose clamps	•				
		– antifreeze temperature condition		•	•		
	Change	– antifreeze					Every 24 months
Raw Water System	Check	– hoses, hose clamps	•				
		– zinc anodes		•			periodically
		– impeller			•		
	Change	– impeller				•	If required
		– zinc anodes		•			If sacrificial progress reaches a material corrosion of 50%
	Preserve	– raw water circuit			•		After season
Raw Water Cooler (Oil-Fuel-Aux. Lubricant)	Check	– raw water passages			•		Clean out desposits in pipelines
	Change	– zinc anodes			•		If sacrificial progress reaches a material corrosion of 50%
Air Filter	Check	– contamination	•				
	Change	– air filter element				•	
	Preserve	–					After season
Fuel System	Check	– for leakage	•				
		– hoses		•	•		
		– prefilter					
	Change	– fuel filters		•		•	
	Check	– fuel filter		•	•		
		– prefilter					
	Preserve	– fuel system					After season
Battery	Battery	– acid level		•	•		
		– density		•	•		
Electronics	Check	– connections					After season
Electrical Equipment	Check	– connections		•	•		Tighten loose connections. Renew cables, if required
		– insulation		•	•		



Service- and Maintenance Schedule			Daily	After first 50 hours or 6 months	Every 300 h. or 12 months	Every 600 h. or 24 months	notes
Inversion Switch	Check	– switch		•			
Driving System	Re-center	– driving unit		•	•		See manufacturers specifications
Turbo Charger	Check	– actuation			•		
	lubricate	–			•		
Warning Device	Check	– function	•				Safety relevant
Engine Mount Screws	Check	– torque		•			Every 900 hours
Safety Equipment	Check	– remote control	•				Local rules and consultation of your STEYR Marine Dealer
		– emergency cutout	•				
		– completeness	•				
		– condition				•	
Poly V-Belt	Check	– belt, pulleys and tighteners for wear		•	•		
	Change	– poly V-belt					Every 1500 hours or every 48 months
Poly V-Belt Tensioner	Check	–		•	•		
	Lubricate	–			•		
Glow Plugs	Change	– plugs					Every 1500 hours or every 48 months
Timing Belt	Check	– belt tension		•	•		
	Change	– timing belt					Every 1800 hours or every 48 months
		– idler pulley					
		– water pump, tensioner					Every 3600 hours or every 48 months
Valves	Check	– valve clearance		•			Every 900 hours
		For Commercial use only					Check valve clearance 300 hrs.
Engine Timing	Check	– set timing		•			Every 900 hours
Unit Injector	Check	– set levers		•			Every 900 hours
		– set point		•			Every 900 hours
		– tighten torques		•			Every 900 hours
		For Commercial use only					unit injector adjustment 300 hrs.
Hydraulic Pump	Check	– oil level	•				
		– for leakage	•				
	Change	– hydraulic oil (ATF)				•	Every 900 h. or every 24 months



<i>Service- and Maintenance Schedule</i>			<i>Daily</i>	<i>After first 50 hours or 6 months</i>	<i>Every 300 h. or 12 months</i>	<i>Every 600 h. or 24 months</i>	notes
Gearbox-Sterndrive	<i>Check</i>	– oil level	●				
		– for leakage	●				
	<i>Change</i>	– gear oil (ATF)					See Manufacturer's specification
		– oil filter					
Torsional Coupler	<i>Check</i>	– Tightness of bolts					Every 48 months
	<i>Change</i>	– bolts					If required, replace bolts by using loc-tite 243
Front Vibration Damper	<i>Check</i>	– tightening torque		●		●	
Engine Compartment and Bilge	<i>Check</i>	– leakage water	●				Repair or consult your STEYR Marine Dealer
		– leakage fuel	●				
		– leakage exhaust gas	●				
Shifting	<i>Check</i>	– smooth action	●				If required, to be replaced by your STEYR Marine Dealer
		– adjustment	●				
Steering	<i>Check</i>	– lubrication	●				See Manufacturer's specification
		– oil level	●				
Shaft Bearing Gland	<i>Check</i>	– lubrication	●				Consult STEYR Marine Dealer
		– sealing	●				



Sticker of 1st preservation

(refer to Installation Manual P/N Z001007-0/
Chapter 18/Installation and pre-delivery
inspection report)

Date:

Sticker of 2nd preservation

Date:

Sticker of 3rd preservation

Date:

Commissioning

Date:

50 h Service

Made by:

Date:

150 h Service

Made by:

Date:

300 h Service

Made by:

Date:

450 h Service

Made by:

Date:

600 h Service

Made by:

Date:

750 h Service

Made by:

Date:

900 h Service

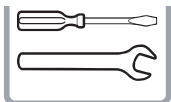
Made by:

Date:

1050 h Service

Made by:

Date:



1200 h Service

Made by:

Date:

1350 h Service

Made by:

Date:

1500 h Service

Made by:

Date:

1650 h Service

Made by:

Date:

1800 h Service

Made by:

Date:

1950 h Service

Made by:

Date:

2100 h Service

Made by:

Date:

2250 h Service

Made by:

Date:

2400 h Service

Made by:

Date:

2550 h Service

Made by:

Date:

2700 h Service

Made by:

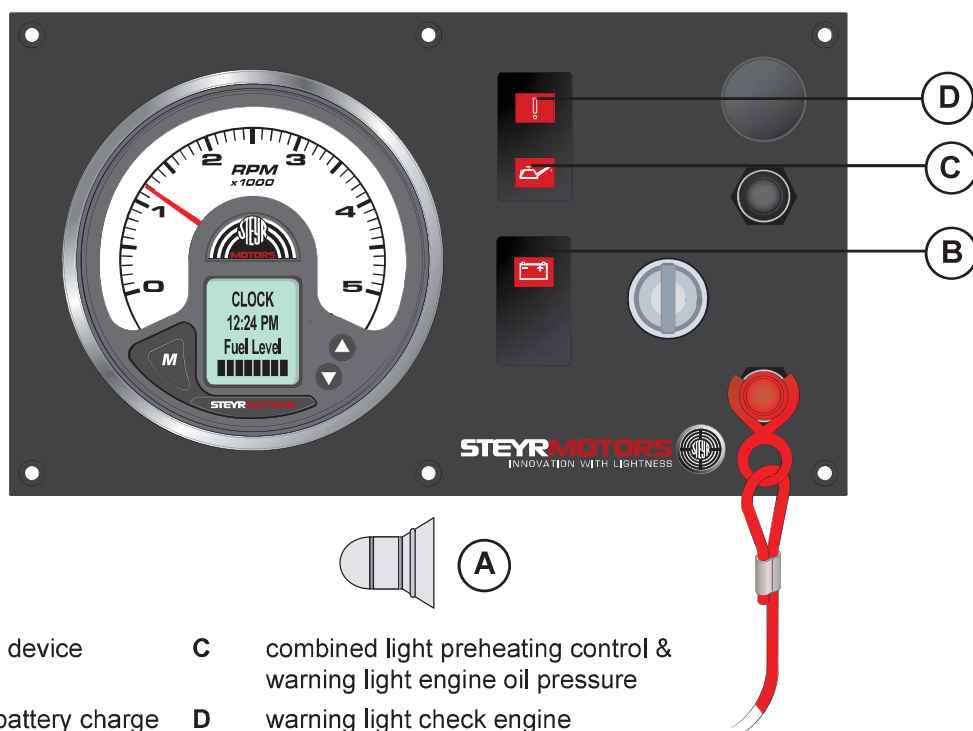
Date:

2850 h Service

Made by:

Date:

Table – Error Indication on Instrument Panel

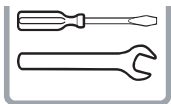


- A** audible warning device **C** combined light preheating control & warning light engine oil pressure
B warning light – battery charge **D** warning light check engine

Operating condition: During normale engine operation, or indication in case of sensor defect while ignition is switched ON.

Event: Speed resp. performance limitation during engine operation

Indication status	Fault	Remarks
<p>80° – 90 °C</p> <p>ON</p>	<p>oil pressure below min. limit</p>	<p>check oil level, contact authorized workshop</p>
<p>80° – 90 °C</p> <p>OFF</p>	<p>fault oil pressure sensor or sensor connection</p>	<p>check oil level, contact authorized workshop</p>
<p>ON</p>	<p>engine overload during break-in period</p>	<p>reduce throttle position until light goes OFF (indication during first 2 hours of operation) see “engine break in procedure”</p>





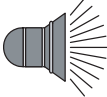



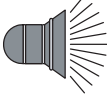



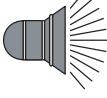








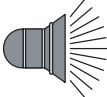

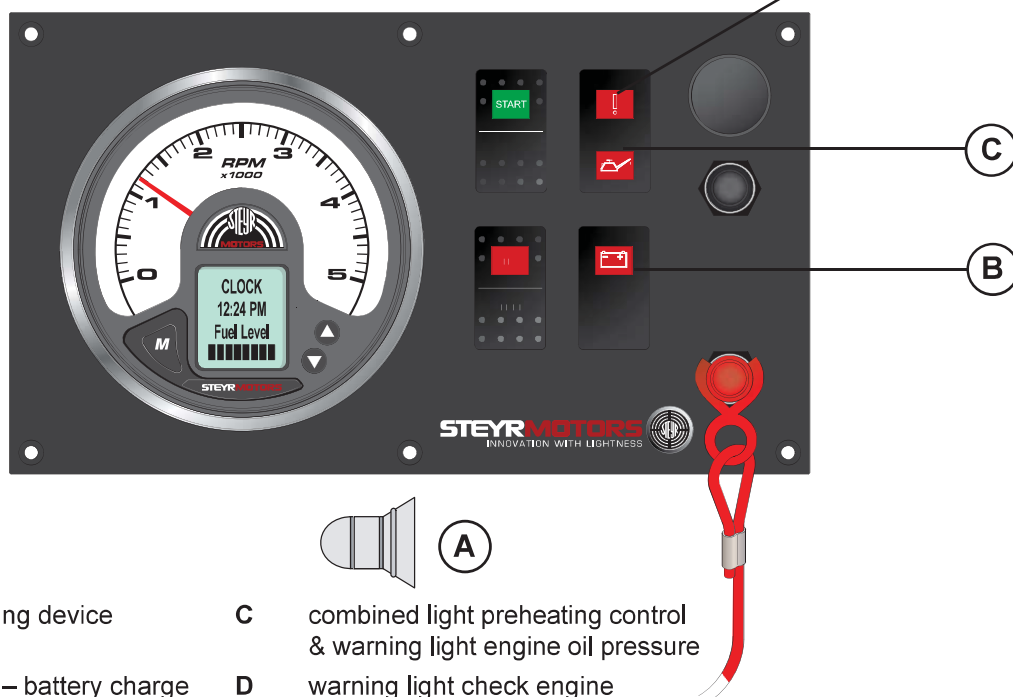
Indication status			Fault	Remarks
80° – 90 °C		FLASHING (2x per sec.)	high exhaust temperature (over 80 °C) or defect exhaust temperature sensor or bad connection	check raw water system, strainer, impeller pump contact authorized workshop
ON		OFF		
 (2x per sec.)		OFF		
high approx 108 °C		OFF	engine coolant temperature too high	after cooling down, check engine coolant level contact authorized workshop
ON		OFF		
 (2x per sec.)		OFF		
120 °C		OFF	defect engine coolant sensor or bad connection	after cooling down, check engine coolant level contact authorized workshop
ON		OFF		
 (2x per sec.)		OFF		
80° – 90 °C		OFF	unstable idle speed, no indication on tachometer 	defect speed sensor or sensor connection contact authorized workshop
OFF		OFF		
		OFF		
80° – 90 °C		ON	Trouble in governing loop, involved components: control solenoid, rack, control gear of unit injector, rack position sensor	contact authorized workshop
ON		OFF		
 (2x per sec.)		OFF		

Table – Error Indication on Instrument Panel (for SOLAS only) D



A audible warning device

C combined light preheating control
& warning light engine oil pressure

B warning light – battery charge

D warning light check engine

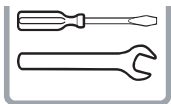
Operating condition:



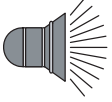



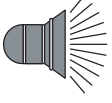









During normale engine operation, or indication in case of sensor defect while ignition is switched ON.

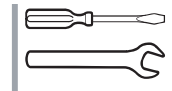
Event:

Speed resp. performance limitation during engine operation

Indication status			Fault	Remarks
ON 	80° – 90 °C	OFF	oil pressure below min. limit	check oil level, contact authorized workshop
		ON		
		OFF		
OFF 	80° – 90 °C	OFF	fault oil pressure sensor or sensor connection	check oil level, contact authorized workshop
		FLASH-ING (1x per sec.)		
		OFF		
ON 		ON	engine overload during break-in period	reduce throttle position until light goes OFF (indication during first 2 hours of operation) see "engine break in procedure"



Indication status			Fault	Remarks
80° – 90 °C		FLASHING (2x per sec.)	high exhaust temperature (over 80 °C) or defect exhaust temperature sensor or bad connection	check raw water system, strainer, impeller pump contact authorized workshop
ON		OFF		
 (2x per sec.)		OFF		
high approx 105 °C		OFF	engine coolant temperature too high	after cooling down, check engine coolant level contact authorized workshop
ON		OFF		
 (2x per sec.)		OFF		
120 °C		OFF	defect engine coolant sensor or bad connection	after cooling down, check engine coolant level contact authorized workshop
ON		OFF		
 (2x per sec.)		OFF		
80° – 90 °C		ON	Trouble in governing loop, involved components: control solenoid, rack, control gear of unit injector, rack position sensor	contact authorized workshop
ON		OFF		
		OFF		



Indication and Cancellation of memorised sensor and circuit faults

Selection and clearing of stored service codes

Procedure:

* Ignition – OFF

* Connect Tool VR00135/1 to Diagnostic Outlet Plug (X23)

* Ignition – ON

NOTE: The program changes automatically to indication of service codes. If no service code is stored, only repeating control code reading "Code # 12" will be displayed. Possible memorized codes are indicated as shown in the previous illustrated example (blinking 3x Code # 12 i. e. 3x service code # 14 etc.) The sequence will be prolonged with additional codes if more than one service code is stored. See Table – Service codes for description

* To delete a determined service code from the Engine Management System concentrate for the 3rd times flashing the desired service code. While this service code is displayed the third time the button (Tool VR00135/1) must be pushed and kept in this position (contact open).

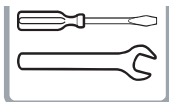
* The indication on the Check Engine Light changes to a fast blinking of the lamp (app. 4 times per sec.). During this rapid flashing light the push button must be released (close contact after app. 2 sec.) to delete this service code.

NOTE: Any other service code have to be selected and cleared individually following the above mentioned procedure to delete a determined service code.

NOTE: An service code can only be deleted if no defect exists in this circuit. In case of a present active failure, the service code keeps reappearing until the problem has been repaired and the circuit is properly working again.

* Disconnect Tool VR00135/1 from Diagnostic Outlet Plug (X23) to exit from service code display.

NOTE: Watch indication of the Check Engine Light and the Warning Horn after ignition contact. If all service codes are deleted from the Engine Management System the indication resumes to 0.7 sec. function test of Check Engine Light and the Warning Horn. For additional details see Chart – Operating Conditions – Instrument panel.



Principle service code list

NOTE: Some codes may not apply due to different application!

Chart – Error Codes V50000_5_x (Issue 08.03.2012)				
ISO Code (dec)	ISO Code (hex)	ABBREV.	INVOLVED DEVICE	POSSIBLE CAUSE
4	4	RPM_E-MIN	RPM Sensor	signal voltage to low, possible short circuit to ground
5	5	RPM_E-MAX	RPM Sensor	signal voltage to high, possible short circuit to battery
6	6	STP_BAD_E-MAX	Engine Start	Engine did not start properly – shift happens
23	17	EXT_E-SIG	Exhaust Temperature Sensor	signal error on EXT – Sensor
70	46	VTGHBIDGE_E-FER	VTG H-Bridge	functional error on ECU- H-Bridge
71	47	VTGHBIDGE_E-MIN	Turbocharger output control	signal voltage to low, possible short circuit to ground
72	48	VTGHBIDGE_E-MAX	Turbocharger output control	signal voltage to high, possible short circuit to battery
263	107	BARO_FP_E-MIN	Barometric Pressure Sensor	signal voltage to low, possible short circuit to ground
264	108	BARO_FP_E-MAX	Barometric Pressure Sensor	signal voltage to high, possible short circuit to battery
275	113	ACT_E-MAX	Ambient Air Temperature Sensor	signal voltage to high, possible short circuit to battery
276	114	ACT_E-MIN	Ambient Air Temperature Sensor	signal voltage to low, possible short circuit to ground
279	117	ECT_E-MIN	Engine Coolant Temperature Sensor	signal voltage to low, possible short circuit to ground
280	118	ECT_E-MAX	Engine Coolant Temperature Sensor	signal voltage to high, possible short circuit to battery
290	122	PED1_E-MIN	Potentiometer accelerator 1	signal voltage to low, possible short circuit to ground
291	123	PED1_E-MAX	Potentiometer accelerator 1	signal voltage to high, possible short circuit to battery
375	177	FUEL_DENSITY_E-FER	Fuel density sensor	Timeout of fuel density sensor – check connection and sensor
376	178	FUEL_DENSITY_E-MIN	Fuel density sensor	Fuel density too low – check sensors
377	179	FUEL_DENSITY_E-MAX	Fuel density sensor	Fuel density too high – check sensors
395	18B	PF20_RANGE_E-FER	PF20 – Fuel Pressure Sensor	fuel pressure is below the limit
396	18C	PF20_E-MIN	PF20 – Fuel Pressure Sensor	signal voltage to low, possible short circuit to ground
397	18D	PF20_E-MAX	PF20 – Fuel Pressure Sensor	signal voltage to high, possible short circuit to battery
537	219	OVRSPD_E-FER	Engine operation	engine overspeed detected
546	222	PED2_E-MIN	Potentiometer accelerator 2	signal voltage to low, possible short circuit to ground

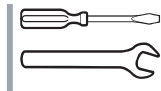


Chart – Error Codes V50000_5_x (Issue 08.03.2012)

547	223	PED2_E-MAX	Potentiometer accelerator 2	signal voltage to high, possible short circuit to battery
594	252	FMS_MALF_E-SIG	Fuel Metering Solenoid	FMS malfunction error detected
595	253	FMS_E-MIN	Fuel Metering Solenoid	rack calibration position is below the minimum SRPOS value
596	254	FMS_E-MAX	Fuel Metering Solenoid	rack calibration position is beyond the maximum SRPOS value
600	258	RPOS_E-MAX	Rack Position Sensor	signal voltage to high, possible short circuit to battery
601	259	RPOS_E-MIN	Rack Position Sensor	signal voltage to low, possible short circuit to ground
899	383	TLE_OUTL2_GPR_E-MIN	Glow Plug RELAY	signal voltage to low, possible short circuit to ground
900	384	TLE_OUTL2_GPR_E-MAX	Glow Plug RELAY	signal voltage to high, possible short circuit to battery
1029	405	EXT_E-MIN	Exhaust Temperature Sensor	signal voltage to low, possible short circuit to ground
1030	406	EXT_E-MAX	Exhaust Temperature Sensor	signal voltage to high, possible short circuit to battery
1284	504	VREF1_E-SIG	Reference voltage 1	Signal error of the reference voltage
1285	505	VREF2_E-SIG	Reference voltage 2	Signal error of the reference voltage
1286	506	VREF3_E-SIG	Reference voltage 3	Signal error of the reference voltage
1289	509	T30FB_E-MAX	T30- Exhaust Temperature Sensor	Invalid signal level
1296	510	SOLAS_E-MAX	Solas Switch	Invalid signal level
1298	512	TPCB_E-MAX	PCB temperature sensor	Sensor fault for PCB temperature – replace ECU
1299	513	IGN_E-MAX	Ignition Switch	IGN- switch level too high
1300	514	VLOAD_E-MAX	Supply voltage	Invalid supply voltage
1301	515	FPR_E-SIG	Fuel Pump Relay Output	Fuel Pump Relay functional error
1314	522	LPS_E-MIN	Lubricant Pressure Sensor	signal voltage to low, possible short circuit to ground
1315	523	LPS_E-MAX	Lubricant Pressure Sensor	signal voltage to high, possible short circuit to battery
1349	545	T30_E-MIN	T30- Exhaust Temperature Sensor	signal voltage to low, possible short circuit to ground
1350	546	T30_E-MAX	T30- Exhaust Temperature Sensor	signal voltage to high, possible short circuit to battery
1376	560	VPROT_E-FER	Supply Voltage	Invalid supply voltage

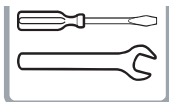


Chart – Error Codes V50000_5_x (Issue 08.03.2012)

		VPROT_E-NPL	Supply Voltage	Invalid supply voltage
1377	561			
1378	562	VBATTIN_E-MIN	Battery Voltage Detection Sensor	Battery voltage to low
1379	563	VBATTIN_E-MAX	Battery Voltage Detection Sensor	Battery voltage to high
1540	604	RAMECC_E-FER	ECU	error on ecu RAM, replace ECU with new one
1557	615	START_BAD_E-SIG	Engine Start	Engine did not start properly – shit happens
1558	616	START_BAD_E-MIN	Engine Start	Engine did not start properly – shit happens
1559	617	START_BAD_E-MAX	Engine Start	Engine did not start properly – shit happens
1576	628	TLE_RL1_FPR_E-MIN	Fuel Pump Relay Output	signal voltage to low, possible short circuit to ground
1577	629	TLE_RL1_FPR_E-MAX	Fuel Pump Relay Output	signal voltage to high, possible short circuit to battery
1581	62D	FMS_E-FER	Fuel Metering Solenoid	rack is not calibrated yet
1592	638	PED_E-NPL	Potentiometer accelerator 1 & 2	Possibly wrong pedal used
1602	642	VREF1_E-MIN	VREF1 Sensor	signal voltage to low, possible short circuit to ground
1603	643	VREF1_E-MAX	VREF1 Sensor	signal voltage to high, possible short circuit to battery
1619	653	VREF2_E-MAX	VREF2 Sensor	signal voltage to high, possible short circuit to battery
1619	653	VREF2_E-MIN	VREF2 Sensor	signal voltage to low, possible short circuit to ground
1688	698	VREF3_E-MIN	VREF3 Sensor	signal voltage to low, possible short circuit to ground
1689	699	VREF3_E-MAX	VREF3 Sensor	signal voltage to high, possible short circuit to battery
1796	704	HYB_CLUTCH_E-FER	Hybrid Transmission Clutch	clutch is not engaged right
1829	725	RPM_E-FER	RPM Sensor	functional error on RPM- Sensor
1831	727	RPM_E-SIG	RPM Sensor	signal error on RPM- Sensor
2047	7FF	ECT_E-FER	Engine Coolant Temperature Sensor	functional error on ECT – Sensor
2586	A1A	HCU_ERROR_E-FER	Hybrid Control Unit	functional error on HCU
2673	A71	HCU_OVERLOAD_E-FER	Hybrid Control Unit	to high voltage on HCU
2684	A7C	HCU_OVERTEMP_E-FER	Hybrid Control Unit	overtemperature on HCU
4097	1001	ITP_E-MIN	Ignition Timing Device Position Sensor	signal voltage to low, possible short circuit to ground

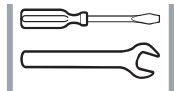


Chart – Error Codes V50000_5_x (Issue 08.03.2012)

4098	1002	ITP_E-MAX	Ignition Timing Device Position Sensor	signal voltage to high, possible short circuit to battery
4112	1010	ITD_INVCALIB_E-FER	Ignition Timing Device	invalid calibration value, recalibrate the ITD
4113	1011	ITD_FP_E-FER	Ignition Timing Device	ITD is possibly not moving
4128	1020	TLE_RL2_GPL_E-MIN	Glow Plug Lamp	signal voltage to low, possible short circuit to ground
4129	1021	TLE_RL2_GPL_E-MAX	Glow Plug Lamp	signal voltage to high, possible short circuit to battery
4130	1022	TLE_RL3_CELMIL_E-MIN	CEL/ MIL- LAMP	signal voltage to low, possible short circuit to ground
4131	1023	TLE_RL3_CELMIL_E-MAX	CEL/ MIL- LAMP	signal voltage to high, possible short circuit to battery
4132	1024	TLE_OUTL3_TEMP_E-MIN	Output Temperature Gauge	Device has a shortcut to Ground or open circuit
4133	1025	TLE_OUTL3_TEMP_E-MAX	Output Temperature Gauge	Device has a shortcut to VBAT
4134	1026	TLE_OUTL4_HORN_E-MIN	Horn Output	signal voltage to low, possible short circuit to ground
4135	1027	TLE_OUTL4_HORN_E-MAX	Horn Output	signal voltage to high, possible short circuit to battery
4136	1028	TLE_OUT1_CF1_E-MIN	Output CF1	Device has a shortcut to Ground or open circuit
4137	1029	TLE_OUT1_CF1_E-MAX	Output CF1	Device has a shortcut to VBAT
4144	1030	TLE_OUT2_CF2_E-MIN	Output CF2	Device has a shortcut to Ground or open circuit
4145	1031	TLE_OUT2_CF2_E-MAX	Output CF2	Device has a shortcut to VBAT
4146	1032	TLE_OUT3_CF3_E-MIN	Output CF3	Device has a shortcut to Ground or open circuit
4147	1033	TLE_OUT3_CF3_E-MAX	Output CF3	Device has a shortcut to VBAT
4352	1100	WAR_E-FER	Engine operation	functional error of WAR-button
4353	1101	T2_E-MIN	T2- Temperature Sensor	signal voltage to low, possible short circuit to ground
4354	1102	T2_E-MAX	T2- Temperature Sensor	signal voltage to high, possible short circuit to battery
4357	1105	TLELPTST_E-FER	ECU	Internal HW error – replace ECU
8191	1FFF	FAULPATH- FER	ECU FAULTS	unexpected error detected, call software department
8744	2228	MAP_E-MIN	Manifold Air Pressure Sensor (Boost pressure Sensor)	signal voltage to low, possible short circuit to ground
8745	2229	MAP_E-MAX	Manifold Air Pressure Sensor (Boost pressure Sensor)	signal voltage to high, possible short circuit to battery

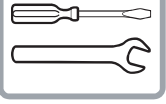
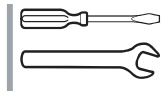


Chart – Error Codes V50000_5_x (Issue 08.03.2012)

8805	2265	WIF_E-FER	Water in fuel sensor	There's too much water in the water separator. Service required
8806	2266	WIF_E-MIN	Water in fuel sensor	signal voltage to low, possible short circuit to ground
8807	2267	WIF_E-MAX	Water in fuel sensor	signal voltage to high, possible short circuit to battery
9572	2564	VTGPOSB_E-MIN	Turbocharger Position Feedback	signal voltage to low, possible short circuit to ground
9573	2565	VTGPOSB_E-MAX	Turbocharger Position Feedback	signal voltage to high, possible short circuit to battery
12387	3063	PF20_RANGE_E-MAX	PF20 – Fuel Pressure Sensor	fuel pressure is above the limit
49153	C001	CANBOFERR_A_E-FER	Diagnostic CAN BUS	Error on CAN interface – turn off ECU and on again
49202	C032	CANPSVERR_A_E-FER	Diagnostic CAN BUS	CAN interface changed to passive state – turn off ECU and on again
49222	C046	CANPSVERR_C_E-FER	J1939 CAN BUS	CAN interface changed to passive state – turn off ECU and on again
49811	C293	HCU_OFFLINE_E-FER	Hybrid Control Unit	HCU is offline, or connection is broken



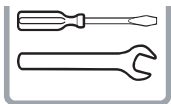
Trouble Check Chart

ATTENTION:



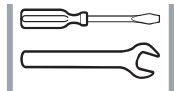
After following the “Action” described in chart, and before cranking the engine, make sure there are no loose fuel connections. Make sure engine compartment is free of fuel vapours. Failure to do so could result in fire.

SYMPTOM	POSSIBLE CAUSE	ACTION
Engine won't start	<ol style="list-style-type: none"> 1. No fuel in tank or shut-off valve closed 2. Air leak in suction lines 3. Fuel line plugged or pump defective 4. Poor fuel quality 5. Water in fuel filter 6. System error or failure 7. Battery output insufficient 8. Inversion switch actuated 	<p>Fill tank or open valve.</p> <p>Bleed fuel system and check for leaks.</p> <p>Fuel pump may be defective. See your STEYR MOTORS Marine dealer.</p> <p>Replace fuel.</p> <p>Replace or drain water from fuel filter. Check fuel supply for water contamination. If water is present, drain fuel tank and flush with fresh fuel.</p> <p>Check Engine Management System display for service code.</p> <p>Charge or replace battery.</p> <p>Cancelled by ignition “OFF – ON”</p>
Only for SOLAS ==>		
Starter won't crank engine	<ol style="list-style-type: none"> 1. Battery connections loose or corroded 2. Battery is dead 3. Starter connections loose 4. Ignition switch 5. Fuse blown on panel 6. Starter auxiliary relay 	<p>Check for loose connections and corrosions. Clean connections and tighten.</p> <p>Check level of electrolyte and charge battery.</p> <p>Check connections and tighten. If solenoid clicks when attempting to start engine, see your STEYR MOTORS Marine dealer.</p> <p>If inoperative, see your STEYR MOTORS Marine dealer.</p> <p>Check and replace if defect.</p> <p>Check terminal connection and function of relay.</p>
Engine runs erratically	<ol style="list-style-type: none"> 1. Water, air and/or dirt in fuel filter 2. Anti-siphon valve stuck 3. Fuel pump 	<p>Replace filter. Inspect fuel supply line.</p> <p>Clean and inspect or replace. (Tank)</p> <p>Check operation of pump. Replace fuel pump. See your STEYR MOTORS Marine dealer.</p>



Trouble Check Chart – Continued

SYMPTOM	POSSIBLE CAUSE	ACTION
Engine vibrates	Propeller condition Unit injector	Check for bent, broken, or damaged propeller. Check for weeds on propeller or sterndrive gearcase. Check for bent propeller shaft. See your STEYR MOTORS Marine dealer.
Engine runs but boat makes little or no progress	Fouled propeller etc.	Check: 1. Propeller for weeds, remove as required. 2. Propeller for spun hub, repair or replace. 3. Hull for excessive marine growth, clean as required.
Performance loss	1. System error or failure 2. Boat overloaded 3. Boat trim 4. Excessive water in bilge 5. Boat hull condition 6. Improper propeller selection 7. Fuel incorrect 8. Throttle not fully open 9. Overheating 10. Air intake troubles	Check: using diagnostics for errors or limitations. Engine coolant temperature; audible and or visual alarms. Reduce load. Distribute boat load evenly. Adjust trim. Drain bilge. See your STEYR MOTORS Marine dealer. Select proper propeller pitch and diameter. Fill tank with correct fuel. Check fuel filter and fuel flow condition. Check throttle command lever for full travel. Check cooling system. Remove debris from water intake. Check belt tension. Check condition of impeller. Check for clogged heat exchanger tubing (in raw water circuit). Check intake air filter. Check ventilation of engine compartment.
Excessive free play in steering wheel	Steering cable loose	See your STEYR MOTORS Marine dealer.
High shift effort	1. Remote control or transom bracket shift cable 2. Remote control binding 3. Engine/drive mechanism binding	Replace and adjust. See your STEYR MOTORS Marine dealer. See your STEYR MOTORS Marine dealer. See your STEYR MOTORS Marine dealer.



Wiring harness 4-cylinder engine

Designation	Component	Description
A5	E-Box	control unit
F1	fuse 50 A	main fuse
F2	fuse 50 A	glow plugs
F3	fuse 50 A	glow plugs
F4	fuse 5 A	permanent current modul and K27
F5	fuse 10 A	switched current for module (K27)
F6	fuse 10 A	fuel pump (K24)
F7	fuse 10 A	preheating – control circuit
G1	alternator	
G2	battery	to be provided by customer
J1	plug 23-pole	connection engine cable – instrument cable
K24	relay	fuel pump
K26-1	relay	preheating – control circuit
K26-2	relay	preheating – load circuit
K27	relay	main circuit
K28	relay	start
M1	starter	
M2	fuel pump	
R10	glow pins	
X2 (S2)	plug 2-pole	gears switch
X3 (S3)	plug 2-pole	inversion switch (only SOLAS)
X5 (A5)	plug 35-pole	module
X12 (B12)	plug 3-pole	boost-pressure senso
X13 (B13)	plug 5-pole	potentiometer accelerator
X14 (B14)	plug 3-pole	rack position sensor
X15 (B15)	plug 3-pole	engine speed sensor
X16 (B16)	plug 2-pole	engine temperature senso
X17 (B17)	plug 2-pole	exhaust gas temperature senso
X18 (B18)	plug 3-pole	oil pressure sensor
X19 (B19)	plug 1-pole	oil pressure gauge (optional)
X20 (Y20)	plug 2-pole	control solenoid
X22 (B22)	without stop	trim sensor (optional)
X23	plug 6-pole	diagnosis
X26 (Y26)	plug 2-pole	disconnection blow-by (only SOLAS)
Z1	splice spot	earth connection sensor
Z2	splice spot	earth connection (31) on engine
Z3	splice spot	ensor supply +5 V
Z4	splice spot	earth connection (31) on E-box plate
Z6	splice spot	shield speed sensor line

Cable numbers/principal functions:

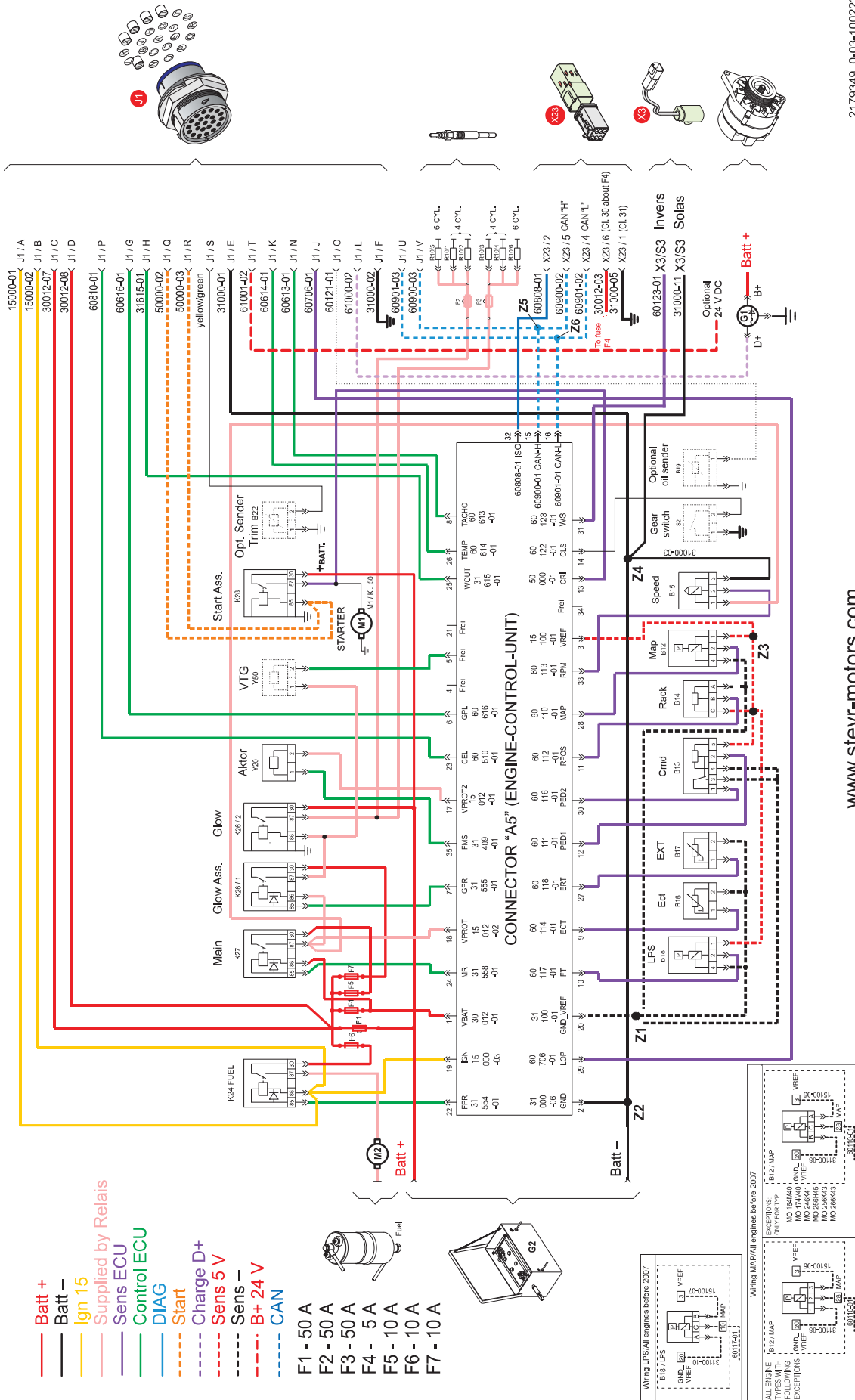
15000-xx	ignition – positive (from ignition switch)	31100-xx	Do not connect mass for sensors with battery negative!
15012-xx	+12 volt via main relay and modulator unit A5	601xx-01	Sensor signal to modulator unit A5 and/ or instruments.
15100-xx	+5 volt supply voltage for sensors	606xx-01	Exit from modulator unit A5 to display system (tachometer, temperature display, ...)
30000-xx	battery-positive (not secured)		
30012-xx	battery-positive (secured)		
31000-xx	battery negative (GND)		

WIRING DIAGRAM/MARINE BASE – 4 CYLINDER – 12 V

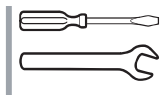
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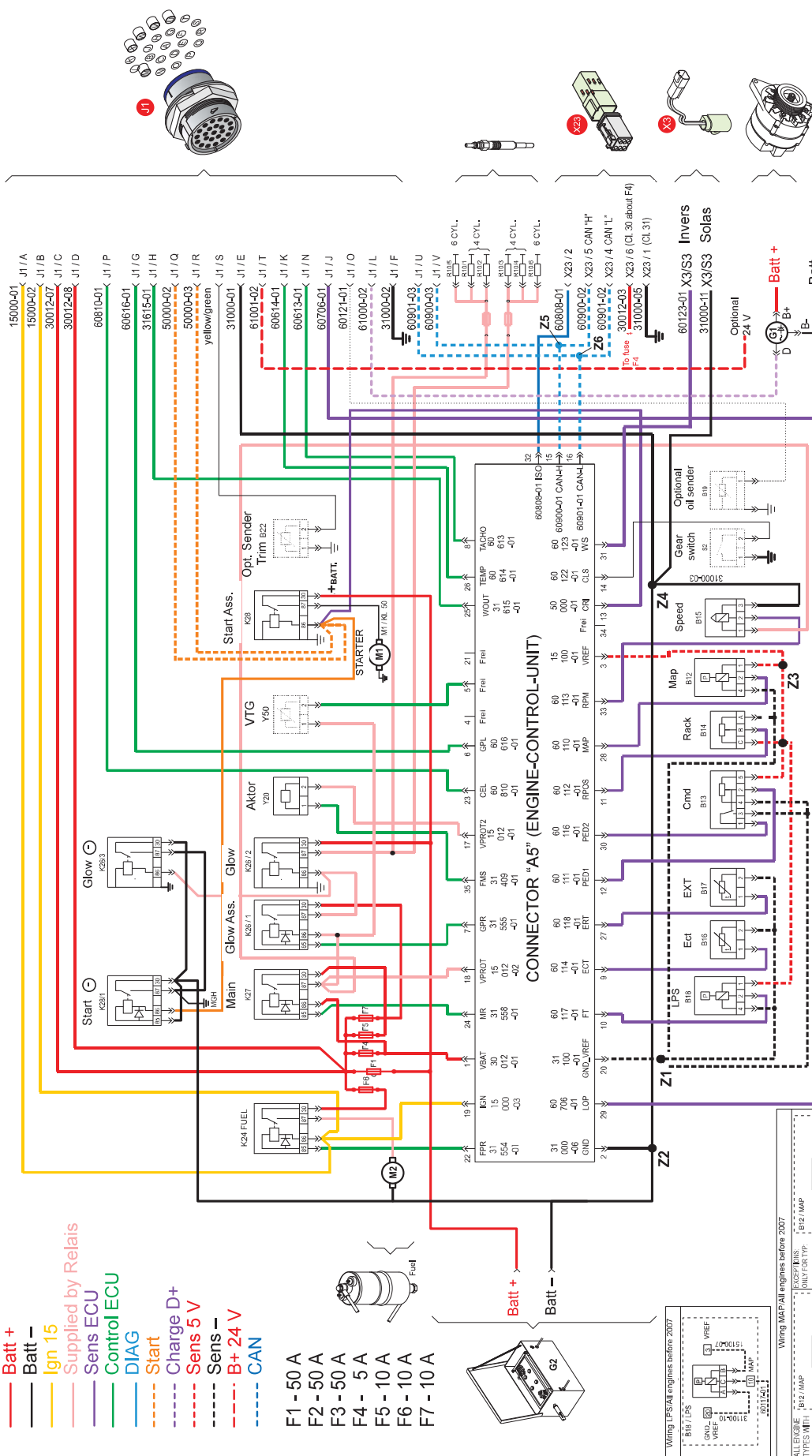


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WIRING DIAGRAM/MARINE – 4 CYLINDER – 2-POLE – 12 V (OPTION)

- Batt +
- Batt -
- Ign 15
- Supplied by Relais
- Sens ECU
- Control ECU
- DIAG
- - - Start
- - - Charge D+
- - - Sens 5 V
- - - Sens -
- - - B+ 24 V
- - - CAN

- F1 - 50 A
- F2 - 50 A
- F3 - 50 A
- F4 - 5 A
- F5 - 10 A
- F6 - 10 A
- F7 - 10 A



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WIRING DIAGRAM/MARINE – 4 CYLINDER – 24 V (OPTION)



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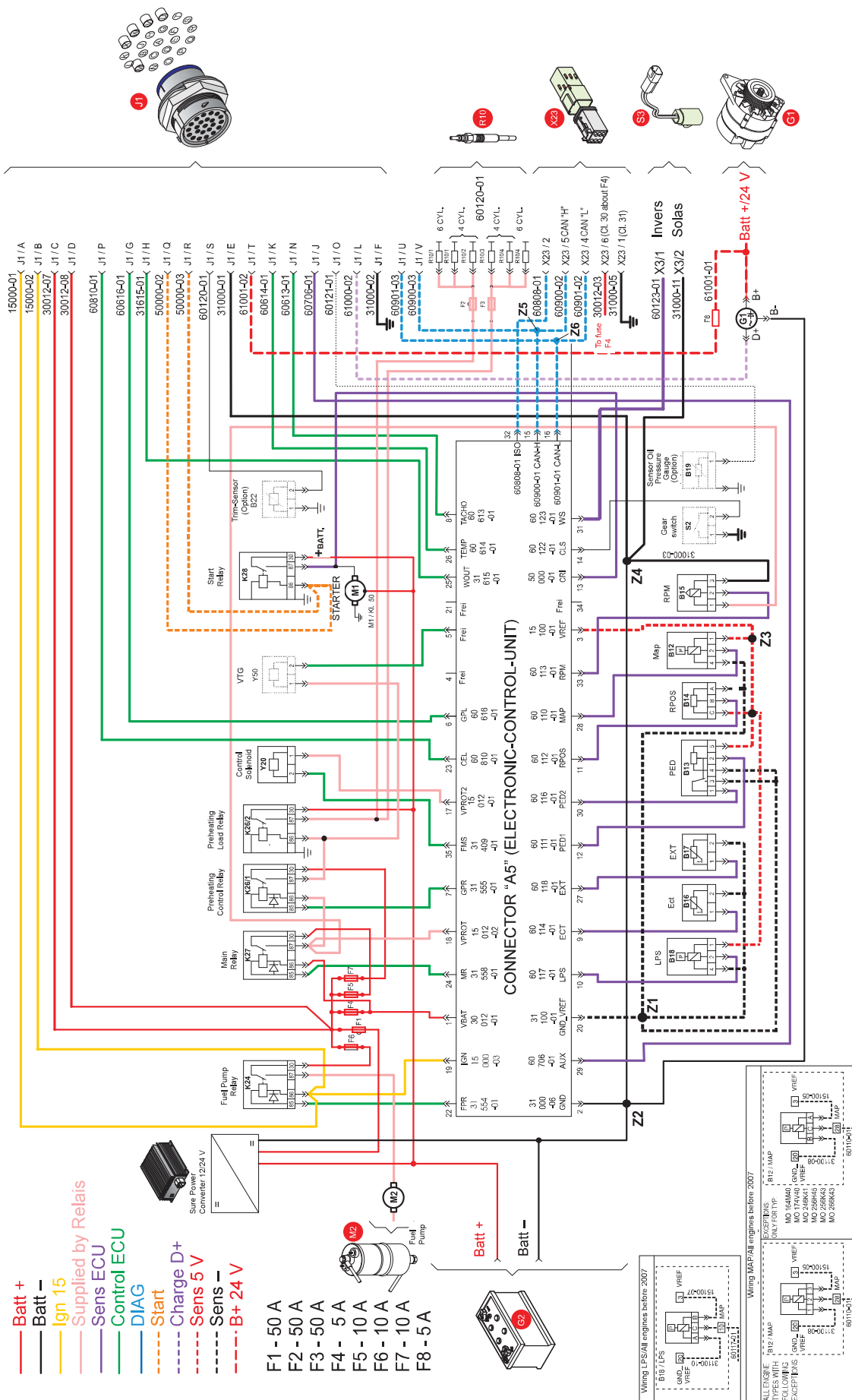
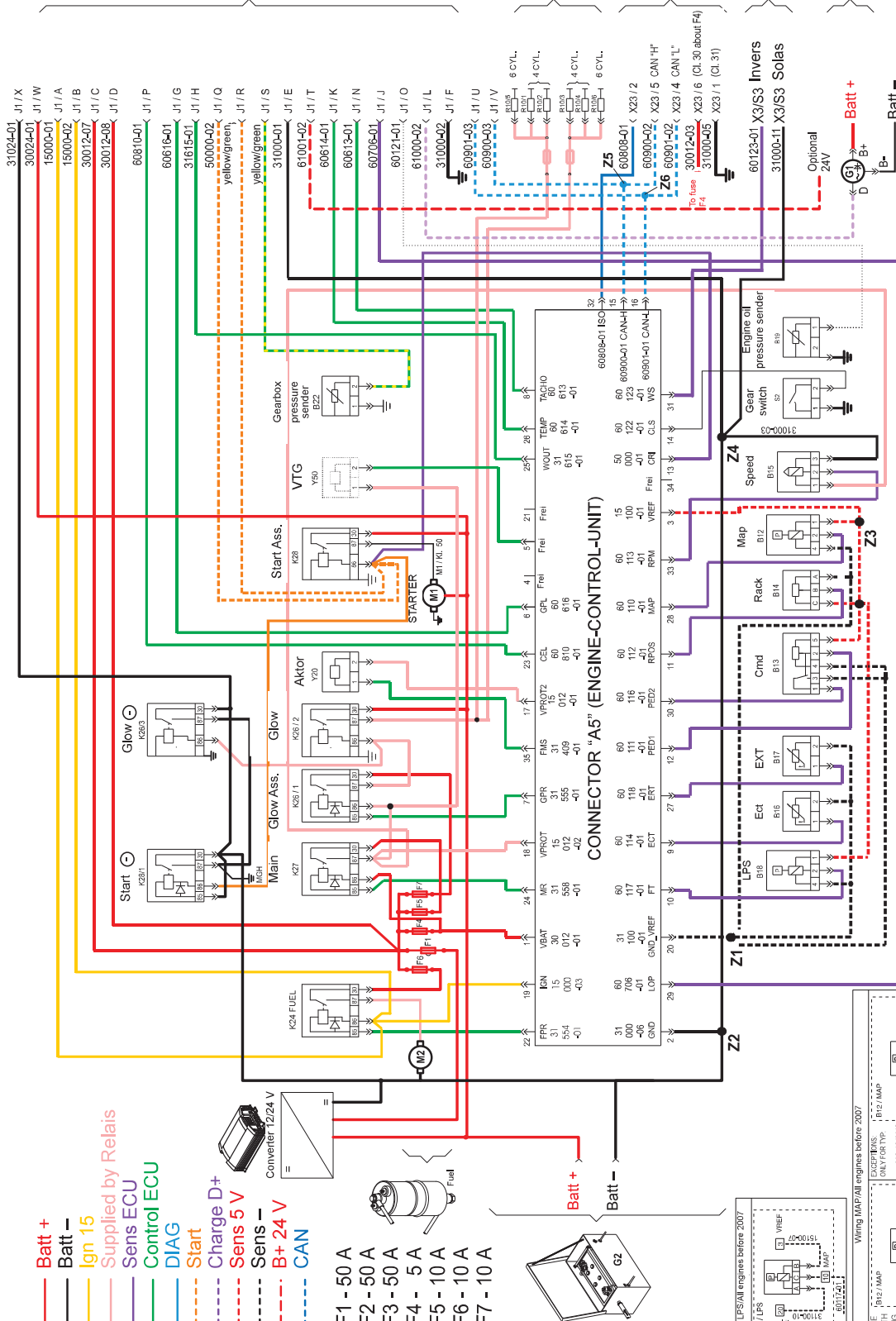


Diagram illustrating the wiring for the 12V24V converter:

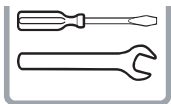
- Batt +** (Red line) connects to the positive terminal of the 12V battery.
- Batt -** (Black line) connects to the negative terminal of the 12V battery.
- Ign 15** (Yellow line) connects to the positive terminal of the 12V battery.
- Supplied by Relais** (Pink line) connects to the positive terminal of the 12V battery.
- Sens ECU** (Purple line) connects to the positive terminal of the 12V battery.
- Control ECU** (Green line) connects to the positive terminal of the 12V battery.
- DIAG** (Blue line) connects to the positive terminal of the 12V battery.
- Start** (Orange dashed line) connects to the positive terminal of the 12V battery.
- Charge D+** (Purple dashed line) connects to the positive terminal of the 12V battery.
- Sens 5 V** (Red dashed line) connects to the positive terminal of the 12V battery.
- Sens -** (Black dashed line) connects to the negative terminal of the 12V battery.
- B+ 24 V** (Red dashed line) connects to the positive terminal of the 24V battery.
- CAN** (Blue dashed line) connects to the positive terminal of the 12V battery.

The 12V24V converter is shown with its terminals labeled: **12V** (positive), **24V** (positive), and **Common** (negative).

Converter 12/24 V

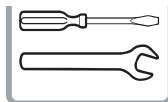


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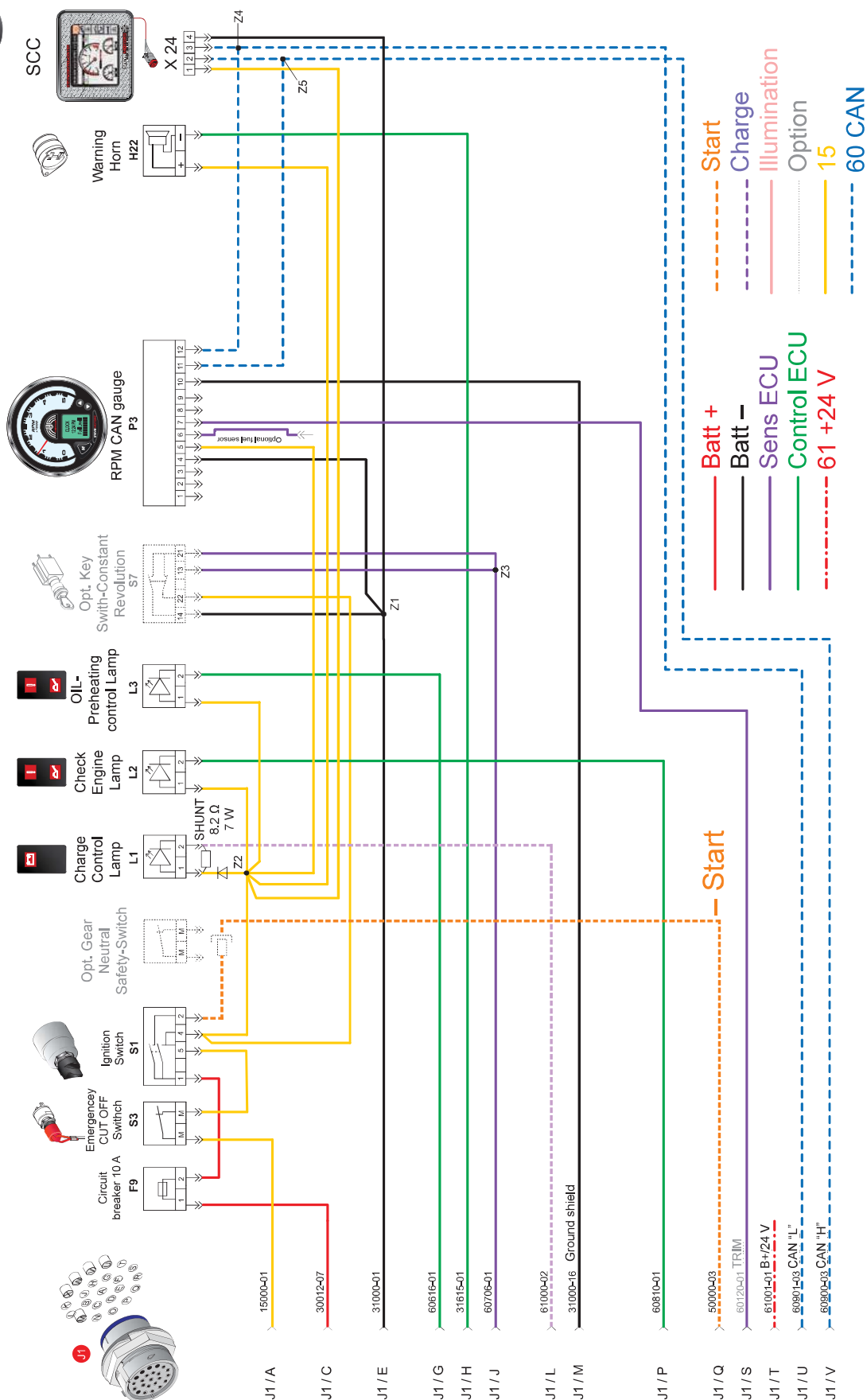


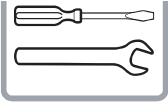
Description – Wiring harness instrument panels 4 cyl. marine engines (current version)

Designation	Component	Description
F9	fuse 10 A	
J1	23-pin plug	connection engine cable – instrument cable
S1	switch	ignition (red)
S2	switch	start (green)
S3	switch	emergency cut off (orange)
S7	switch	key switch constant revolution (optional)
L1	lamp	charge control
L2	lamp	cel – check engine lamp
L3	lamp	oil pressure/preheating control
P1	gauge	engine coolant temperature
P2	gauge	oil pressure (optional)
P3	gauge	tachometer with running-time meter
H22	warning horn	
E10	lighting	engine coolant temperature gauge
E11	lighting	oil pressure gauge (optional)
E12	lighting	tachometer gauge
X8	1-pin plug	connector illumination switch
X24	8-pin plug	connector STEYR MOTORS – display
Z1	splice	battery +
Z2	splice	battery –
Z3	splice	ignition (+)
Z4	splice	key switch constant revolution
24 V	interm. cable	charge indicator

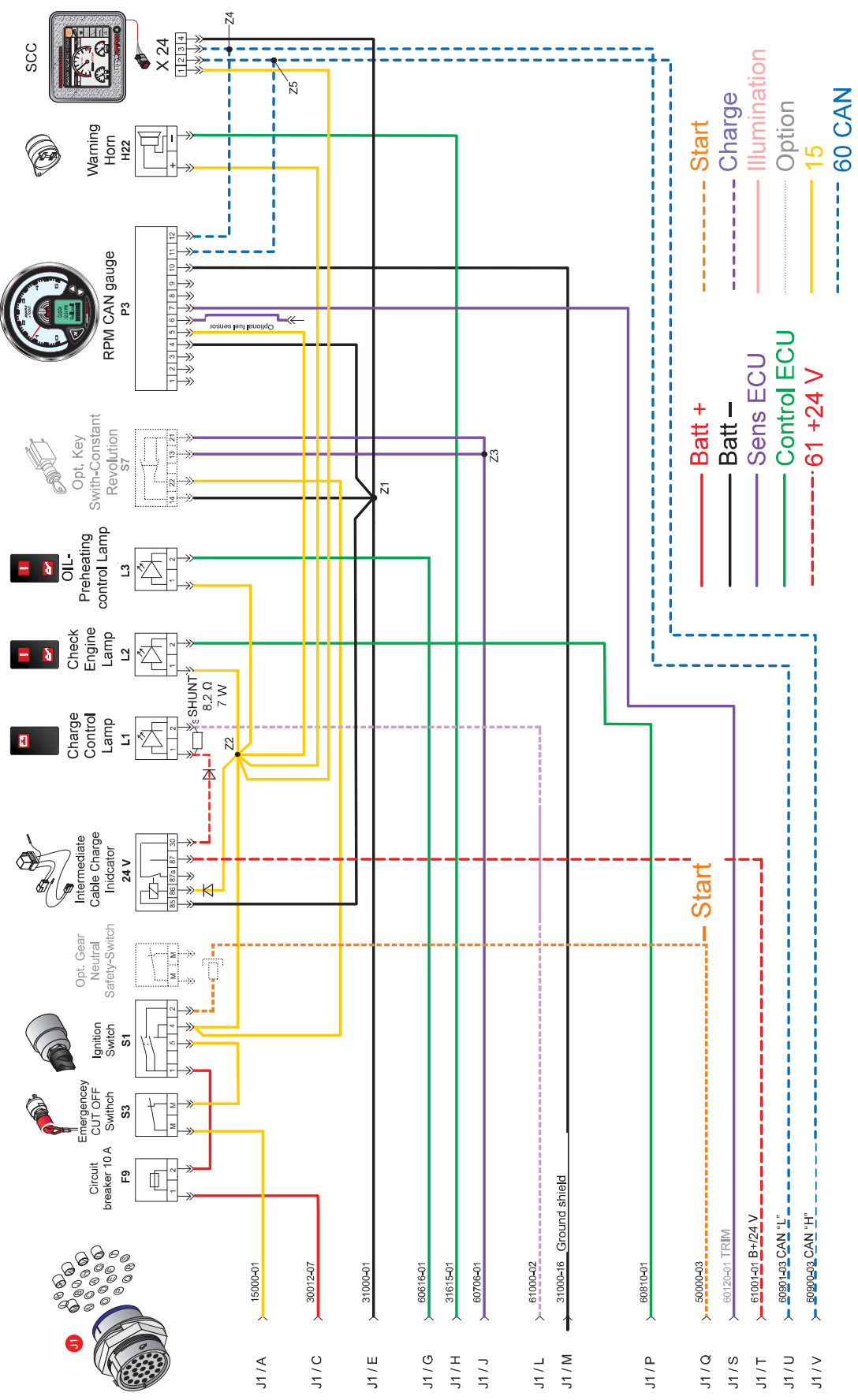


WIRING DIAGRAM/INSTRUMENT CAN PANEL – 4 & 6 CYLINDER – 12 V



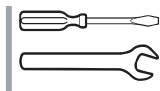


WIRING DIAGRAM/INSTRUMENT CAN PANEL – 4 & 6 CYLINDER – 24 V (OPTION)

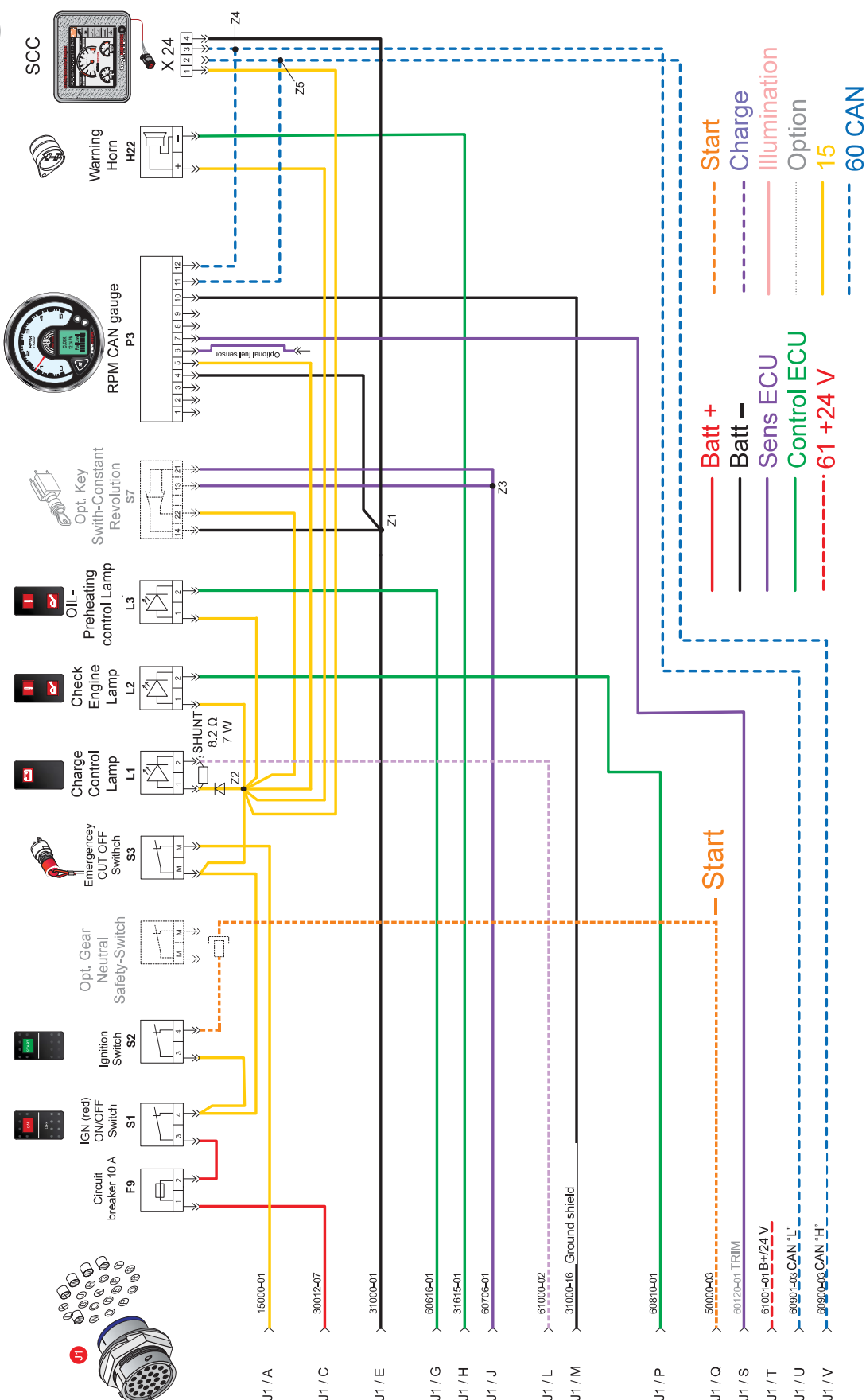


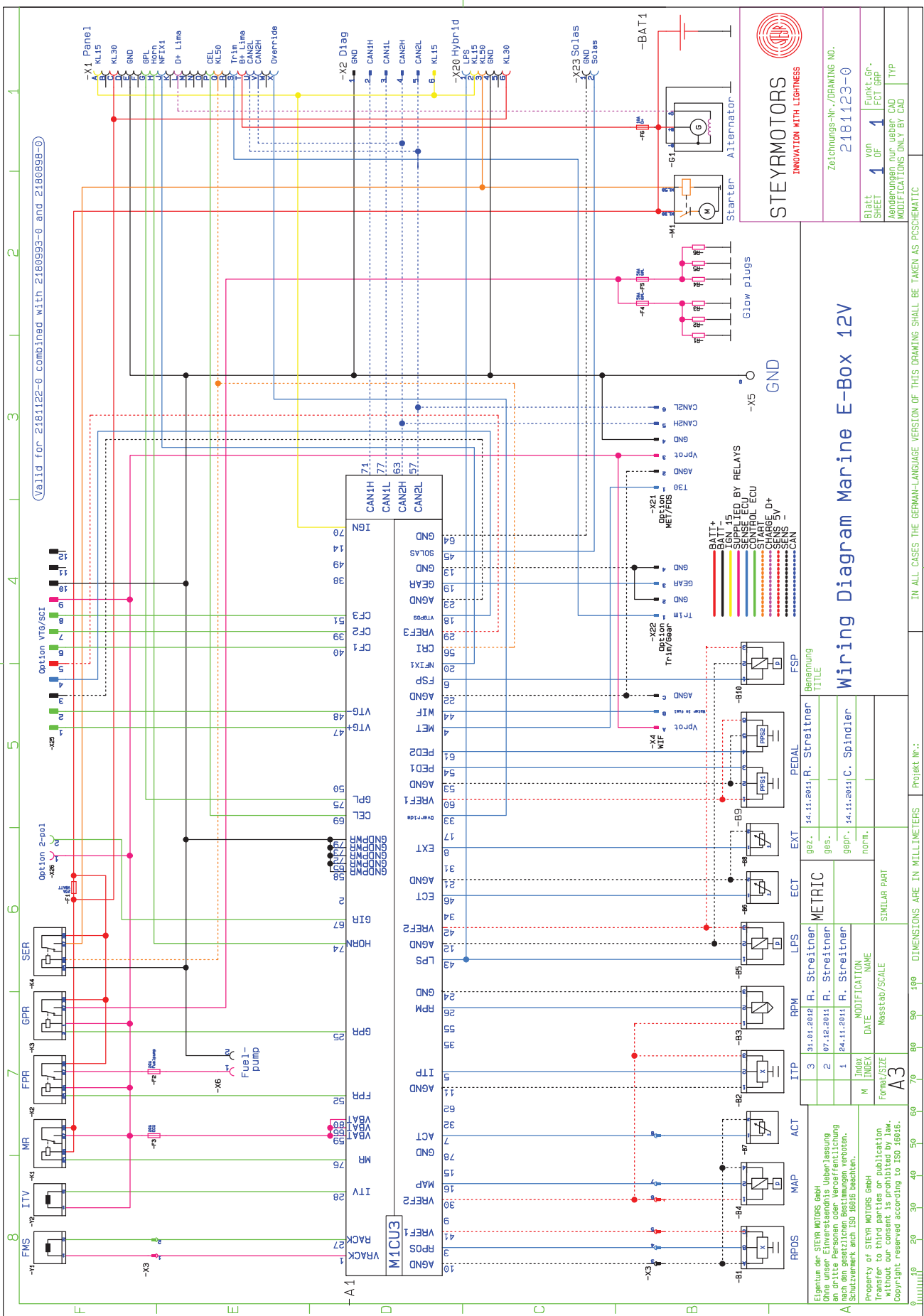
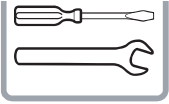
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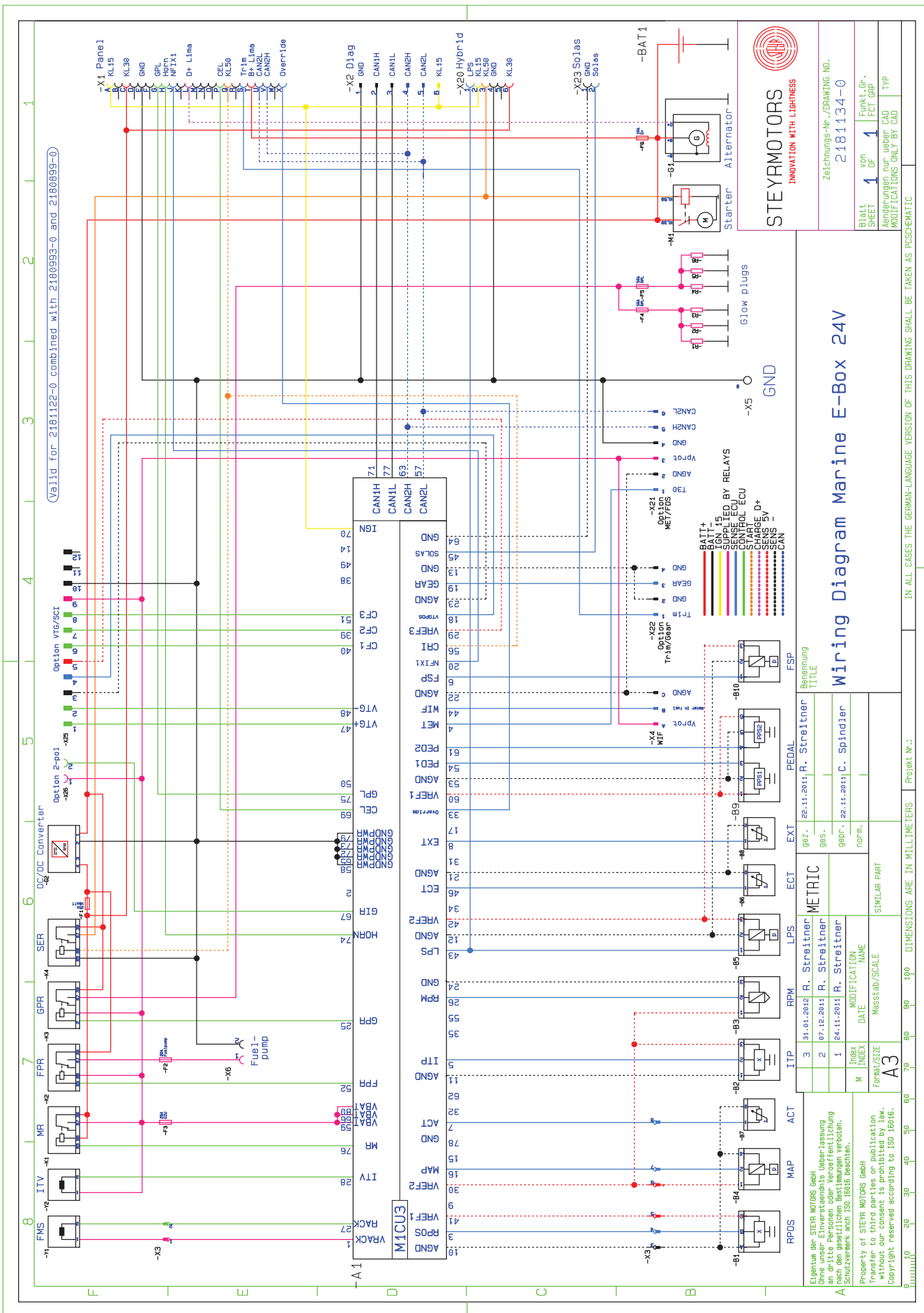
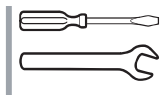
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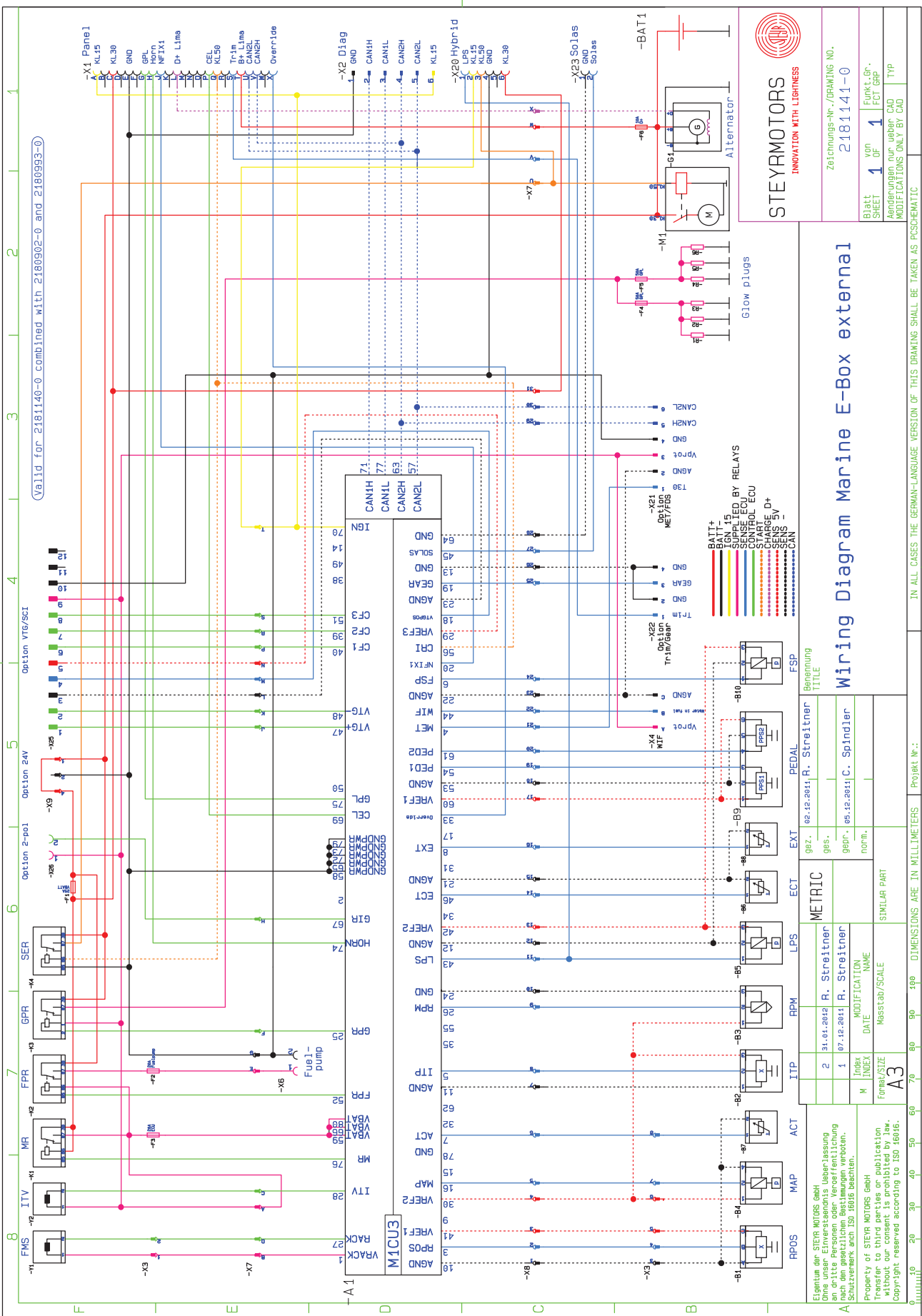
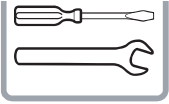


WIRING DIAGRAM/INSTRUMENT CAN PANEL – 4 & 6 CYL. – Solas – 12 V (OPTION)





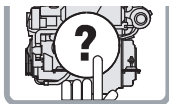






DEALER'S RESPONSIBILITIES

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Check motor oil level

ATTENTION: Check with cooled down engine only, or after a shut down period of app. 3 to 5 min.



- 19** Then remove oil dipstick (**19/A**), clean it and insert again into oil dipstick tube (**19/A**), then remove again and check oil level on marker.

Refill motor oil

Remove motor oil filler cap (**19/B**) and add **STEYR MOTORS TURBO DIESEL ENGINE OIL 10 W-40** or an equivalent marked **ACEA E7, E4** or with **API Code CF** up to specified **maximum marker** on oil dipstick.

ATTENTION: Motor oil must not exceed maximum marker. An overfilling results in high operating temperatures, foaming (air in oil), loss in efficiency and reduced engine life.

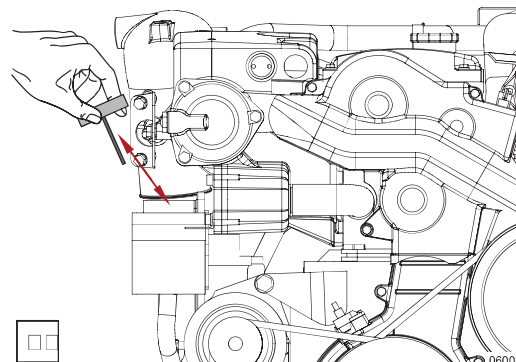


Put on the motor oil filler cap.

NOTE: Remove possible oil contaminations. The use motor oil with other quality than specified warranty can expire.

Oil level for Power Steering

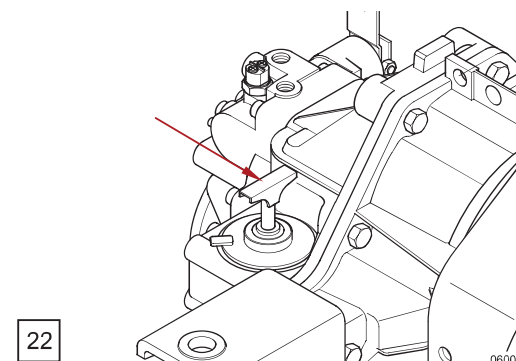
- 21** Whenever you check motor oil level, also check oil level of power steering. If required, add automatic transmission oil (available with your STEYR MOTORS Marine dealer). Other approved oils, such as GM Servo or Dexron II, may also be used. Do not overfill pump reservoir.

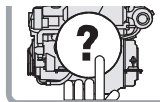


Oil level for Transmission

- 22** Whenever you check motor oil level, also check oil level of transmission. If required, add automatic transmission oil (available with your STEYR MOTORS Marine dealer). Other approved oils, such as GM Servo or Dexron II, may also be used. Do not overfill transmission.

NOTE: Consider specifications of respective transmission manufacturer



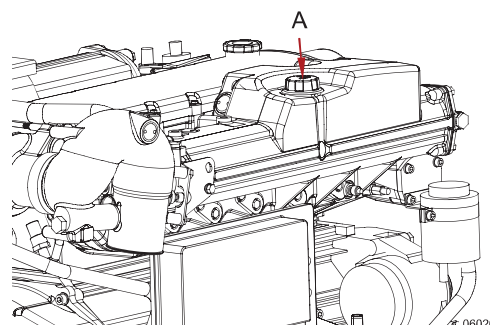


Check coolant (closed cooling circuit)

ATTENTION: With hot engine, the closed cooling circuit is under pressure. Do not try to open the radiator cap or the drain plugs when engine is hot. This may cause severe injuries by hot coolant. As soon as the engine has cooled down, the cap may be opened.



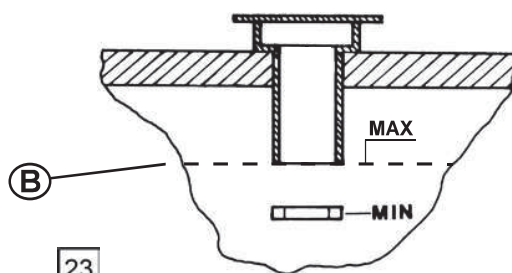
23 Remove radiator cap (**23/A**). Coolant level should reach the "MAX" marking (**23/B**) in the expansion tank. Refilling of coolant only at the expansion tank.



ATTENTION: Only add STEYR MOTORS engine coolant. Do not refill at the pressure cap.



NOTE: When not using the original STEYR MOTORS coolant, severe damage to the cooling system of your engine may occur.



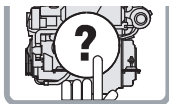
Drain points of coolant circuit:

- 1) Engine Block
- 2) Oil Cooler
- 3) Heat Exchanger Housing

Check Coolant SE-Series

Do not open Pressure Cap if the engine is hot.
Fill in the coolant until you see it in the upper bullseye





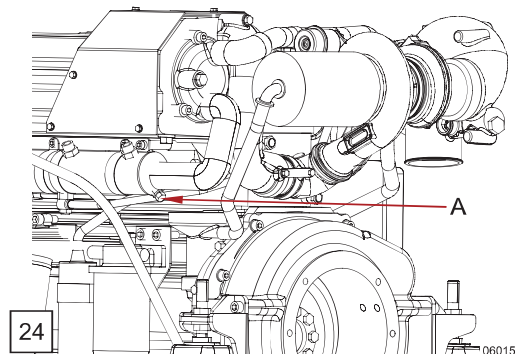
Drain the raw water circuit of the engine

ATTENTION: Not draining the raw water circuit in time before the winter season and/or daily when running the engine during the winter season, may lead to freeze damage on the engine.



- 24** Remove drain plug **(24/A)**. Engine empties itself via exhaust system.

NOTE: Drain plug (24/A) is not available for all types, in that case remove the hose.

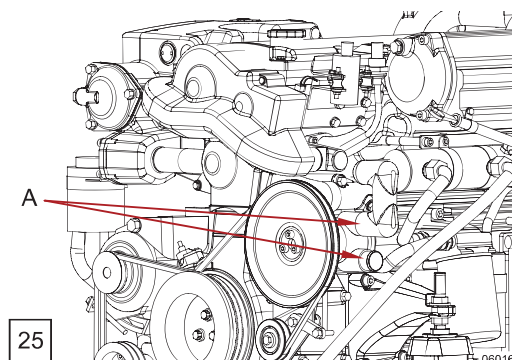


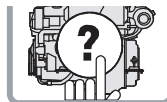
- 25** Loosen 2 hose clamps **(25/A)** and remove raw water hoses, quickly start the engine so that raw water pump empties itself.

NOTE: As to procedure for draining the remaining equipment on your boat, see your STEYR MOTORS Marine dealer.

Check raw water (open circuit with pump)

Filling is done automatically via raw water pump after having started the engine.





Cooling System Anodes

26/27

FOR ALL 4 CYL. MARINE ENGINES

28/29

FOR ALL 6 CYL. MARINE ENGINES

There are 4 sacrificial zinc anodes in the raw water cooling system normally, although if an exhaust high riser is used there is one extra fit in it. Which are installed as per ill. 26 and 27.

Remove and inspect anodes for galvanic erosion according to the maintenance schedule.

Replace anode when material loss is 50 – 75 %.

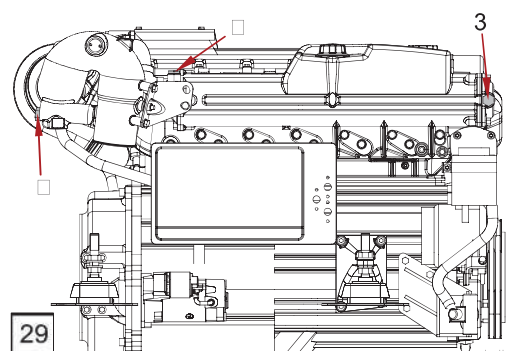
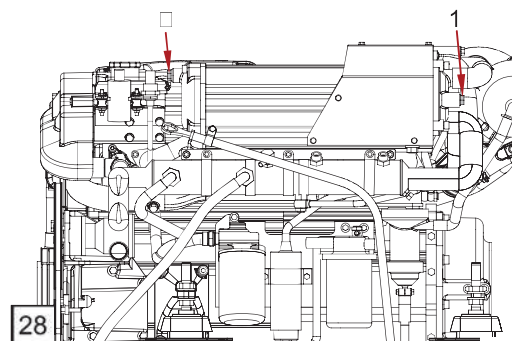
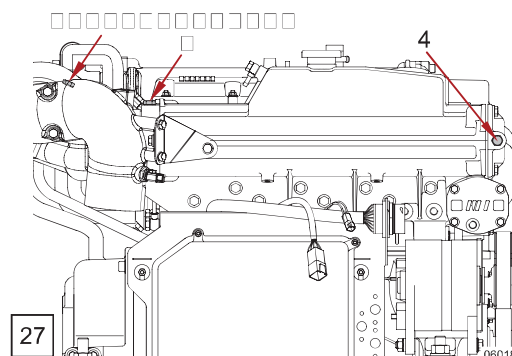
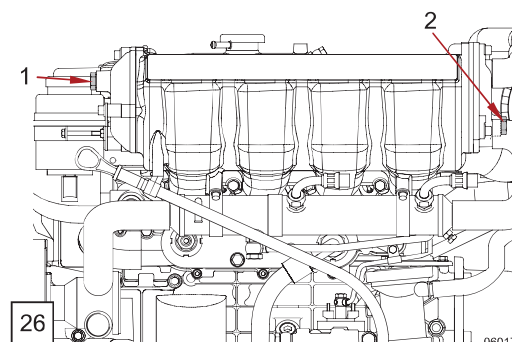
Anti-Corrosion Anodes

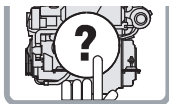
If additional electronic equipment is installed, each should have an individual anode or grounding device and all grounding devices must be interconnected. Follow recommendations of manufacturers of equipment.

NOTE: Inspect anodes every 30 days, or more frequently if used in extremely salty water. Anode is to be replaced according to the maintenance schedule.

Boats that connect to an AC power source (shore power) require protection against increased potential of galvanic and "spray current" corrosion. For protection, a galvanic isolator can be installed in series with the grounding (green) wire in the shore power cable between the boat and the shore power outlet on the dock. The isolator blocks direct current (DC) flow, but permits the passage of alternating current (AC) thus providing a path for ground fault currents.

NOTE: If a boat is connected to an AC power source (shore power), and it is not equipped with a galvanic isolator, the zinc anti-corrosion anodes may be unable to handle the added corrosion potential.

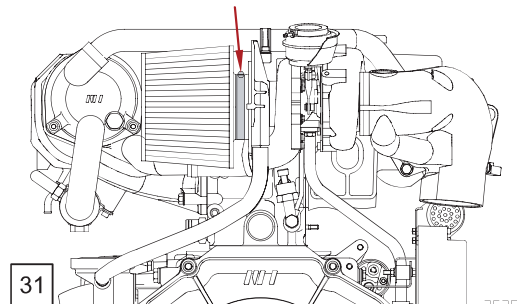




Air Filter

All **STEYR MOTORS Marine Engine** models are equipped with an air filter at the turbocharger inlet; as to specifications, see **Specifications and Maintenance**.

- 31** Loosen clamp to exchange air filter. Remove air filter. Place clamp on filter neck and mount air filter onto flange. Tighten clamp. (3 Nm)

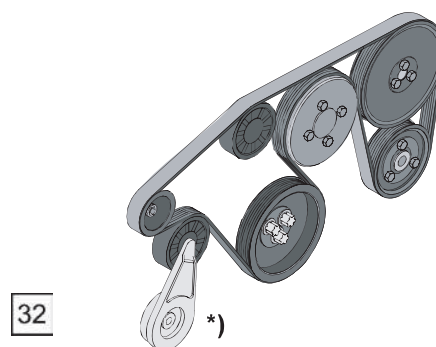


Maintenance Poly – V – belt resp. Serpentine Belt

FOR 4 CYL. MARINE ENGINES

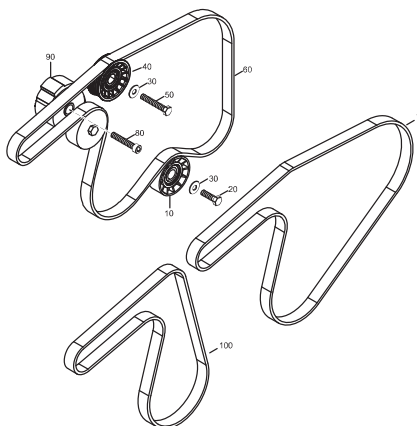
- 32** Occasionally check components for excessive wear and/or clearance on tension bearing.

NOTE*): It is recommended to spray frequently some corrosion inhibiting spray into the spring housing of the belt tensioner.



FOR 6 CYL. MARINE ENGINES

32a



32a

Occasionally check components for excessive wear and/or clearance on tension bearing.

NOTE: It is recommended to spray frequently some corrosion inhibiting spray into the spring housing of the belt tensioner

Engine alignment

Engine alignment requires special tools. The output coupler must be disengaged from the take-off shaft. This should be rechecked during off-season storage preparations. Because of the special tools required, engine alignment is to be performed by a STEYR MOTORS Marine dealer.

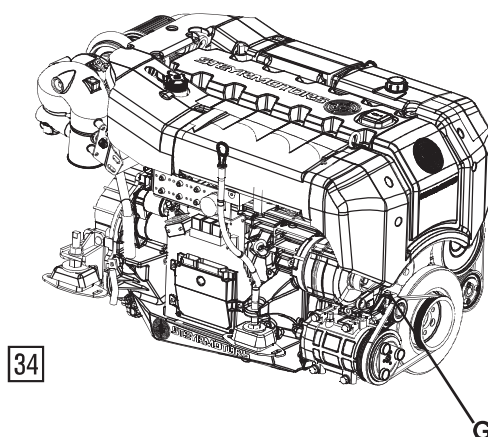
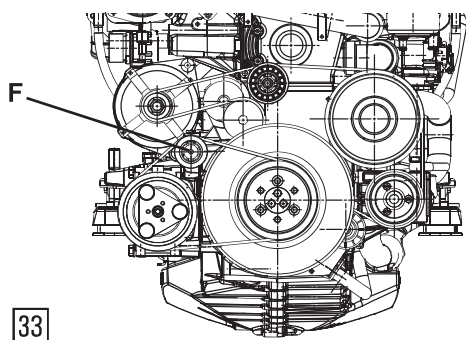
NOTE: Failure to check the engine alignment could result in premature failure of engine coupler or universal joints.

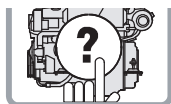


FOR 6 CYL. MARINE ENGINES WITH AC-Compressor (optional)

33/34

To tension the poly v-belt: Loosen hexagon screw (33/F). Turn the clamping bolt (34/G) clockwise in order to increase the belt tension to 200 ± 25 Nm. Tighten hexagon screw (35/F) with a Torque of $23 \text{ Nm} \pm 2$ to secure idle pulley bracket. Check belt tension.





Propeller Selection

- 35** Your STEYR MOTORS Marine dealer has chosen a propeller designed to deliver top performance and economy under most conditions. To obtain the maximum percentage of available output **(A)**, the engine RPM at **Full Throttle** should be in the specified **Full Load Speed Range** (**←(B)→**). As to specifications, see **Technical Data and Maintenance**.

If the engine's full throttle RPM with normal load is below the specified range, use a propeller with less pitch to increase the RPM. Should the engine's full throttle RPM exceed the specified range, the engine RPM and output is limited by the governor. Use a propeller of higher pitch to achieve a RPM reduction in the specified range (**←(B)→**).

NOTE: Engine damage can result from incorrect propeller selection if

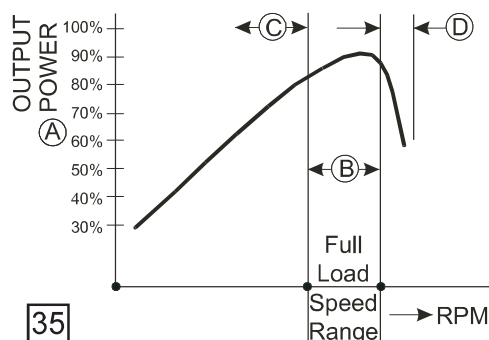
- The engine RPM **does not attain** the specified **"Full Load Speed Range"**.
The engine thus runs in RPM range (**←(C)→**).

Therefore, use a propeller with **a lower pitch**.

- The engine RPM exceeds the specified **"Full Load Speed Range"**.
Engine speed is therefore above the admissible range (**←(D)→**).

Therefore, use a propeller with **a higher pitch**.

engine model		Full Load Speed Range "B" rated rpm (range of tolerance)
4 cylinder	MO54NA33	3300 rpm (+0 rpm/−200 rpm)
	MO84K32	3200 rpm (+0 rpm/−200 rpm)
	MO94K33	3300 rpm (+0 rpm/−200 rpm)
	MO114K33	3300 rpm (+0 rpm/−200 rpm)
	MO144V38	3800 rpm (+0 rpm/−300 rpm)
	MO144M38	3800 rpm (+0 rpm/−300 rpm)
	MO164M40	4000 rpm (+0 rpm/−300 rpm)
	MO174V40	4000 rpm (+0 rpm/−300 rpm)
6 cylinder	SE126E25	2500 rpm (+50 rpm/−200 rpm)
	SE156E26	2600 rpm (+50 rpm/−200 rpm)
	SE196E35	3500 rpm (+50 rpm/−200 rpm)
	SE236E40	4000 rpm (+50 rpm/−200 rpm)
	SE236S36	3600 rpm (+50 rpm/−200 rpm)
	SE266E40	4000 rpm (+50 rpm/−300 rpm)
	SE266S36	3600 rpm (+50 rpm/−300 rpm)
	SE286E40	4000 rpm (+50 rpm/−300 rpm)
	SE306J38	3800 rpm (+50 rpm/−300 rpm)

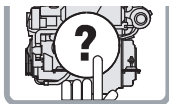




STEYR MOTORS – Dealer – Check-List

NOTE: If STEYR MOTORS HYBRID SYSTEM is in use, check below mentioned points but also START UP OF HYBRID SYSTEM (see HYBRID INSTALLATION MANUAL P/N Z001044-0/ chapter 5) before ignition is turned on or engine is started!

1. Remove carton from palette and check the separately packed components are complete and undamaged.
2. Visual inspection of engine for transit damage and finish.
3. Check coolant and oil level. If required add operational fluids as specified in Operation, Maintenance & Warranty Manual and Service Manual.
4. Inform customer about important guidelines in the Installation Manuals and instruct him as to safety regulations.
5. Inform customer about break-in procedure in the Operation, Maintenance & Warranty Manual.
6. Advise customer what to do when the engine's self-diagnostic management system reduces the power. See Electronic Engine Control Unit (ECU) in section Start-up and Operation of Operation, Maintenance & Warranty Manual.
7. Check tightness of all cooling water hose clamps.
8. Check fuel hoses for correct size and safe routing to and from engine.
9. Check battery units for correct polarity and battery for correct capacity.
10. Check all electrical connections (engine harness, main connector, accessories, instrument panel)
11. Check level of all operational fluids:
 - Motor oil
 - Coolant
 - Power steering fluid
 - Drive or gear
 - Reservoir of trim pump
12. Fill fuel tank for engine test run.
13. Check function of displays on instrument panel.
14. Check function of bilge pump and blower.
15. Check fuel system for free flow and leaks.
16. Check function of trim installation.
17. Check function of anchor light, navigation lights and instrument panel lights.
18. Install drain plug of bilge.



19. Steering – Lubricate
20. Check condition and tension of all drive belts.
21. Check all engine mount screws for tight seat.
22. Check for any leaks, deficiencies, signs of wrong use etc.
23. Check function of all warning devices installed.
24. Read out memorized service codes and make necessary corrective actions.
25. Start engine and check for normal instrument display and normal operating noise.
26. Obtain propeller load absorption.
27. Check installation and fill in commissioning report (Installation Manual P/N Z001007-0, chapter 9 Appendix).
28. Grease raw water pump impeller at BUKH-STEYR MOTORS SOLAS engine with original grease of P/N Z011753/2.
29. Carry out Start-Idle-Test and check engine operation. Check behavior of the boat when engine is in idle gear. If there are unpleasant vibrations, adjust the engine speed to a vibration-free operation (see Service Manual)
30. Check correct function of gearshift.
31. Stop engine and check again the levels of all operational fluids during test run a certain loss operation fluids may occur.

(Mechanic's Signature)

(Dealer's Signature)

DEALER:

ADDRESS AND DATE:

ENGINE TYPE/SERIAL NUMBER:

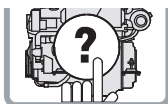
ENGINE RUNNING HOURS:

SIGNATURE:

**A copy of the "installation and pre-delivery inspection log" is to be sent to
STEYR MOTORS GmbH, After Sales Service!**

COMMISSIONING REPORT

Engine- serial number:	Engine- model:
*) Hybrid- serial number:	
Boat Owner:	
Company/Name:	
Address/Phone:	
Dealer:	
Company:	
Address/Phone:	
Type of boat:	Dimension of propellers:
Model No.:	Special Equipment from STEYR MOTORS (SCC, IFG, Cabin Heating etc.):
Boat length: m	
Boat weight: kg	
Driving system:	*) Hybrid- Battery specification:
Gear reduction:	
Extended Storage Preservation Procedure (acc. SERVICE Manual/GENERAL/D3)	
Date of Preservation: #1	#2
<u>ENGINE- CHECK POINTS:</u>	
Installation checked according to the installation guide. Following points are in compliance:	
<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5 <input type="checkbox"/> 6 <input type="checkbox"/> 7 <input type="checkbox"/> 8 <input type="checkbox"/> 9 <input type="checkbox"/> 10	
Notes:	
*) HYBRID	
<input type="checkbox"/> ELECTRICAL CONNECTIONS according schematic "CONNECTION SCHEMATIC- HYBRID" (see Hybrid Installation Manual- schematic with art.nr. 2180526-0) Notes (e.g.: wiring extensions etc.):	
<input type="checkbox"/> SYSTEM GROUNDS connected (see Hybrid Installation Manual- schematic with art.nr. 2180526-0)	
<input type="checkbox"/> PROTECTION COVERS mounted on: <input type="checkbox"/> HCU (U, V, W and B+, B-) <input type="checkbox"/> Generator (U, V, W) <input type="checkbox"/> Hybrid battery (+/-)	
<input type="checkbox"/> END POSITON/FREE MOVEMENT of Coupling Actuator (D-Mode, E-Mode) ensured	
<input type="checkbox"/> MAIN SWITCH capacity (between Hybrid battery+ and HCU+): Amp (min. 400 Amp)	
<input type="checkbox"/> CONSUMERS mounted to Hybrid battery (only to 48 V, max. 100 Amp):	
<input type="checkbox"/> Hybrid-Cooling: <input type="checkbox"/> Raw water cooling <input type="checkbox"/> Dual circuit cooling <input type="checkbox"/> Keel cooling	



COMMISSIONING REPORT

BEFORE MEASURING DATA:

Correct level of operating fluids (motor oil, gear oil, hydraulic oil, cooling agent) confirmed ☐ yes

Leakage (oil, fuel, coolant) checked: ☐ ok if not detail:

***) HYBRID**

☐ full filled STEYR MOTORS Dealer Check List (find in Hybrid Operation, Maintenance and Warranty Manual) and send signed document to STEYR MOTORS GENERAL Distributor

☐ Max. Voltage supply from Hybrid- battery bank to HCU(≤ 57 V): V

Application

Pleasure

Commercial

Government

Marine Duty Rating:

HO (High Output)

INT (Intermediate)

MCD (Medium Continuous Duty)

[1 of 8 <300 h]

[2 of 8 <1500 h]

[3 of 12 <3000 h]

MEASURING DATA:

Max. boat speed: knots Fuel flow amount on return-line in idle: l/min

Max. engine- rpm by WOT (CMD=5) rpm Motor oil pressure (SMO-EDT): bar

Idle speed: rpm Engine coolant temp. (SMO-EDT): °C

Temperature engine compartment: °C Exhaust raw water temp. (SMO-EDT): °C

Exhaust backpressure: mbar Boost-pressure at max. rpm (SMO-EDT): mbar

Active engine warnings: ☐ YES ☐ NO if YES which:

Instruments adjusted: ☐ YES

LOG FILE (Idle – Full Load – Idle) name:

***) HYBRID**

Max. boat speed in E-Mode: knots

– with Speed Mode: ☐ low ☐ mid1 ☐ mid2 ☐ high

– max. engine rpm achieved in E-Mode: rpm

D- Mode status on SCC E-Mode ready-red, D-Mode ready- green, HCU-Mode ready-green, GENERATOR ☐ YES

(see SCC User Manual Z001071-0; chapter Hybrid menu)

Notes:

E- Mode status on SCC E-Mode ready-green, D-Mode ready-red, HCU-Mode ready-green, E-Drive ☐ YES

(see SCC User Manual Z001071-0; chapter Hybrid menu)

Notes:

Flow-rate through Hybrid cooling- system: l/min (see in Hybrid cooling schematics mentioned above)

Max. HCU temperature on SCC: °C (see SCC User Manual Z001071-0; chapter Hybrid menu)

Max. E-MOTOR temperature on SCC: °C (see SCC User Manual Z001071-0; chapter Hybrid menu)



Preparations for Off-Season Storage

An adequate preservation of the engine will contribute to an efficient and troublefree operation in the long term. Consult your **STEYR MOTORS Marine Dealer** to get professional assistance in performing a proper off season storage.

NOTE: If engine is stored above 1 year, advise your **STEYR MOTORS Marine Dealer** to the Extended Preservation Procedure (Service Manual P/N Z001019/0, chapter GENERAL D3).

1. Change motor oil and oil filter.
2. Change fuel filter.
3. Check air filter.
4. Check coolant (closed circuit).
5. Add fuel stabilizer to fuel.
6. Drain engine's raw water system.

NOTE: If the raw water is not completely removed from the engine, expensive freeze damage may be the result.

7. Drain raw water system from boat and driving system (consider manufacturer's instructions as to storage).
8. Change gear oil or lubricant.
9. Disconnect battery and store it.
10. Spray engine outside with corrosion prevention oil.
11. Ventilate engine compartment and bilge.

Start-up after Storage

An correct start-up of the engine will contribute to an efficient and troublefree operation in the long term. Your **STEYR MOTORS Marine Dealer** will gladly be available as consultant or for an expert performance.

1. Check condition of hoses and hose clamps.
2. Clean battery terminals.

ATTENTION: Connect RED cable to positive terminal and then BLACK cable to negative terminal. Wrong connection of battery terminals may damage the electronic system.



3. Grease outer sides of terminals.
4. Open fuel stop valve and check all fuel lines for leakage.
5. Thoroughly check the boat and engine for slack or missing screws or nuts.
6. Pump the bilge dry and clean the engine compartment.
7. Complete the raw water system.
8. Open the raw water inlet.

ATTENTION: Insufficient raw water supply may damage the engine and the raw water pump.



9. Test run. Start engine. Check voltmeter, oil pressure- and water temperature gauge. (Make sure that all systems function properly.)
10. Check all parts for oil-, fuel- or water leakage.

NOTE: For additional Information regarding engine preparation for long term preservation please consult your **STEYR MOTORS Marine Service Partner**.

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WARRANTY

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STEYR MOTORS – Marine Engines – LIMITED ENGINE WARRANTY

STEYR MOTORS, GmbH ("STEYR MOTORS") warrants to the original retail purchaser of a product covered under this Warranty ("the Product"), and to any other person to whom the Product is transferred during the duration of this Warranty, that in the event of a failure of the Product occurring during the applicable warranty period resulting from a defect in materials or factory workmanship, STEYR MOTORS will, at its option, repair or replace the defective Product according to the terms and conditions set forth herein.

Products Warranted

This Limited Warranty applies to all new marine engines manufactured by STEYR MOTORS, GmbH and sold by STEYR MOTORS or by a STEYR MOTORS approved distributor or dealer until such time as this Warranty may be subsequently updated or revised. This Warranty also applies to the following engine accessories when approved and supplied by STEYR MOTORS and when installed by STEYR MOTORS or by a STEYR MOTORS approved distributor or dealer:

- acc. To enlisted distributor as stated in STEYR MOTORS Service Network (refer to website at www.steyr-motors.com)

This Warranty does not apply to any component manufactured by a third party and supplied by STEYR MOTORS as part of a package. Such non-covered components include, but are not limited to, any MerCruiser Bravo Series stern drive, ZF Marine transmissions, sail drives, water jet, control lever and commander systems, etc., that may be sold together with a Steyr engine. Buyers of a package that includes a MerCruiser Bravo Series stern drive should consult the product literature accompanying the stern drive for details on the warranty provided by its manufacturer, Mercury Marine. The provided warranty registration card with the Mercury Marine/MerCruiser product needs to be returned to STEYR MOTORS for registration in their system.

What You Must Do to Activate the Warranty

Owner Registration

IMPORTANT: In order to obtain the full benefit of this Warranty, your new Steyr engines must be timely registered at the factory, latest within 3 years from the date of sales document. The engines you have purchased have been shipped from the factory together with a Warranty Registration Card, a copy of which is included in your Operation, Maintenance and Warranty Manual. It is your responsibility to insure that the distributor or dealer from whom you purchased the engines fills out the Warranty Registration Card in its entirety and that it is immediately forwarded to STEYR MOTORS. The Registration Card must include your name and address, the product number and serial number(s), date of sale, and type of use, as well as the seller's name, address, code number and a properly obtained commissioning report. It must also contain the selling distributor/dealer's certification that you are the original purchaser and user of the Product.

In case of an engine doesn't get put into operation within the first year from production, the STEYR MOTORS long-term preservation and conservation procedure must be followed and documented as described in this procedure to prove proper storage handling and re-commissioning of the product.

A copy of the Warranty Registration Card, designated "Purchaser's Copy," MUST be given to you immediately after the card has been completely filled out by the selling distributor/dealer. Your copy of the Warranty Registration Card should be retained together with your Owner Identification Card and kept in a safe place. In the event that you ever require warranty service, you will be required to present your copy of the Warranty Registration Card along with your Owner Identification Card so that the date of purchase and delivery may be verified and so that the Warranty Claim Form can be properly completed.

Failure to register the Product with the factory within 60 days of the date on which you take delivery of the Product will cause the warranty period to begin running from the date on which the Product is shipped from STEYR MOTORS in Austria, rather than on the date of delivery to you. It is to your benefit to have all Products timely registered at the factory so that you receive the maximum available coverage under the Warranty and so that STEYR MOTORS has a means of identifying and contacting you in the event of product updates or service notifications.



Commissioning Report

Your new Steyr engines have been shipped together with a form entitled “Commissioning Report,” a copy of which is included in the installation manual that accompanies your engines. It is your responsibility to insure that this form is completed by the seller (distributor, dealer, or boat builder) at the time of installation and that it is immediately returned to STEYR MOTORS. Keep a copy of the completed form for your records, as you will be required to present it in the event you ever require warranty service. Failure to complete and immediately return the Commissioning Report to STEYR MOTORS will cause your warranty to be voided.

Base Engine Warranty

The Base Engine Warranty covers any failure of the Product under normal use and service that occurs during the applicable period of coverage and that results from a defect in STEYR MOTORS material or factory workmanship (a “Warrantable Failure”).

STEYR MOTORS’ Responsibilities under the Base Engine Warranty

During the applicable period of coverage under the Base Engine Warranty, and subject to all conditions, limitations and exclusions herein, STEYR MOTORS will, at its option, either repair or replace the defective Product. In the event that STEYR MOTORS elects to repair the Product, STEYR MOTORS will do the following:

- STEYR MOTORS will pay for all parts and labor reasonably required to repair the defect responsible for the Warrantable Failure.
- STEYR MOTORS will pay for all lubricating oil, antifreeze, filter elements, and other similar maintenance items replaced during a warranty repair when such items are not reusable due to a Warrantable Failure.
- STEYR MOTORS will pay for the usual and customary labor costs for engine removal and reinstallation when necessary to repair a Warrantable Failure.

Labor costs will be paid by STEYR MOTORS only for work pre-authorized by STEYR MOTORS and performed by an approved service facility during normal business hours. Labor costs will be paid in accordance with STEYR MOTORS’ published standard repair time guidelines. Parts used in warranty repairs may be new STEYR MOTORS parts, STEYR MOTORS-approved rebuilt parts, or repaired parts.

Duration of Coverage

The duration of coverage under the Base Engine Warranty depends upon whether your engine application and use are rated for “Pleasure Duty” or for “Commercial Duty”.

- For engines rated “Pleasure Duty,” the Base Engine Warranty extends for a period of 24 months or until the engines have been operated for 1000 hours, whichever occurs first.
- For engines rated “Commercial or Governmental Duty,” the Base Engine Warranty extends for a period of 12 months or until the engines have been operated for 1000 hours, whichever occurs first.

The period of coverage commences on the date on which the Product is delivered to the first retail purchaser, or the date on which the unit is first leased, rented or loaned, or when the Product has been operated for 30 hours, whichever occurs first.



Extended Major Components Warranty

The Extended Major Components Warranty covers any failure under normal use and service of any of the below-listed parts or castings that occurs during the extended warranty period and that is caused by a defect in material or factory workmanship:

- Engine Monoblock Casting
- Engine Camshaft
- Engine Crankshaft
- Engine Connecting Rods
- Crankshaft Sprocket
- Camshaft Sprocket
- Engine Housing
- Flywheel Housing

STEYR MOTORS' Responsibilities under the Extended Major Components Warranty

During the applicable period of coverage under the Extended Major Components Warranty, and subject to the conditions, limitations and exclusions herein, STEYR MOTORS will, at its option, either repair or replace the defective component. STEYR MOTORS' responsibilities in the event of a repair shall be the same as provided with respect to the Base Engine Warranty, except that the cost of labor for removal and reinstallation is not covered under the Extended Major Components Warranty.

Duration of Coverage

The Extended Major Components Warranty extends for a period of 60 months or until the engine has been operated for 1,800 hours, whichever occurs first. As with the Base Engine Warranty, the period of coverage commences on the date on which the Product is delivered to the first retail purchaser or on the date on which the unit is first leased, rented or loaned, or when the Product has been operated for 30 hours, whichever occurs first.

¹ Bushing and bearing failures are not covered.



Summary of Warranty Coverage

Type of Coverage	Duration (Months)*	Duration (Hours)*	Repair Costs based on stdd. repair time rates are paid by STEYR MOTORS		
			Parts	Labor	Labor for Removal & Reinstallation
Base Engine Warranty – PLEASURE	24	1000	Yes	Yes	Yes
Base Engine Warranty – COMMERCIAL	12	1000	Yes	Yes	Yes
Extended Major Components Warranty	60	1800	Yes	Yes	No

*whichever occurs first

Additional Coverage for Parts Replaced or Repaired Under Warranty

Any STEYR MOTORS product or part replaced or repaired under the Base Engine Warranty will be covered under the Base Engine Warranty for the remainder of the warranty period.

Warranty Coverage for genuine Spare Parts

STEYR MOTORS warrants genuine spare parts for extent of 6 month from the date of sales.

Conditions of Warranty Coverage

This Warranty is expressly conditioned upon proper application, installation, commissioning, operation, and maintenance of the Product in accordance with the specifications and guidelines set forth by STEYR MOTORS in its Operations, Maintenance and Warranty Manual and in its installation and service manuals. Proper use and operation of the Product entails, among other things, use of the Product in strict compliance with the following power ratings:

Pleasure Duty. This power rating is intended for use in variable load applications where full power is limited to one (1) hour out of every eight (8) hours of operation. Reduced power operations must be at 200 RPM or below of the maximum rated RPM. This rating (ISO3046 Fuel Stop Power Rating) is for application operating less than 300 hours per year and is intended exclusively for pleasure/non-revenue generating applications.

Engines rated "Pleasure Duty" may not be used for any commercial application without voiding the product warranty. A "commercial or governmental application" includes any work or employment-related use of the Product, or any use of the Product that creates income, even if the Product is only occasionally used for such purpose. A "commercial application" also includes charter, naval, police, and other similar applications.

Commercial or Governmental Duty according to Marine Duty Rating. If an engine is intent to be used for commercial operation the application must comply with below described duty rating conditions. The duty ratings are defined in three different engine operation pattern and annual use of the unit. The operation pattern defines a ratio between full power-speed-range and cruising-speed-range, wherein cruising speed must be maintained on a specified reduced rpm below the actual set propeller speed. The specified reduced speeds are mentioned in the Marine Duty Ratings below.

High Output (HO), this power rating is intended for intermittent use in variable load applications where full power is limited to one (1) hours out of every eight (8) hours of operation. Reduced speed for cruising range must be at 300 rpm, or below from actual set Propeller Speed. The defined fuel power speed range for each engine model is specified in chapter general, table marine engine overview. This rating (ISO3046 Fuel Stop Power Rating) is for application operating less than 300 hours per year.

Intermittent Rating (INT), this power rating is intended for intermittent use in variable load applications where full power is limited to two (2) hours out of every eight (8) hours of operation. Reduced speed for cruising range must be



at 200 rpm, or below from actual set Propeller Speed. The defined fuel power speed range for each engine model is specified in chapter general, table marine engine overview. This rating (ISO3046 Fuel Stop Power Rating) is for application operating less than 1500 hours per year.

Medium Continuous Rating (MCD), this power rating is intended for intermittent use in variable load applications where full power is limited to three (3) hours out of every twelve (12) hours of operation. Reduced speed for cruising range must be at 400 rpm, or below from actual set Propeller Speed. The defined fuel power speed range for each engine model is specified in chapter general, table marine engine overview. This rating (ISO3046 Fuel Stop Power Rating) is for application operating less than 3000 hours per year.

STEYR MOTORS' duty of performance under this Warranty is expressly conditioned upon the purchaser's maintenance of the following documentation and records which must be made available to STEYR MOTORS in the event that warranty service is required:

- You are responsible for keeping complete and accurate records of all service performed on the engines and for maintaining a log of all regularly scheduled maintenance in the Owner Service Log included in your Operations, Maintenance and Warranty Manual.
- You are responsible for assuring that at all times the engine hour meter on your Steyr engines is in good working order and in a condition that accurately reflects the total hours that the engines have been operated.
- You are responsible for keeping copies of the completed Warranty Registration Form and of the Commissioning Report.

Limitations and Exclusions

STEYR MOTORS is not responsible for any engine failure or other problem attributable in whole or in part to any of the following:

- Any application or installation inconsistent with STEYR MOTORS' published application and installation guidelines.
- Abuse or neglect, including but not limited to operation without adequate coolants or lubricants, over-fueling, over-speeding, lack of maintenance of cooling, lubricating or intake systems, improper storage, preservation, rust or corrosion, improper starting, warm-up, run-in or shutdown practices, or failures caused by incorrect oil or by water, dirt or other contaminants in the fuel or oil.
- Unauthorized modifications of the engine.
- Use of a service facility not approved by STEYR MOTORS, or use of parts not supplied or approved by STEYR MOTORS. For information on approved service partner in your area, please contact STEYR MOTORS or refer to the list of approved service facilities posted on STEYR MOTORS' website at www.steyr-motors.com.
- Prolonged or incorrect storage. Prolonged storage, for purposes of this Warranty, is storage for a period of over one (1) year from the date of shipment from the STEYR MOTORS factory.
- Normal wear or wearout of parts.
- Faulty workmanship, whether or not performed by an approved dealer or distributor of STEYR MOTORS, and whether or not occurring in conjunction with a warranty repair.

STEYR MOTORS will not pay for any of the following costs, which shall be the sole responsibility of the Owner:

- The cost of transporting any STEYR MOTORS engine or product to or from the place of warranty service.
- The cost of haulage, launch, docking, or cranes.
- The cost of lubricating oil, antifreeze, filter elements, and other maintenance items replaced during warranty repairs unless such items are not reusable because of the Warrantable Failure.
- The cost of any part supplied, or labor performed, by a service facility not approved by STEYR MOTORS.
- The cost of any part supplied, or labor performed, by a service facility without the prior authorization of STEYR MOTORS.



STEYR MOTORS does not warrant any product or component not specifically identified in the “Products Warranted” section of this document. Please note in particular the following:

- STEYR MOTORS does not warrant any product or component not manufactured by STEYR MOTORS, except for those accessories specifically identified in the “Products Warranted” section of this document that are supplied by STEYR MOTORS and installed by STEYR MOTORS or by a STEYR MOTORS approved distributor or dealer. Examples of items not warranted are stern drives, sail drives, gear boxes, and water jets, control lever, etc.
- STEYR MOTORS does not warrant maintenance components supplied by STEYR MOTORS after 90 days of the date on which warranty coverage commences. Maintenance components include, but are not limited to, sea water pump impellers, zinc plugs, oil filters, fuel filters, air filters, water filters, fuel/water separator filters, belts, automatic belt tensioner, timing belt and idler, gaskets, hoses, fuses, brushes and accommodator, fuel injection nozzle valves, expansion tank pressure caps, and thermostats.
- STEYR MOTORS will not warrant their product with the limited engine warranty if the provided product warranty registration card will not be submitted and received by STEYR MOTORS within 3 years from the date of product manufacturing.

IN NO EVENT SHALL STEYR MOTORS BE RESPONSIBLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES.

Such excluded damages include, but are not limited to, loss of use (including “down time”), loss of income or business revenue, costs of travel, costs of transport, extra costs required to make the Product accessible as a result of particular vessel designs and/or installations (including the removal and/or replacement of partitions or material), personal injury, loss of property, cargo damage, fines, taxes, damages to parts or goods other than products specifically covered by this Warranty, and any other indirect or consequential loss resulting from a Warrantable Failure. **Some states do not allow limitations on how long an implied warranty lasts, so the above limitation may not apply to you.**

THE WARRANTIES SET FORTH HEREIN ARE THE ONLY WARRANTIES MADE BY STEYR MOTORS WITH RESPECT TO THE PRODUCT. NO DEALER OR DISTRIBUTOR OF STEYR MOTORS IS AUTHORIZED TO MAKE ANY ADDITIONAL WARRANTY, PROMISE, OR REPRESENTATION ON BEHALF OF STEYR MOTORS OR TO MODIFY OR EXTEND THE TERMS OR DURATION OF THIS WARRANTY. ANY WARRANTY IMPLIED BY LAW, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY OR OF FITNESS FOR A PARTICULAR PURPOSE, SHALL BE LIMITED IN DURATION TO THE TERM OF THIS WARRANTY.

Procedure for Making a Warranty Claim

Warranty service may be obtained from any approved STEYR MOTORS distributor or dealer. For a list of approved service locations, please refer to STEYR MOTORS’ website at www.steyr-motors.com or contact STEYR MOTORS’ After sales Division, the contact information for which is provided on the final page of this document.

In the event of a Warrantable Failure arising during the applicable warranty period, a warranty claim must be submitted promptly **IN WRITING**. A warranty claim must be made immediately upon discovery of facts that would lead a reasonably prudent owner to believe that the Product is defective in materials or factory workmanship, but in no event more than 30 days after such discovery.

To make a warranty claim, contact any approved STEYR MOTORS distributor or dealer and present your STEYR MOTORS identification card and your copy of the Warranty Registration Form and Owner Service Log. You may also be required to present your copy of the Commissioning Report all maintenance and service records.

A STEYR MOTORS Warranty Claim Form (a sample copy of which is available from STEYR MOTORS’ website at www.steyr-motors.com) must be completed by the dealer or distributor and returned to STEYR MOTORS in Austria. It is your responsibility to insure that the Warranty Form is properly completed and to retain a copy for your records as proof of the making of a timely warranty claim.

All warranty claims **MUST** be approved by STEYR MOTORS before any warranty work is undertaken. No distributor or dealer of STEYR MOTORS is authorized to approve, or to guarantee approval of, a warranty claim. Any work performed prior to obtaining authorization from STEYR MOTORS will be at the risk of the owner and/or service facility undertaking the work. Upon approval of a warranty claim, you are responsible for making the Product available for repair at the place designated by STEYR MOTORS within a reasonable period of time.



IMPORTANT: The foregoing procedures for making a warranty claim are mandatory. Failure to comply with the requirements for submitting a warranty claim shall be presumed to have deprived STEYR MOTORS of adequate and timely notice of a defect and shall relieve STEYR MOTORS of any duty of performance under this Warranty.

Venue and Applicable Law

This Limited Warranty and the rights and obligations of STEYR MOTORS and of the Owner as they relate to any product supplied by STEYR MOTORS shall be governed by and construed in accordance with Austrian law, and any legal action instituted against STEYR MOTORS as a result of this Warranty shall be brought in Vienna, Austria. In the event of a legal action commenced against STEYR MOTORS in the United States, STEYR MOTORS shall have the option to consent to jurisdiction and to require that the action be submitted to binding arbitration according to the commercial rules of the American Arbitration Association.

Miscellaneous

This Warranty document consists of the complete and final expression of the intent of the parties with respect to the warranty obligations of STEYR MOTORS. The terms of this Warranty may not be modified except by a writing signed by an authorized representative of STEYR MOTORS. Dealers and distributors of STEYR MOTORS engines (whether or not approved by STEYR MOTORS) are not agents of STEYR MOTORS and have no authority to alter the terms of this Warranty or to waive any condition or requirement stated herein.

Should any portion of this Warranty be determined unenforceable in a court of law, the validity and legal effect of the remainder of the document shall not be affected. STEYR MOTORS may in certain circumstances, and at its sole discretion, provide for service outside the scope of this Warranty to update, modify, or repair a product. In that event, STEYR MOTORS shall not be deemed to have assumed any additional obligation to the owner or to have modified or waived any of the provisions of this Warranty.

The owner shall be responsible for the cost of investigating complaints found not to be attributable to a defect in STEYR MOTORS material or factory workmanship.

Any STEYR MOTORS product or part replaced under warranty will automatically become the property of STEYR MOTORS.

This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.



If You Do Not Receive Satisfactory Warranty Service

STEYR MOTORS strives, through an extensive network of independent distributors and dealers, to provide prompt, courteous, and competent warranty service to owners of Steyr engines. If you fail to receive satisfactory warranty service from a STEYR MOTORS distributor or dealer, please contact STEYR MOTORS after sales division directly. Its contact information is as follows:

STEYR MOTORS, GmbH
Im Stadtgut B1, 4407
Steyr, Austria

Phone: +43 7252 222-52
Fax: +43 7252 222-29
e-mail: service@steyr-motors.com

Erstellt/Issued: 04.02.2011 Kundendienst/After Sales Service	Geprüft und freigegeben/Approved: 04.02.2011/Ing. Rudolf Mandorfer
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Engine, Gearbox, Boat Model and Hull Identification Numbers

Record your engine and gearbox model and serial numbers immediately after purchase.
This will enable you to have them available for quick reference when ordering parts or literature.

Engine Model No.: _____

Engine Serial No.: _____

Gearbox or Stern Drive Model No.: _____

Gearbox or Stern Drive Serial No.: _____

Ignition Key No.: _____

Boat Model No.: _____

Hull Identification No. (HIN): _____

Recommended Propeller Size: _____

Replacement Parts

Never use parts of unknown quality on your **STEYR MOTORS Marine Engine**.
Insist on **GENUINE-STEYR MOTORS** Marine parts.

See your local STEYR MOTORS Marine dealer.



STEYR OWNER IDENTIFICATION CARD

Owner's Name		
Address		
City	State	Zip
Date of commissioning		
MODEL #		SERIAL #



DEALER RECORD CARD

ENGINE REGISTRATION	MODEL	SERIAL
TRANSMISSION OR OUT DRIVE REGISTRATION	MODEL	SERIAL
TRANSOM MOUNT REGISTRATION	MODEL	SERIAL

Owner's Name		
Address		
City	State	Zip
Date of commissioning	Ignition Key No.	
Boat Mfg.	Hull No.	
Boat Model	Boat length	

Owner's signature

IMPORTANT: The Federal Boat Safety Act requires registration list to be maintained on product sales by manufacturer and DEALER. This is a standard card on which a dealer can keep his records.

Name		
Address		
City	State	Zip
Date of commissioning		
Type of use:		
<input type="checkbox"/> Pleasure	<input type="checkbox"/> Commercial	<input type="checkbox"/> Government
Application according Marine Duty Rating		
<input type="checkbox"/> HO (High Output) [1 of 8 <300 h]	<input type="checkbox"/> INT (Intermediate) [2 of 8 <1500 h]	<input type="checkbox"/> MCD (Medium Continuous Duty) [3 of 12 <3000 h]
Extended Storage Preservation Procedure (refer to Installation Manual Z001007/0, commissioning REPORT)		1 st preservation 2 nd preservation

Dealer Name		
Address		
City	State	Zip
Owner's e-Mail	Dealer Code	

Engine Registration	Model #	Serial #
Boat Mfg	Model	
Hull No.	Length	
Trailer Vin No.		
Rate Overall Quality of		
Boat	<input type="checkbox"/> Good <input type="checkbox"/> Acceptable <input type="checkbox"/> Poor	<input type="checkbox"/>
Motor	<input type="checkbox"/>	<input type="checkbox"/>



SERVICE NETWORK

AUSTRIA

STEYR MOTORS GmbH
Im Stadtgut B1, 4407 STEYR, AUSTRIA

Phone +43 7252 222-52

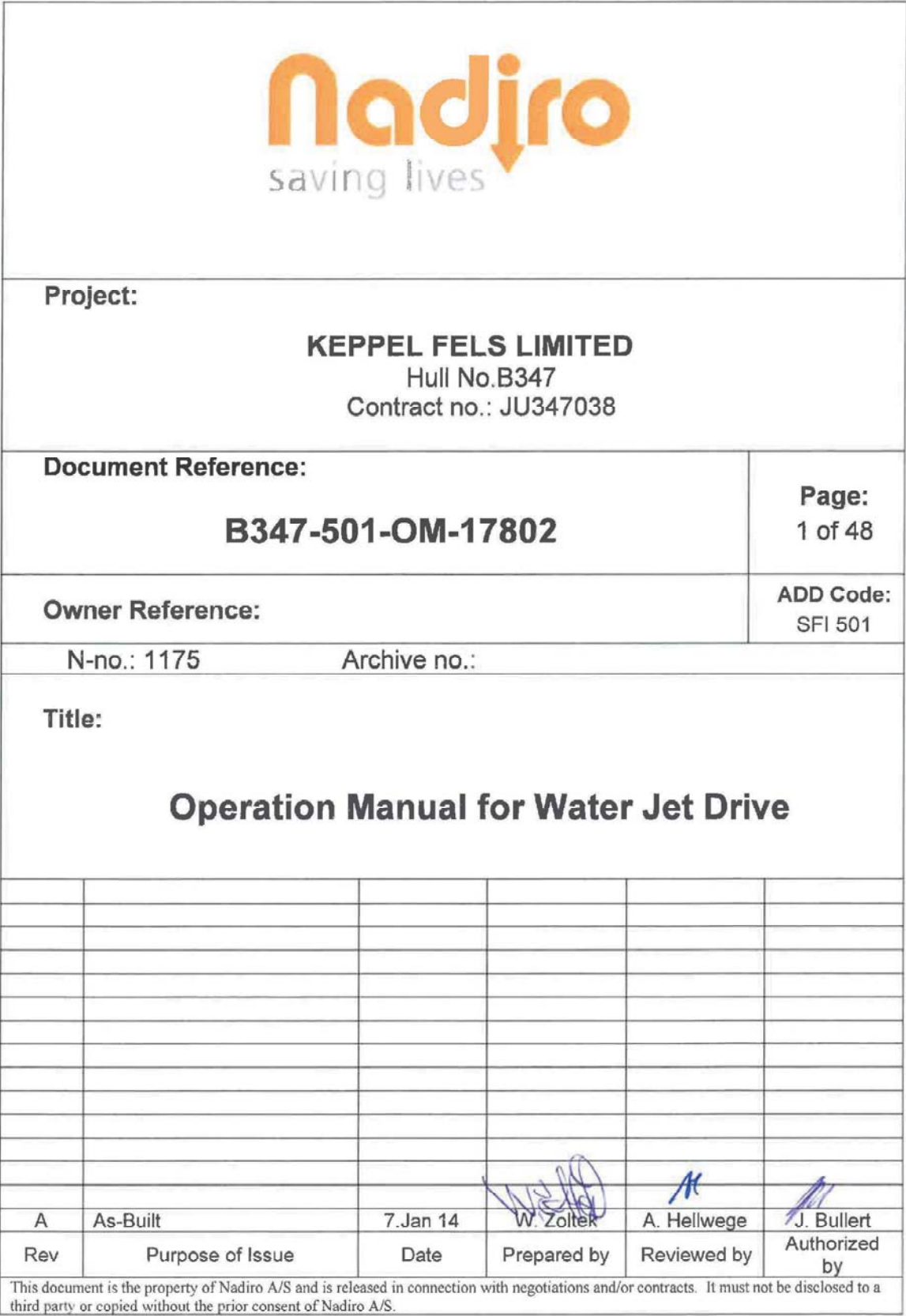
Fax +43 7252 222-29

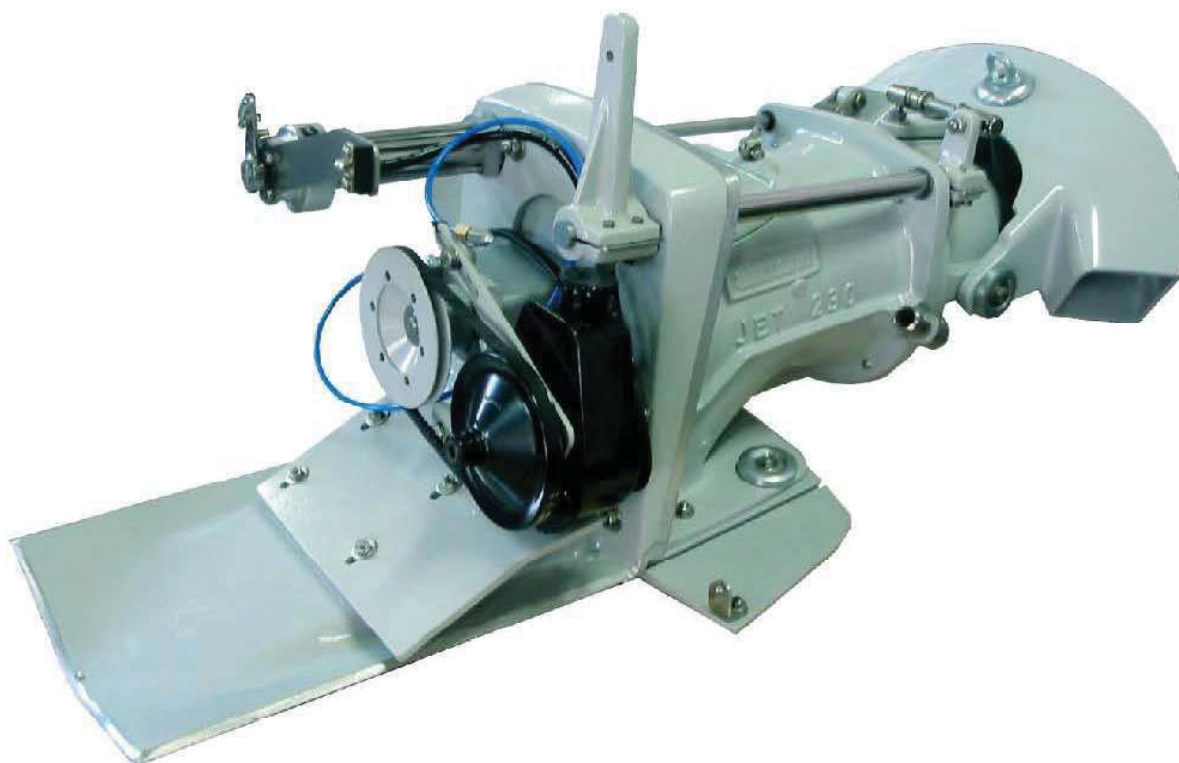
e-mail: service@steyr-motors.com

<http://www.steyr-motors.com>

A full list of our worldwide Service network can you found on our homepage under:

<http://www.steyr-motors.com/network>





Operating and maintenance manual

jet 230

Alamarin-Jet Oy - 62300 Härmä - Finland
Tel. 00 358 6 485 3800 Fax. 00 358 6 485 3888

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alamarin-jet

Operating and Maintenance Instructions

Congratulations on acquiring your new **alamarin jet**. We recommend reading this manual before taking the device into use and trying your new **jet**-boat for the first time. This ensures the best benefit and pleasure from your device.

alamarin jet, matching the right boat with appropriate engine and impeller = always a good result.

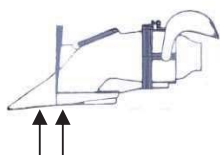
- low fuel consumption
- easy handling and excellent maneuverability
- low requirement for **jet** maintenance

How the water jet propulsion system works

The water jet propulsion system is the result of years of development. The system works by increasing water flow rate in the nozzle. Change in water flow rate creates a reacting force in the direction of water flow. Boat can be steered and speed increased by controlling the amount and direction of the water jet.

1. Water Jet Propulsion System

Main parts: Intake,- impeller,- nozzle,- and steering and control device



1.1 Intake, which consists of inlet duct, mounting piece, and an inlet grill. The purpose of the intake is to direct water from outside the boat to impeller suction face with as little loss as possible and on an even speed distribution.

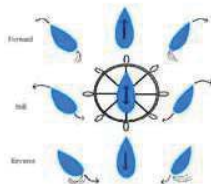


1.2 Impeller, which is rotated by drive engine on direct drive, increases water flow rate.



1.3 Nozzle transforms the pressure energy created by the propeller into motion energy.

1.4 Steering device is used to alter the direction of the jet coming from the nozzle. This creates the thrust required for turning the boat.



1.5 Control device Boat reverses by lowering reverse deflector. Water jet is directed obliquely forward under the boat, and thrust is thus directed forward and downward. The reverse deflector is also used to stop the boat. See sections: Safety, page 7; and Control, page 10.

2. Control and Safety

- 2.1 Thrust from the water jet propulsion system should be powerful enough to ensure proper behaviour and easy maneuverability.

Boat is hard to control on idle running in wind or waves or when beaching.

- 2.2 The water jet propulsion system creates strong currents near the boat on high engine rpm.

- 2.3 Avoid using the water jet propulsion system to bring the boat to a complete stop from high speed. Practise stopping when driving with the water jet propulsion system for the first time. The use of “reverse gear” is recommended only when the boat has slowed down considerably.

WARN OTHER PEOPLE ON THE BOAT

ABOUT SUDDEN STOPS!

- 2.4 Before you start the engine, use the control device to ensure that the lever is in neutral gear. See page 9.
- 2.5 In reverse gear also steering is reversed. The boat reverses right when you turn the steering wheel to the left and vice versa. This is easy to learn with the following rule of thumb: When reversing, the bow turns in the direction you turn the steering wheel.
- 2.6 When driving in shallow waters, rocks may damage the impeller and sand may accelerate wear of the impeller.

Always consider weather conditions

3. Warnings

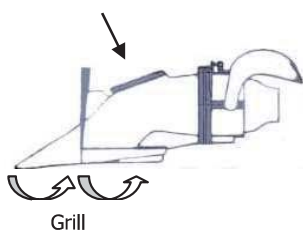
3.1 Devices equipped with a water lubricated end bearing

DO NOT DRY USE

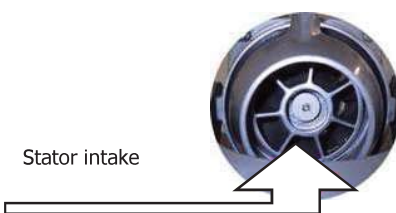
- 3.2 Lubricated end bearing. No time limit for dry use.
(boats in professional use and boats used in shallow waters)
- 3.3 After malfunction drive slowly to the nearest shore. Repair malfunction before using the device again.
- 3.4 Check regularly that intake, grill, stator inlets, or drive shaft do not contain foreign objects.
- 3.5 If you get stuck on a shoal or in shallow waters, try to avoid using the water jet propulsion system for release to protect the impeller from damage.
- 3.6 Before opening inspection hatch, ensure that impeller shaft cannot suddenly turn.

**Inspect and clean grill , intake, and drive shaft.
THROUGH INSPECTION HATCH!**

Inspection hatch



Stator intake



Close hatch by tightening wing nut firmly by hand.
Do not use tools!

4. Running-in

Running-in : *alamarin jet* – water jet propulsion system is ready for running on full power.

The water jet propulsion system has an engine implanted. Engine manufacturer's instructions must be taken into consideration.

Before accelerating to planing speed, make sure that engine has achieved normal running temperature.

Engine monitoring gauges must be followed more closely than normal during first running-in hours.

The impeller may make a slight clinging noise in the beginning of running-in. The sound will, however, fade away shortly.

5. Steering and Control

Engine is started when control lever is in neutral gear.

Due to the fixed connection between the engine and **jet** – water jet propulsion system power transmission this neutral gear is not unambiguous. It depends on engine rpm and will not thrust the boat forward or backward.

The boat driver must find the neutral gear in the control lever on the first run. This is done by trying different positions.

When engine is running, neutral gear must usually be fine-tuned by pushing the control lever slightly in the required direction. Simultaneously, as the boat begins to turn on the spot, the steering wheel is turned in the opposite direction.

In an electronic reverse deflector (**jet** 180 S , **jet** 230, and **jet** 280) the position of the control lever tells the position of the deflector, which makes it easy to find the neutral gear.

To ensure the best maneuverability at start, the engine must be used on clearly higher rpm than idle running (approximately 1500 – 1800 rpm). Boat speed is then controlled with deflector control lever. This important fact must always be remembered when the boat is moving and even when standing still.

Boat is hard to control in waves and wind when the engine is idle running.

Boat moves forwards when control lever is pushed forward and backwards when control lever is pushed back.

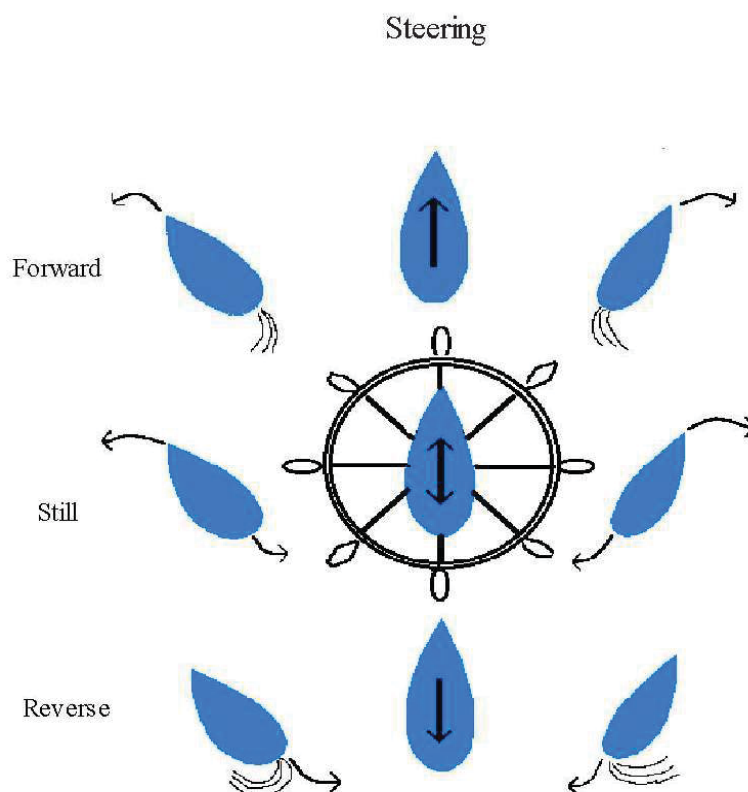
This all happens steplessly as the boat operator wishes.

In neutral gear the boat can turn virtually within its own length. In reverse one should remember that also steering is reversed: bow turns to the direction where the steering wheel is turned when reversing. As the steering wheel of a reversing boat is turned right, the boat reverses to the left.

When moving slowly in unfamiliar, shallow waters and dodging rocks, engine must be run on high rpm and boat speed is controlled with deflector control lever. Normally, when the boat is planing, the deflector is not used. Boat speed is then controlled with engine rpm.

In a tight spot engine rpm is not lowered, but the boat is stopped or rocks dodged using deflector control lever and steering wheel.

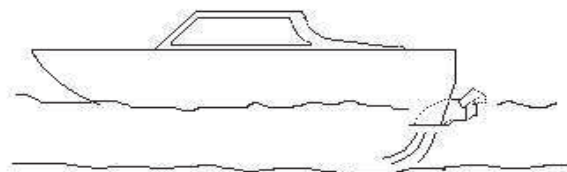
Also going ashore in both familiar and unfamiliar harbours is done as explained above and not by using engine on idle running.



6. Use in Shallow Waters

Alamarin jet–boat can be used in extremely shallow waters, but one should take into consideration the powerful suction of the intake especially on high engine rpm.

Loose objects may become sucked in the grill and small objects will go directly through the ***jet***. Rocks may, however, cause damage. Wear is inevitable in sandy or silted water. The maintenance requirement of a worn impeller is explained in the maintenance section of this manual. See Impeller tuning and mounting on page 20.



Grill seen from side below

7. Use in Rushy Waters

On planing speed *jet* – boat usually goes over rushy waters without difficulties.

Clogs may, however, occur in harsh conditions.

In cases of clogs (when so called cavitation also occurs) the following measures are recommended :

1. Stop the engine. Foreign objects in the grill thus simply fall out.
2. Let the engine run a few times at high rpm. This usually sucks foreign objects through the *jet*, thus cleaning it in the progress.
3. If the boat can be planed. Drive the boat as fast as possible and turn off the engine. The speed of the boat usually wipes the grill clean.
4. Drive the boat on reverse as fast as possible. As the boat is moving backwards, turn off the engine and push the deflector control lever on the forwards-position. Water flows thus backwards through the *jet* and backflushing usually removes any clogs whatsoever.

Following these simple instructions, it is usually possible to clean the *jet* even after the boat has come to a complete halt in rushy waters.

Unlike with other propulsion systems, the engine of a boat equipped with *jet* water jet propulsion system hardly ever stops because of rush clogs.

If, however, the above measures prove insufficient, the water jet propulsion system is equipped with an inspection hatch through which clogs can be located and removed.



Inspection hatch



Remember to close and tighten the hatch!

8. Cavitation

The most common malfunction in **jet** water jet propulsion systems manifests as cavitation. It can be seen in too high engine rpm.

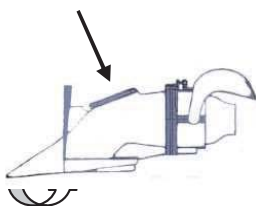
Cavitation occurs when water pressure drops locally so that water vaporizes on impeller blades, causing steam bubbles. This lowers performance remarkably and damages the impeller.

Cavitation can often be heard as a bubbling sound.

Any factor that makes it harder for water to flow in the **jet** increases the risk of cavitation.

Check the following points if cavitation occurs.

Inspection hatch



1. Grill



2. Drive shaft



2. Stator-nozzle device



3. Inspection hatch
+ seal



4. Impeller

Check that: (Through inspection hatch)

1. grill is not clogged
(from grass, rush, plastic, rocks etc.)
2. stator-, nozzle, or impeller
do not contain foreign objects
(rope, rush entwined on drive shaft,
rocks in outlet)
3. intake device does not have air leaks, inspection
hatch is not loose or badly sealed.
4. impeller is not damaged. The impeller should be flat
without sharp dents.

If boat runs slowly even though engine is running at
high rpm, find out the reason for this.

Contact the manufacturer in cases of uncertainty.

9. Maintenance

alamarin jet -water jet propulsion system is designed and manufactured to be as simple as possible. Therefore, it requires a minimal amount of maintenance and all maintenance can be done beached.

End bearing

Water jet propulsion system with a grease fitting. Can be dry-used. (No time-limit)



Grease fitting

Bearing lubrication

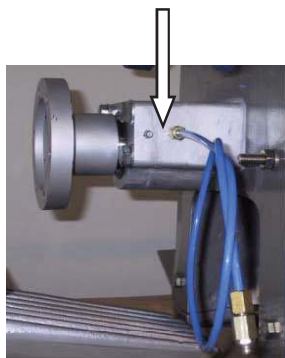
Lubrication interval	50 h
Lubricant	high-grade graphite vaseline
Amount of lubricant	10-15 shots on a lubricator

Devices without a grease fitting have a water lubricated end bearing. See exploded view

IMPORTANT! DO NOT DRY-USE!

Front bearing

Grease fittings (Bearing and thrust bearing)

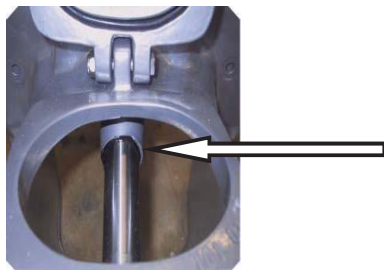


Front bearing lubrication

Front bearing grease fittings are located in the engine room.

Grease fitting and curled grease tube can also be mounted in a more easily reachable.

Overlubrication is not possible. An empty bearing housing requires approx. 85 shots of lubricant and approx. 7 shots in bearing.



Bearing housing contains enough lubricant when its outlet can be seen through inspection hatch in drive shaft outlet.

Lubrication instructions : See page 14.

Notice : Grease tube length and clamp operation.

Water lubricated end bearing

Water lubricated end bearing. See parts list – part n. 23034 slide bearing

IMPORTANT ! DO NOT DRY USE

Bearing wear affects impeller properties. If bearing is worn, extra vibration is created in the device and the impeller makes a clinging sound.

Also impeller wears and its power decreases.

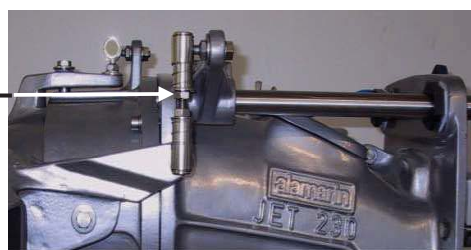
A worn bearing must be replaced when the above symptoms occur.

Control devices:

Control device joints are made of acid-proof steel and contain plastic bearings that should be lubricated with water-resistant lubricant.



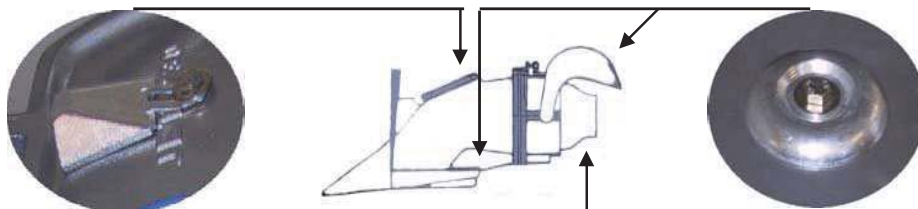
(With electric bucket steering)



However, it is a good idea to rinse water jet propulsion system with fresh water after it has been used in seawater.

Periodic maintenance:

- wash both boat and water jet propulsion system with fresh water
- empty engine of water and perform maintenance operations according to engine manual
- empty exhaust system from water
Afterwards, fill system with antifreeze (50/50 %)
- Lubricate water jet propulsion system bearings
- Tune impeller allowance to minimum See Impeller tuning, page 21.
- Check anode condition (zincs)

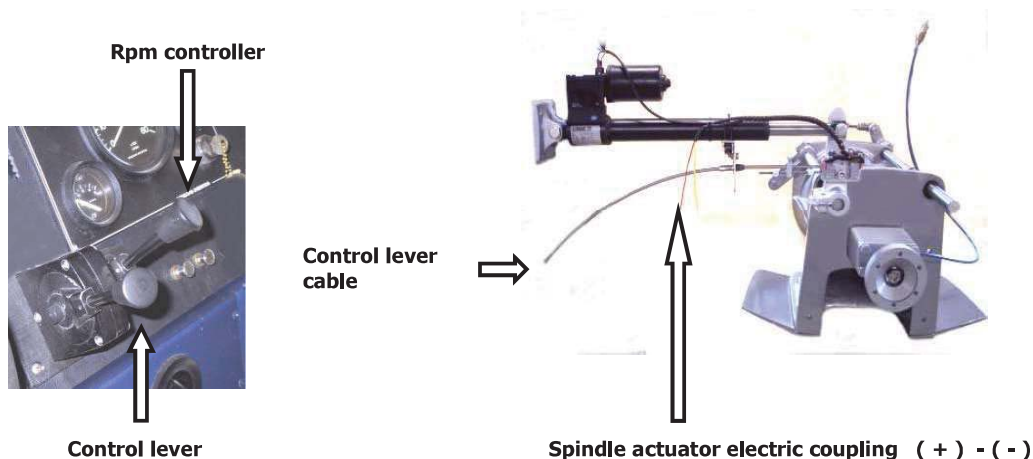


- Lubricate control device joints
- Dry bilge

If water is collected in bilge, the reason must be found out and a possible leak repaired. Water can damage drive engine if it reaches clutch case, for example. If this happens, remove drive engine and dry it.

10. Control Devices

Electronic deflector control device



Mounting spindle actuator

Electric installation must be done with precision. Plus- and minus wires must be connected to correct poles. Check thrust directions before mounting spindle actuator.

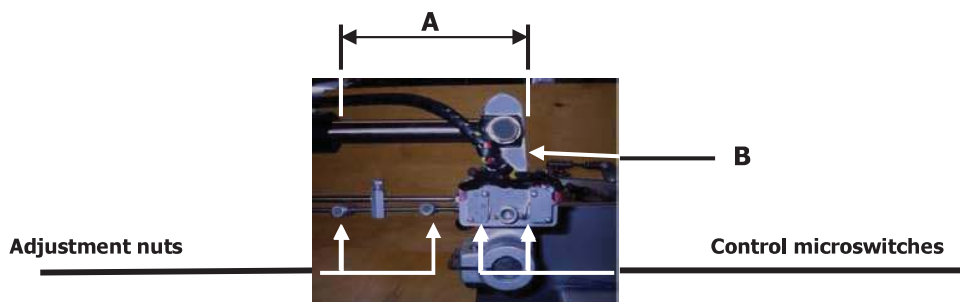
Drive spindle cylinder as close as possible to the position shown in the picture.

Measure **A** = 135 mm

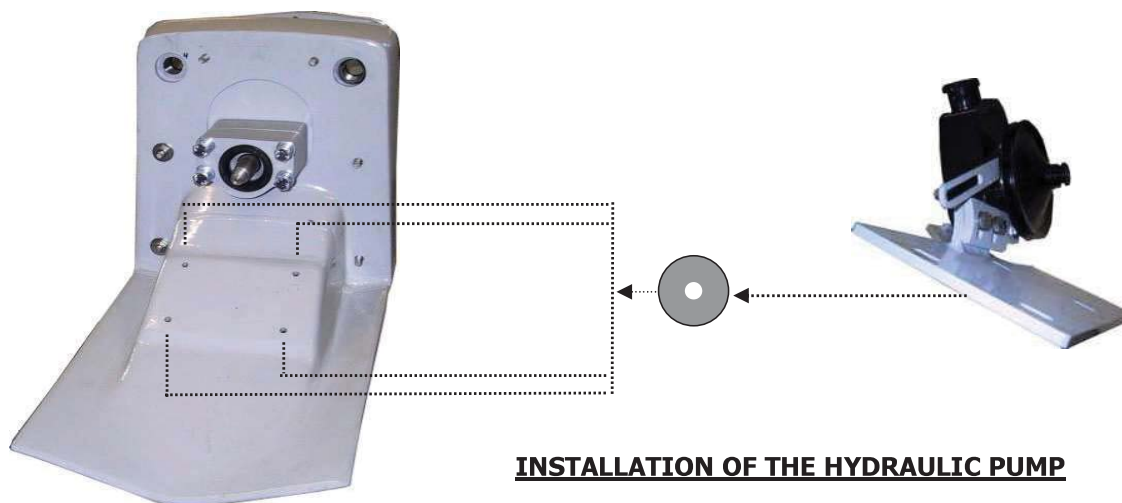
Turn power off. During mounting, spindle actuator should be horizontally level when lever (**B**) is positioned vertically

After mounting spindle actuator, check deflector extreme positions and perform possible fine-tuning using adjustment nuts.

Important ! Always remove deflector lever before mounting (23043) (23045)
See exploded view



Hydraulic control for the reverse scoop



INSTALLATION OF THE HYDRAULIC PUMP

When installing the hydraulic pump rack :

1. Use sandpaper to roughen the lower surface of the hydraulic pump rack and the surface of the grass grill. Also roughen the counter surfaces in the boat.
2. Add seawater-proof sealing compound to the lower-surface of the hydraulic pump rack.
3. Add seawater-proof sealing compound to the surface of the grass grill. The compound has to be spread around the bolt holes thoroughly.
4. Place the four countersunk head screws(M8) through the grass grill and the hydraulic pump rack. Place 4 pcs washers (M8 , DIN 440) between the hydraulic pump rack and the boat hull. Tighten the rack slightly so that it still can be mowed.



5. Staking of the belt wheels

5.a Vertical staking

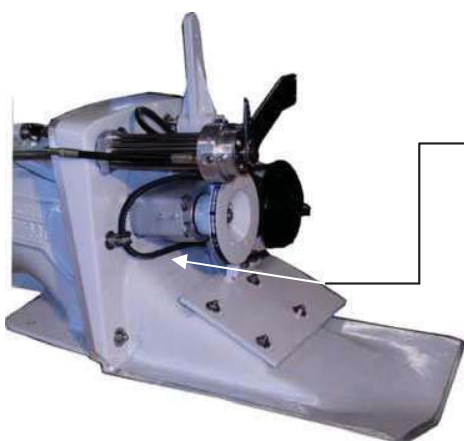
Adjust the hydraulic pump with the curved fastening part. Fasten the bolts.

5.b Horizontal staking

Adjust the hydraulic pump by the oval bolt holes in the hydraulic pump rack. Fasten the bolts.



6. After staking the belt wheels tighten the nuts (35Nm). move the extra compound from underneath the boat and from the engine room.

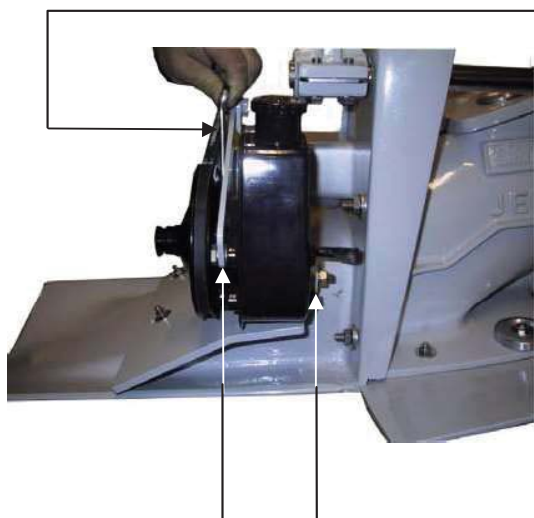


7. Install the spare V-belt and fasten it with plastic ties.

8. Install the V-belt (AVX 10 x 800 La) and tighten it.

9. Tighten the hinge bolts for the hydraulic pump.

Fork wrench 17 mm



Installation of the hydraulic cylinder



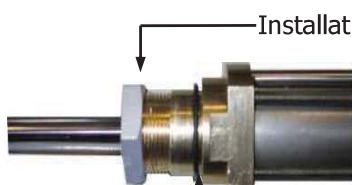
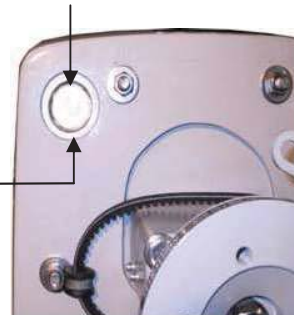
Install the drilling guide (outer thread R 1¼ ") to the frame of the water jet.



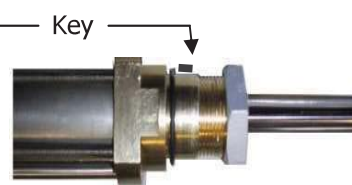
Drill a hole (Ø 51 mm) trough the installation surface.

Installation surface = boat astern or the template

Keyway



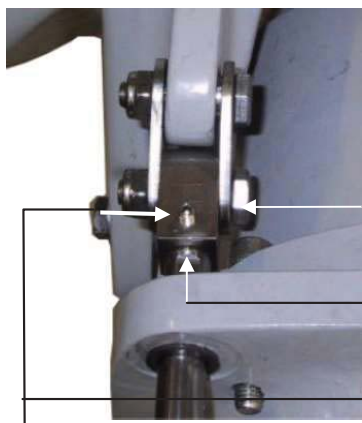
Rubber sealing ring. Make sure that the rubber sealing ring and the key are properly placed.



Add sealing compound around the collar.
Place the hydraulic cylinder.

Place the washer and tighten the nut for the cylinder.





1. The point mark on the cylinder rod has to point upwards before fastening of the cylinder rod to the reverse scoop.
2. Screw the joint to cylinder rod. Tighten the hinge, clearance 0,5 mm. Lock the nuts with glue (Loctite).
3. Tighten the socket-head screw (M6) for the piston rod and hinge. Lock it with glue (Loctite).

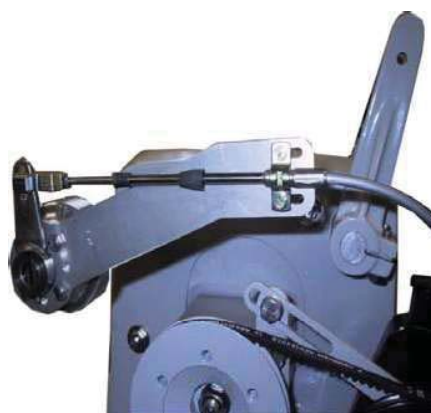
Control cable rack

Rack for the control cable will be installed by the manufacturer (shown in the picture). The rack can be installed also in the other positions if necessary. This will be done by the manufacturer and shall be requested when ordering the water jet.

NOTICE!

WARRANTY CLAUSE:

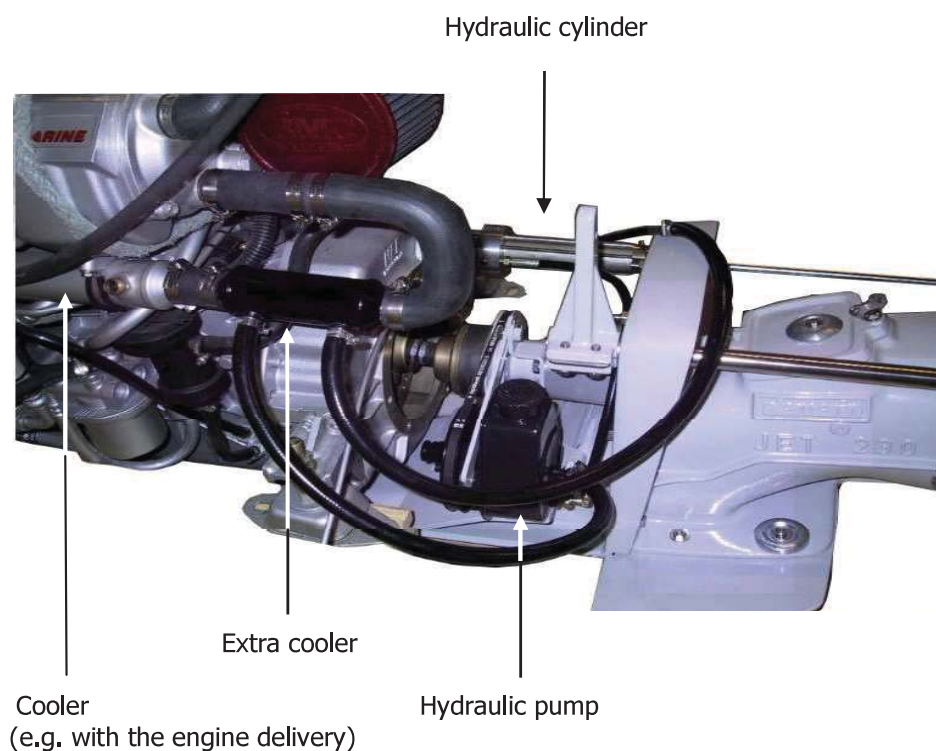
Alterations to the hydraulic cylinder and to the control cable rack installations may only be performed by the jet manufacturer or by an authorized mechanic.



Cooling of the hydraulic oil in the hydraulic control system for the reverse scoop

NOTICE!

WARRANTY CLAUSE: Hydraulic oil in the hydraulic reverse control system has to be cooled without exception.

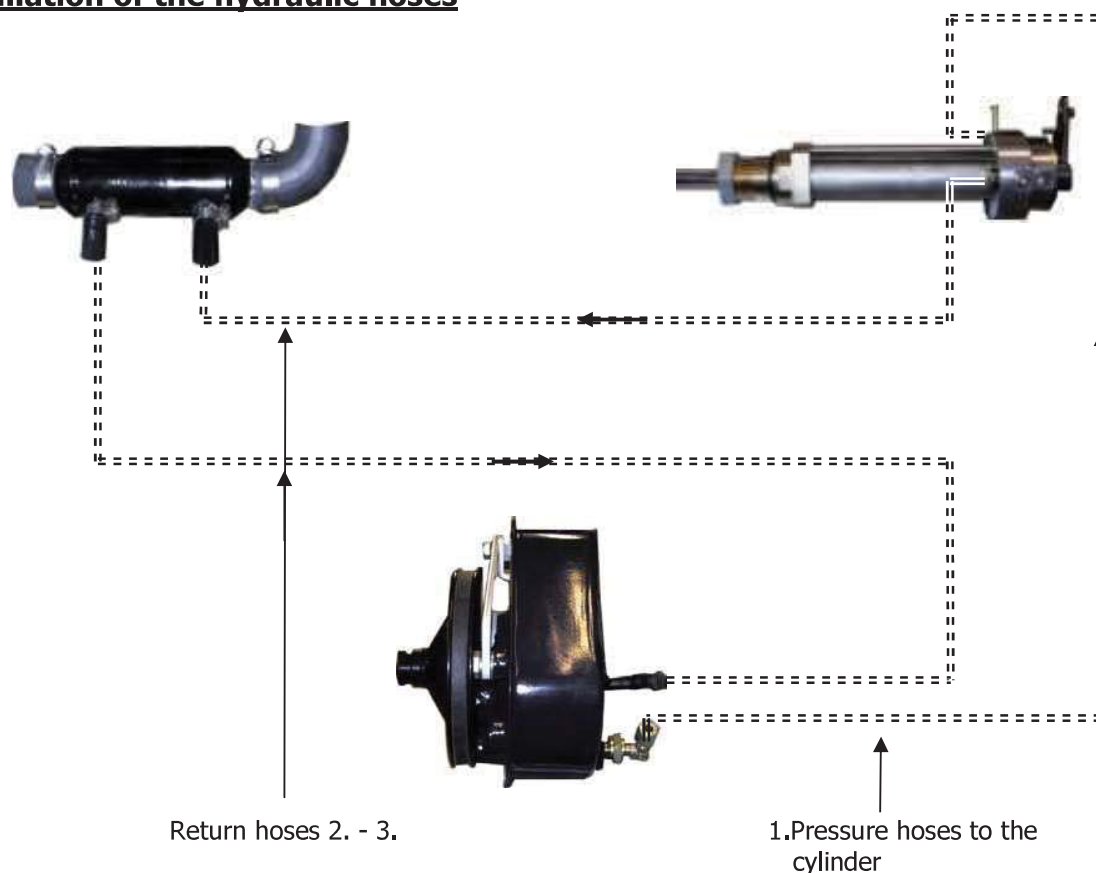


An extra cooler has to be installed in the following cases :

1. If there is no cooler included in the engine delivery the extra cooler has to be installed in the engine coolant line case by case.
2. If the engine cooler is reserved e.g. for the gear box cooling has to be installed.

Installation can be done as shown in picture (e.g. with the Steyr - engines).

Installation of the hydraulic hoses



1. Pressure hoses from the hydraulic pump to the cylinder is mounted by the jet manufacturer.
2. - 3. Return hoses are to be mounted by the boat manufacturer(because of dimensioning of the hoses in the engine room).

Test run of the hydraulic control for the reverse scoop

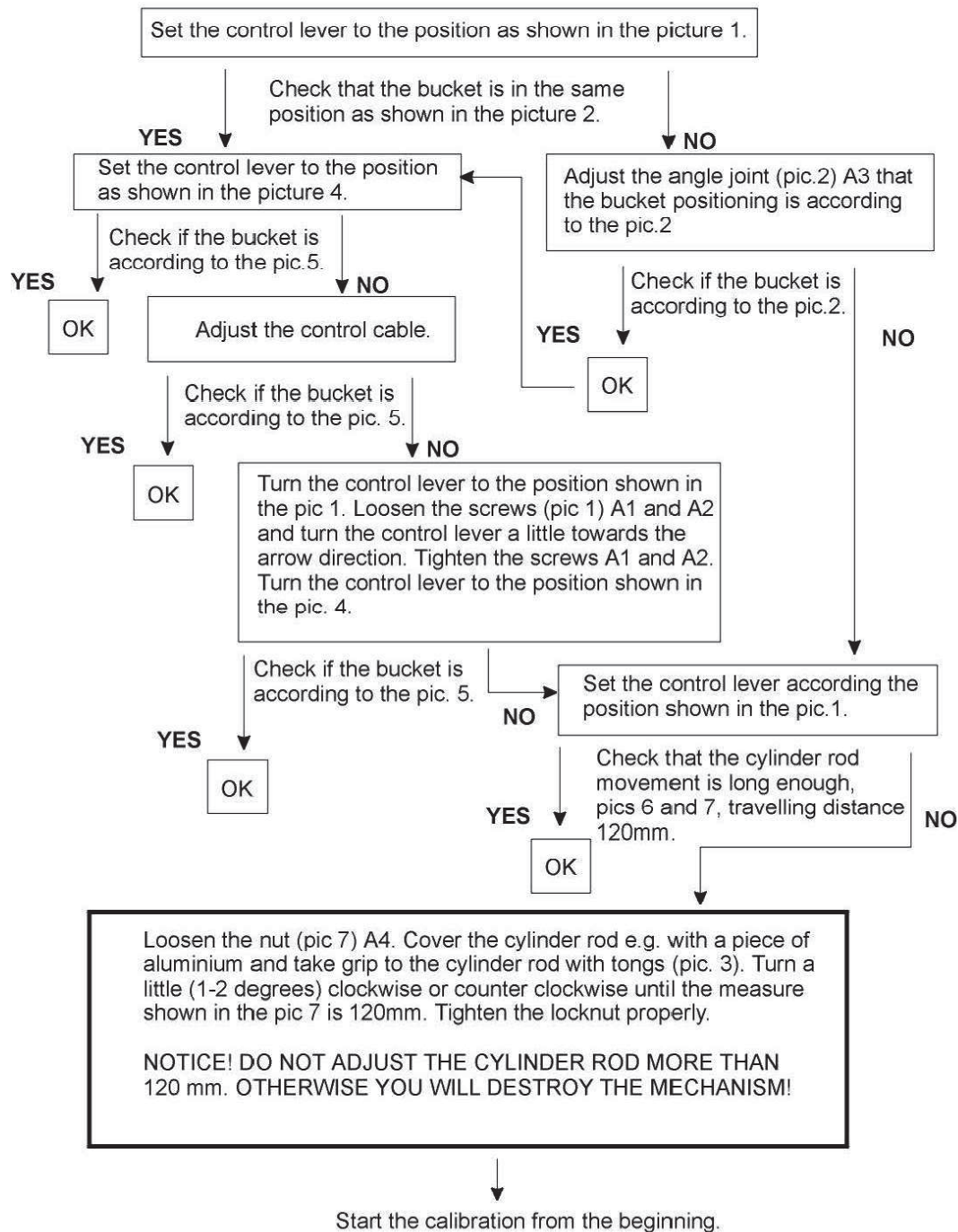
1. Make sure that all bolts, nuts and hose connections are tightened before use.
2. Fill in the hydraulic tank with hydraulic oil to the upper level of the measuring stick. Close the top.
(recommended oil e.g. = Mobil ATF 220)
3. The hydraulic system has to be vented before the test drive of the boat. Vent the hydraulic system by moving the scoop to its extreme positions. The air comes out through the top even if it is closed. Continue this as long as "sounds of airing" can not be heard from the hydraulic system and the reverse scoop functions properly.
4. After venting check the oil level and refill if needed.
5. **NOTICE! Always before starting the engine the handle grip for the bucket has to be in the middle position!**

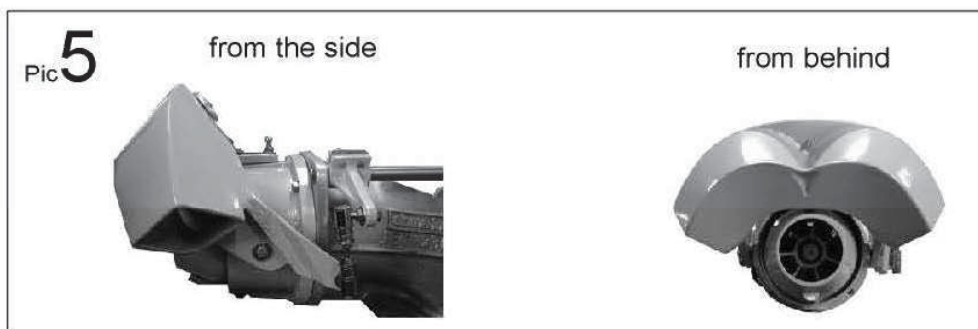
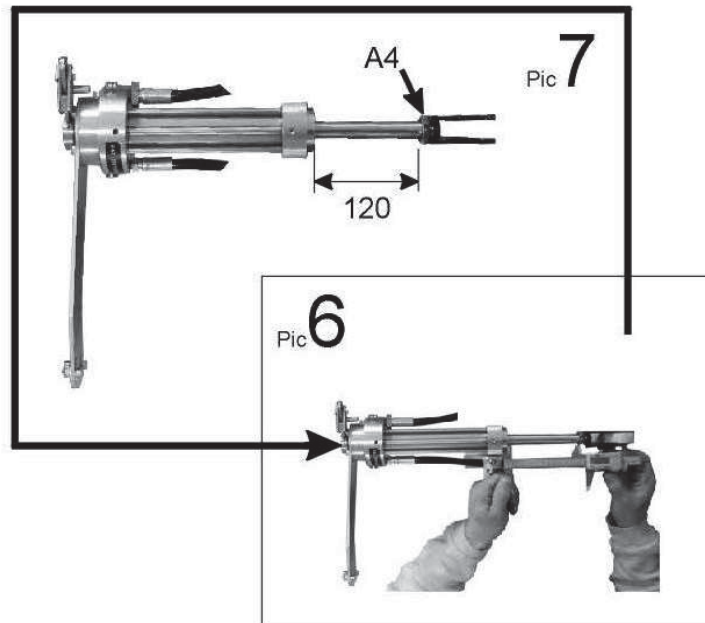
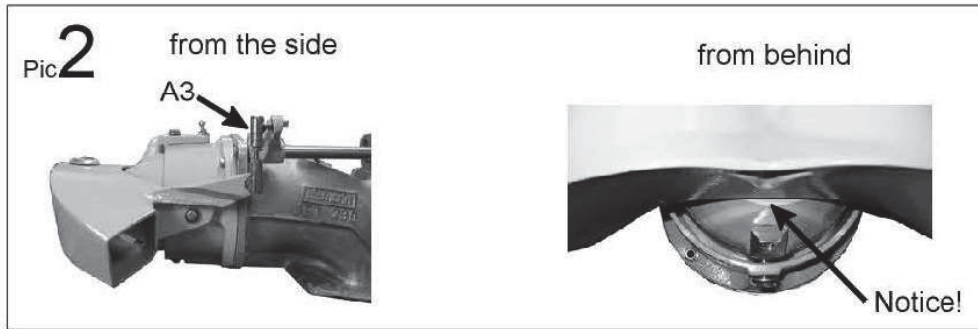
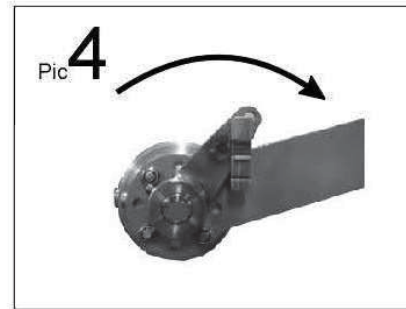
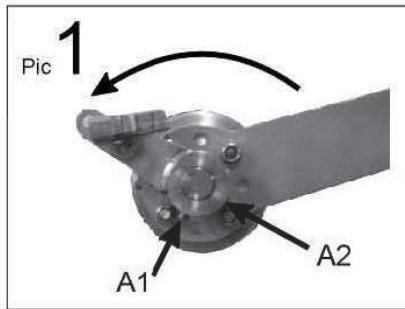
NOTICE! Contact the manufacturer if problems arise or you should have any questions about the hydraulic control for the reverse scoop. Any possible repairs for the hydraulic cylinder has to be done by the manufacturer.

NOTICE! WARRANTY CLAUSE: The maintenance work and repairs for the hydraulic control for the reverse scoop have to be done by the manufacturer.

Calibration of the hydraulic cylinder (instructions pictures page 25)

NOTICE! The hydraulic pump has to be running during the calibration. !





11. Impeller

Impeller usually wears from the outer edges of the blades. The impeller works in a cone-shaped space and its position can be adjusted in shaft direction by blade wear.

Allowance between the outer edges of the blades and cone should be as small as possible to ensure best possible power. (Factory allowance 0,2 mm)

The shape of the edges of impeller blades is important. Damaged edges cause cavitation.

Edges can be repaired by carefully peening the marks caused by bigger rocks and sanding the edges clean.

Front edge must not be sharpened, but left approx. 2mm thick and rounded, $r = 2 \text{ mm}$



You can also return the impeller to the factory for checking and repairing.

Inspection hatch



1. Check seal condition when opening
2. Clogs in impeller and on shaft are easy to remove through the hatch.
3. Impeller tuning with threaded sleeve is done through the hatch.
4. Tighten winged nut by hand when closing the hatch – Do not use tools.



Fastening bolts

Mounting the impeller

Plastic mounting cone is fitted in impeller boss and fastening bolts(3) are fitted with washers and placed through the free holes in the mounting cone.

The screws should rotate by turning them slightly by hand.

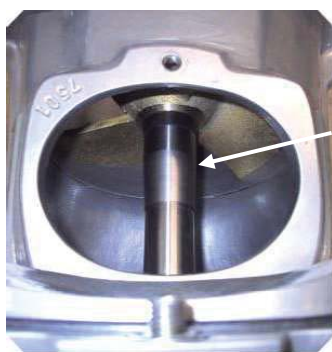
Check that shaft key is in place. Place mounting cone and impeller on the shaft in the direction pointed by the key. Take hold of mounting cone (not impeller!) and push it firmly in place. Before this, the threaded sleeve must be loosened so that it does not yet connect to the impeller.

Tighten bolts (Torque 20 Nm). When bolts have been fastened, check by moving shaft end hand that the allowance between impeller and cone is max. 0.2 mm and fasten sleeve to the impeller.

After this:

Mount water jet propulsion system stator and nozzle in place. Stator fastening bolts (Torque 70 Nm).

Tuning the impeller



Allowance is determined by turning the threaded sleeve on the shaft. The sleeve has a left-handed thread. See exploded view.

Perform tuning if allowance between impeller and cone exceeds 0.2 mm. Larger allowance decreases the power of the water jet propulsion system.

Mark and keyway must be uniform.



Size number of impeller



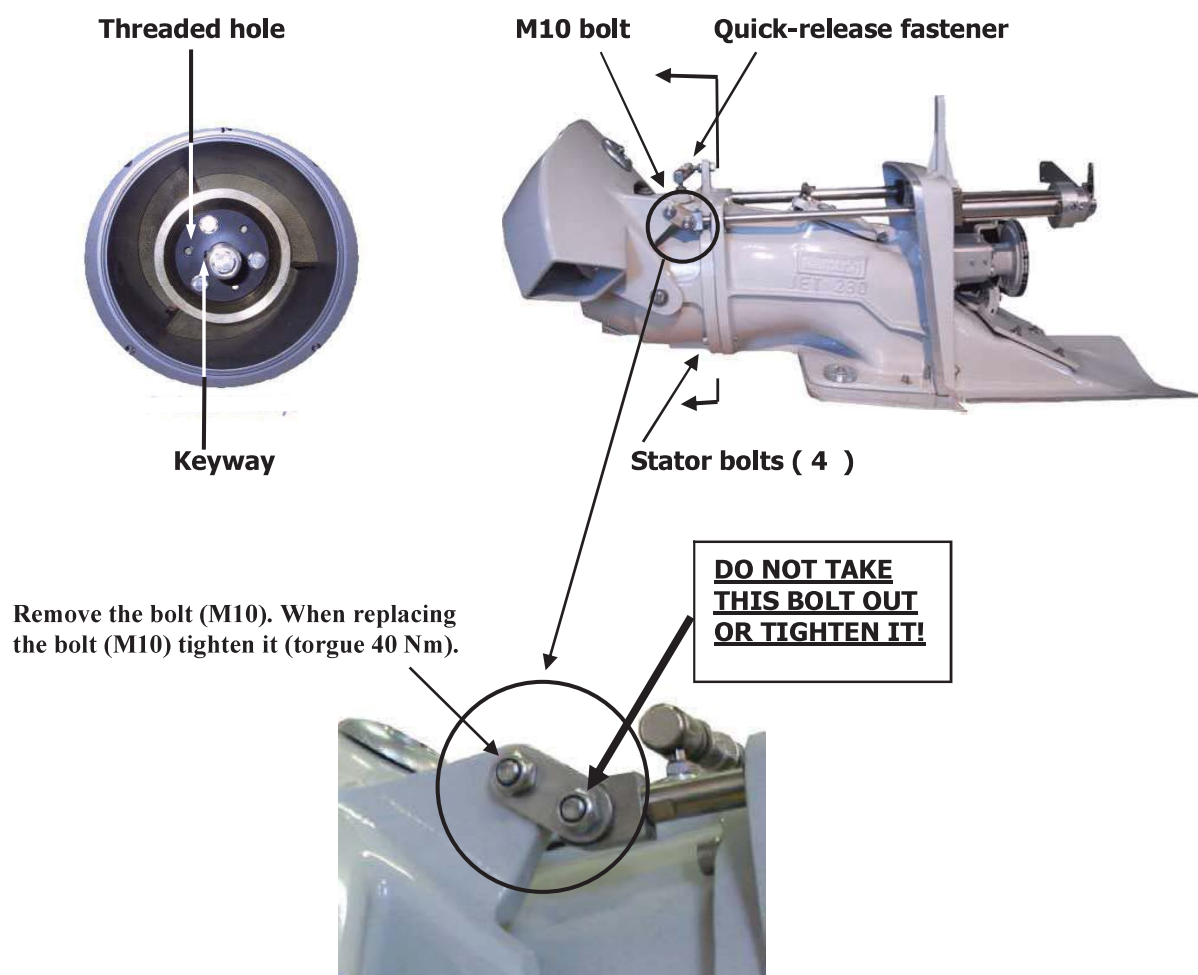
Removing the impeller

The back of the water jet propulsion system is removed by opening stator fastening bolts (4). Remove reverse deflector and nozzle control levers from quick-release fasteners. After this, stator, deflector, and nozzle can be removed as a whole.

Stator and water jet propulsion system frame are fitted together tightly. You can use a screwdriver to pry the parts loose.

Impeller fastening bolts are loosened and one of them is removed completely. It is placed in the next threaded hole, by keyway, and tightened carefully, causing tightness to decrease.

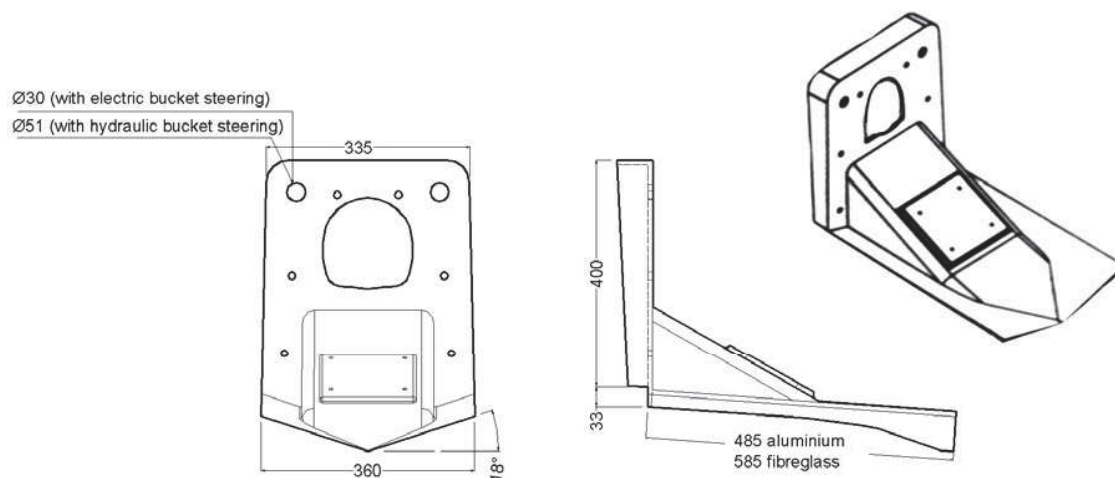
If the parts fit extremely tight, several bolts are used. The bolts can be removed from the shaft when mounting cone and impeller tightness is relieved.



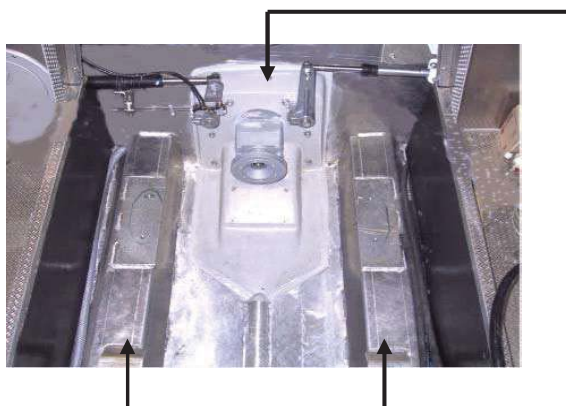
**Important! Remember thread-locking compound when assembling parts back together!
Ensure that the inspection hatch is closed!**

12. Mounting

Mounting piece



Mounting piece is delivered : For fibreglass boats / in fibreglass
For aluminium boats / in aluminium



Mounting piece lamination or Welding

1. Intake duct (23090)
2. Engine mounting bars

Mounting piece lamination or welding

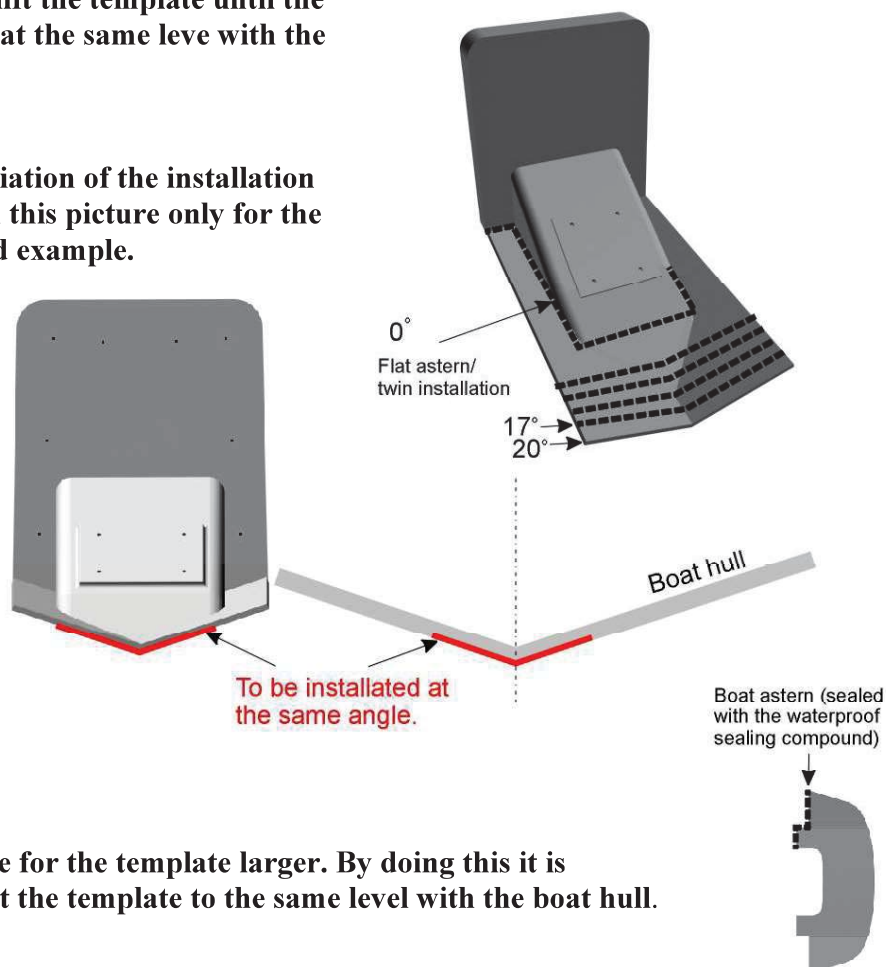
Check watertightness after launching.

Check watertightness after starting.

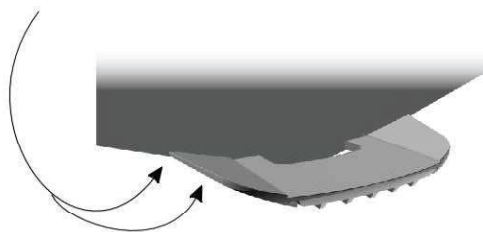
Installation instructions for the template

1. Shorten and lift the template until the lower plan is at the same level with the boat hull.

Notice! The variation of the installation angles shown in this picture only for the information and example.



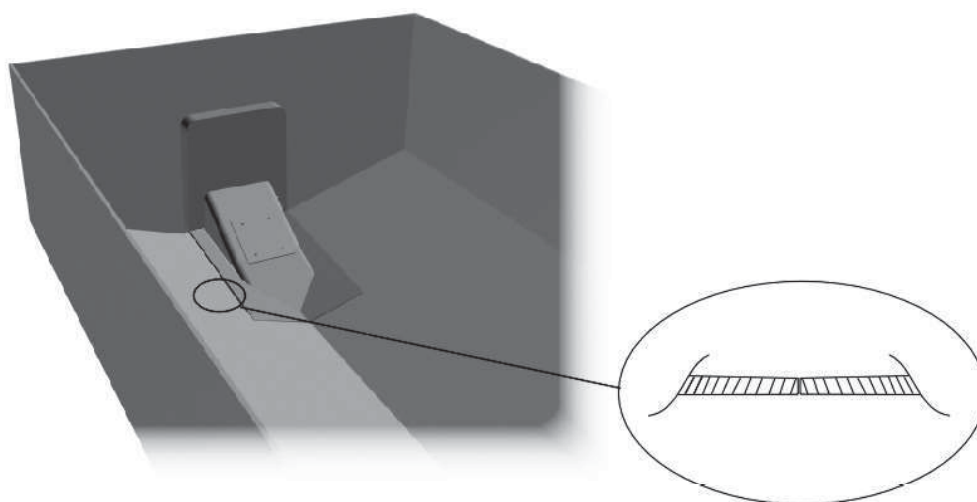
2. Make the hole for the template larger. By doing this it is possible to get the template to the same level with the boat hull.
3. Check the markings (the bolt hole marks) in the template. When installing the jet according to these markings the jet will be positioned at the right place. Cut the cavitation plate according to the boat astern and seal it.
4. Cavitation plate and boat bottom, please look the hiddenline:
NOTICE! Inclination and line must be uniform.



5. Cut a hole to the boat hull according to the template.



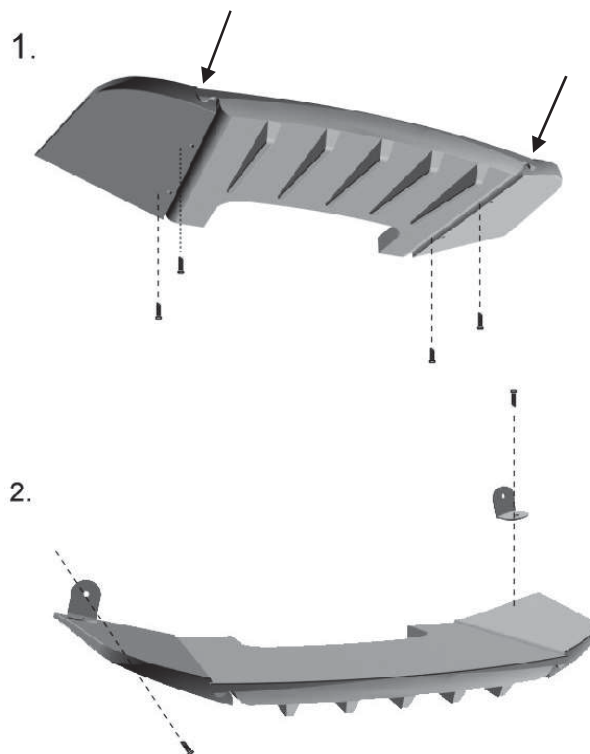
6. Place the template to the hole. **NOTICE!** The template and the boat hull has to be at the same level with eachother.
7. Attach the template from underneath with tape or fast drying 2-cmponent compound.
8. Strengthen the installation by laminating the template at its place.
Thickness of the lamination should be about 12-14 mm.



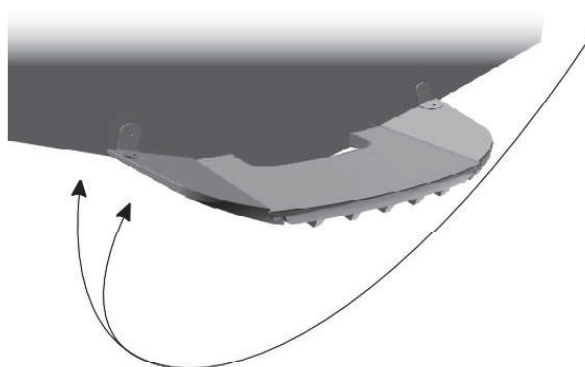
9. Cut the extra collar of the template to the same level with boat astern.
Finish the astern surface.

Installation instructions for the cavitation plate

Add waterproof sealing mass to the seams and screw holes.



Cavitation plate and boat bottom. NOTICE! Inclination and line must be uniform.



Mounting Jet - 230

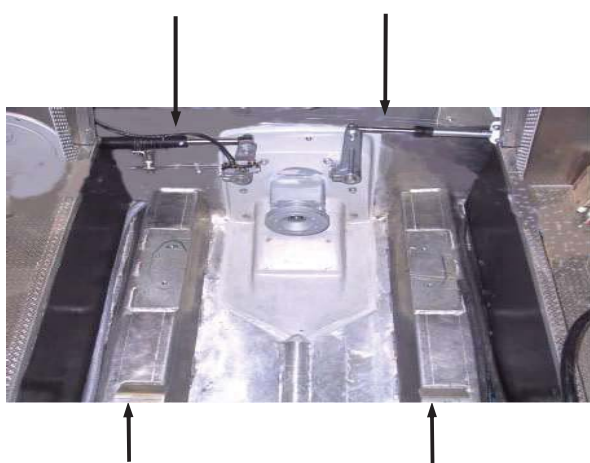


Water jet propulsion system mounted in stern.



**Cavitation plate and boat bottom
inclination and line must be uniform**

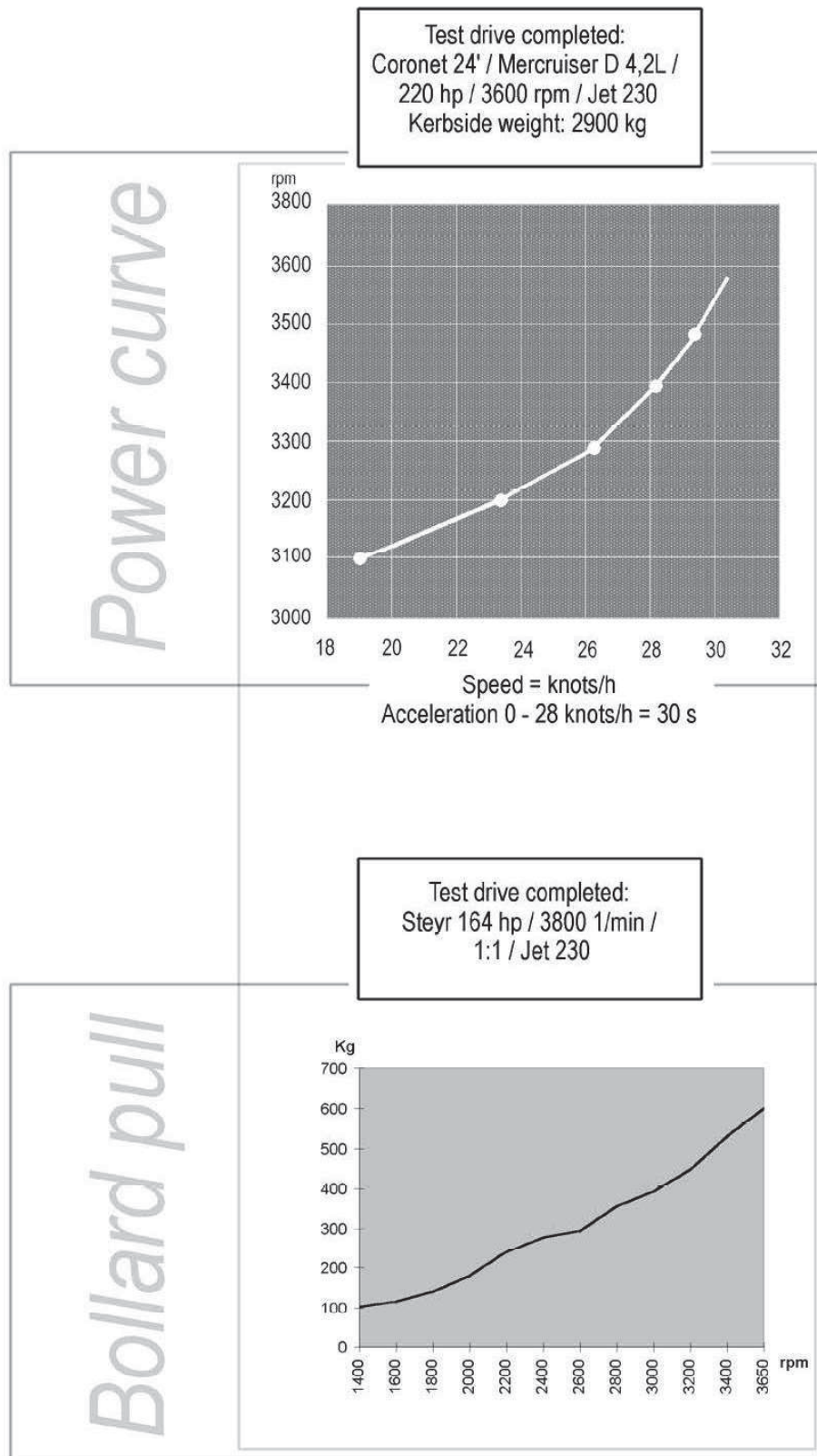
Deflector control Control



**Mounted intake duct
(aluminium boat)**

Engine mounting bars

13. Test results



Performance information of Alamarin Jet 230

FRB vessels of GRP

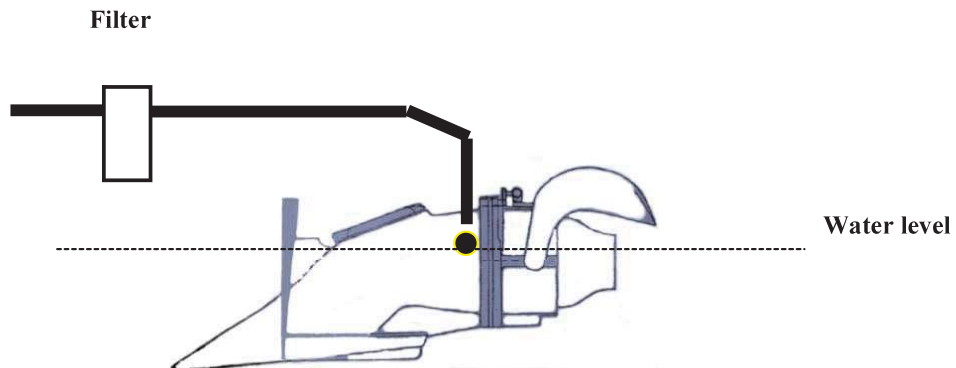
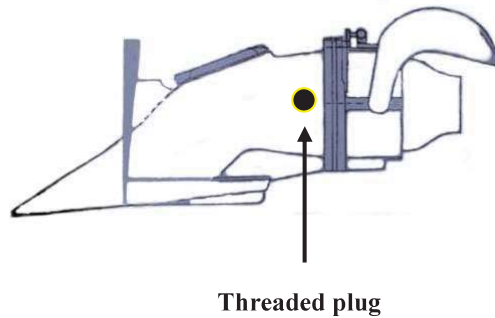
Boat	LOA (metres)	BOA (metres)	DEG	Engine	Weight (tn)	Speed (knots)
-	7,68	2,8	17°	Steyr 212 HP/4300 rpm	3,3	31
-	6,55	2,7	18°	Steyr 144 HP/3750 rpm	2,1	29
-	7,5	2,7	18°	Steyr 212 HP/4300 rpm	2,9	31
-	6,15	1,8	21°	Steyr 144 HP/3800 rpm	1,8	34

Aluminium

Boat	LOA (metres)	BOA (metres)	DEG	Engine	Weight (tn)	Speed (knots)
Silver Eagle	6,3	2,4	18°	Steyr 212 HP/4300 rpm	1,4	40,5
Fiskars Buster Magnum	6,3	2,35	18°	Steyr 164 HP/3700 rpm	1,9	29
Fiskars Buster Magnum	6,3	2,35	18°	Steyr 164 HP/3700 rpm	1,4	35

14. Engine cooling

Jet -water jet propulsion system has an engine cooling water connection ready. The engine does not require a separate water pump. The cooling water connection has been factory sealed with a threaded plug.



Cooling water pipes are mounted above water level.

15. Tools

- | | |
|--|-------|
| <input type="checkbox"/> Set wrench | 10 mm |
| <input type="checkbox"/> Set wrench | 13 mm |
| <input type="checkbox"/> Set wrench | 17 mm |
| <input type="checkbox"/> Hexagonal socket wrench | 5 mm |
| <input type="checkbox"/> Hexagonal socket wrench | 6 mm |
| <input type="checkbox"/> Hexagonal socket wrench | 8 mm |
| <input type="checkbox"/> Knife | |
| <input type="checkbox"/> General pliers | |

Alamarin Jet Oy - 62300 Härmä

Tel. 00 358 6 485 3800 Fax. 00 358 6 485 3888

Email: alamarin-jet@netikka.fi

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Email: alamarin-jet@netikka.fi

IMPORTANT !

Contact factory immediately if problems arise.

Our goal is a satisfied **alamarin - jet** water jet propulsion system user

16. Part list

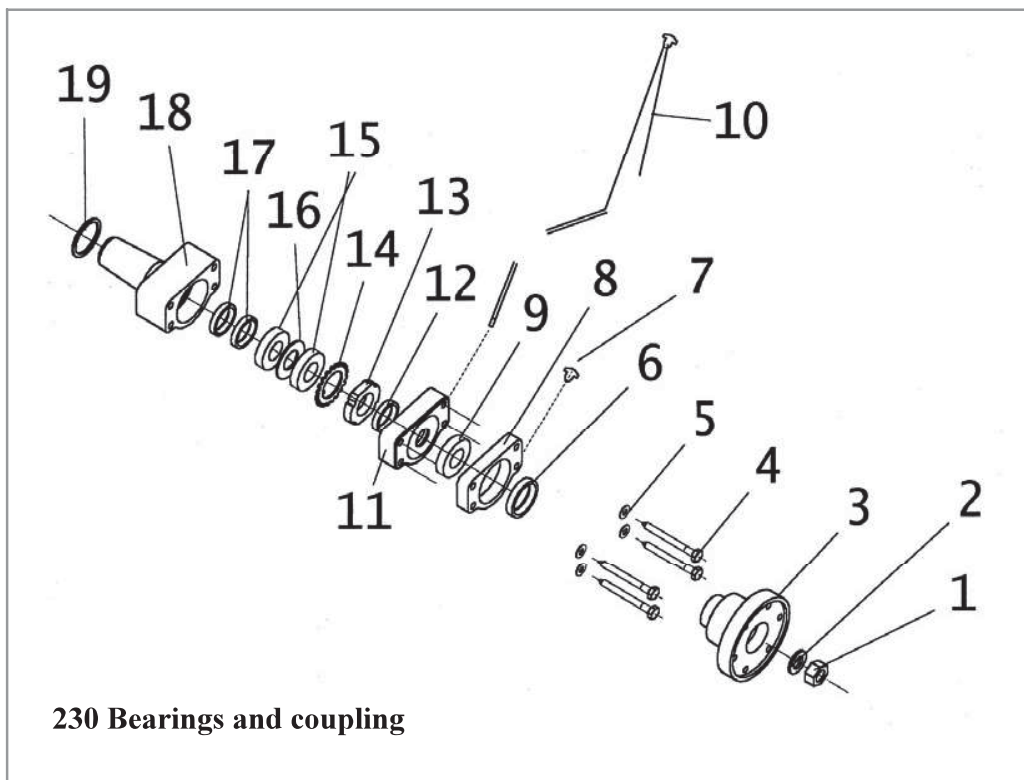
JET-230

LIST OF PARTS

Always state part number
when ordering

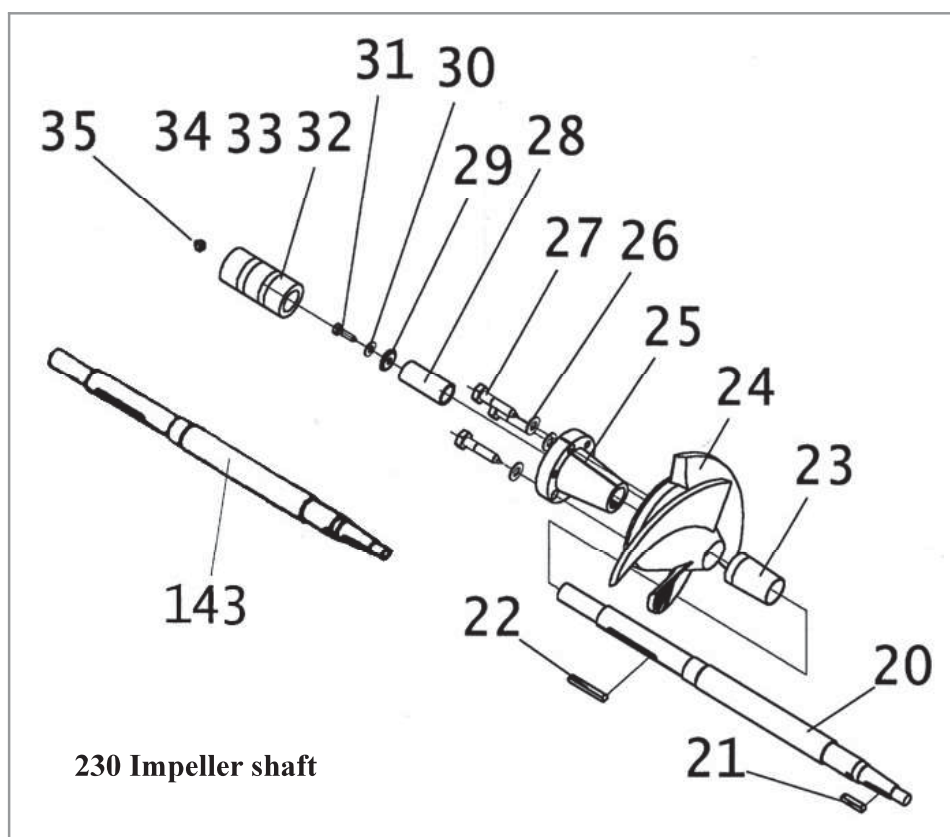
Bearing application and flange

23001 nut M16	1
23002 washer M16	1
23003 flange (alternatively DIN 120 flange)	1
23004 hexagonal head screw M12	4
23005 washer M12	4
23006 shaft seal	1
23007 grease fitter M6	1
23008 bearing housing	1
23009 bearing	1
23010 grease tube	1
23011 bearing housing cover	1
23012 shaft seal	1
23013 shaft nut	1
23014 safety washer for nut	1
23015 bearing	2
23016 washer	1
23017 shaft seal	2
23018 bearing housing	1
23019 O-ring	1



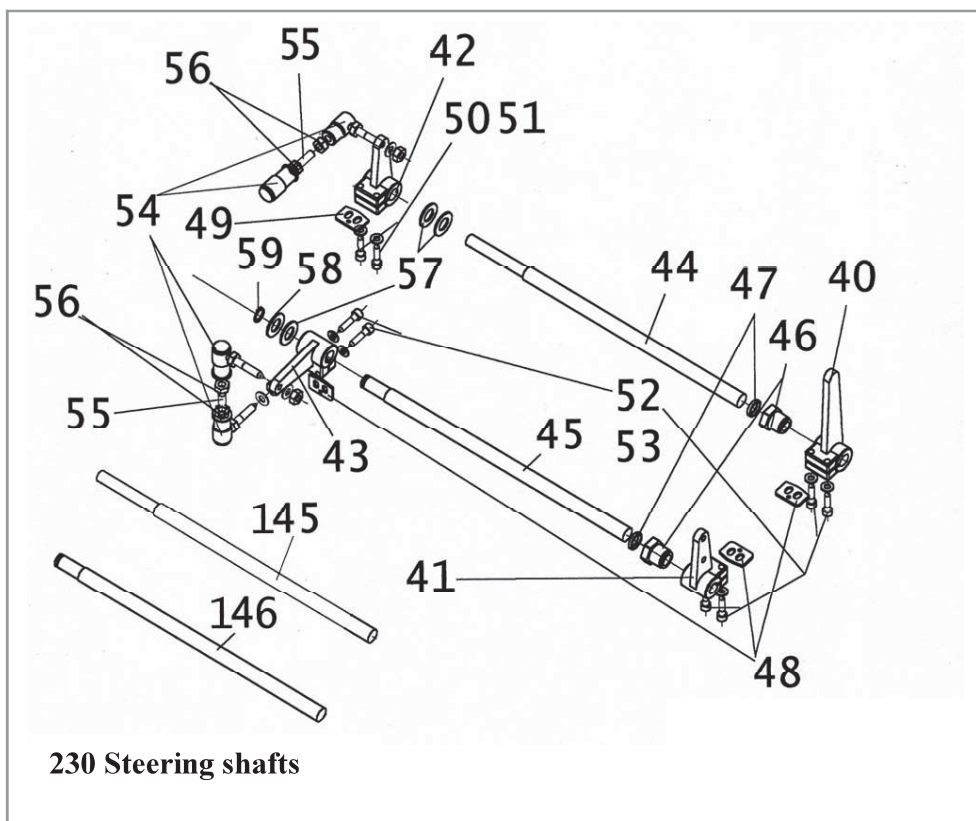
Impeller shaft

23020	shaft	1
23021	key	1
23022	key	1
23023	adjuster sleeve	1
23024	impeller	1
23025	impeller mounting cone	1
23026	washer M10	3
23027	hexagonal head screw M10	3
23028	shaft sleeve	1
23029	locking plate	1
23030	washer M10	1
23031	hexagonal head screw M10	1
23032	lubricatable stator bearing	1
23033	shaft seal	1
23034	slide bearing	2
23035	grease fitter M8	1



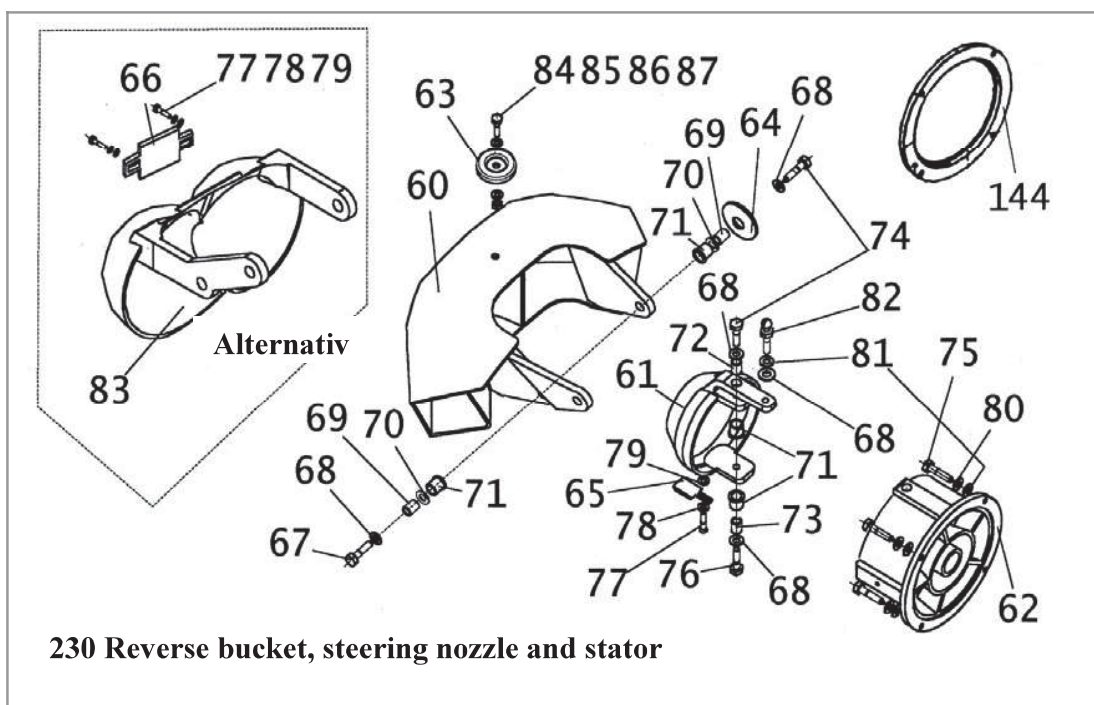
Steering shafts

23040	lever (control)	1
23041	lever (driving direction)	1
23042	lever (control)	1
23043	lever (driving direction)	1
23044	steering control shaft	1
23045	driving direction control shaft	1
23046	lead-in	2
23047	shaft seal	2
23048	wedge plate	3
23049	wedge plate	1
23050	hexagonal head screw M8	2
23051	washer M8	2
23052	hexagonal socket-head screw M10	6
23053	washer M10	6
23054	angle joint	4
23055	bolt	2
23056	nut M10	4
23057	washer	3
23058	washer	1
23059	locking ring	1



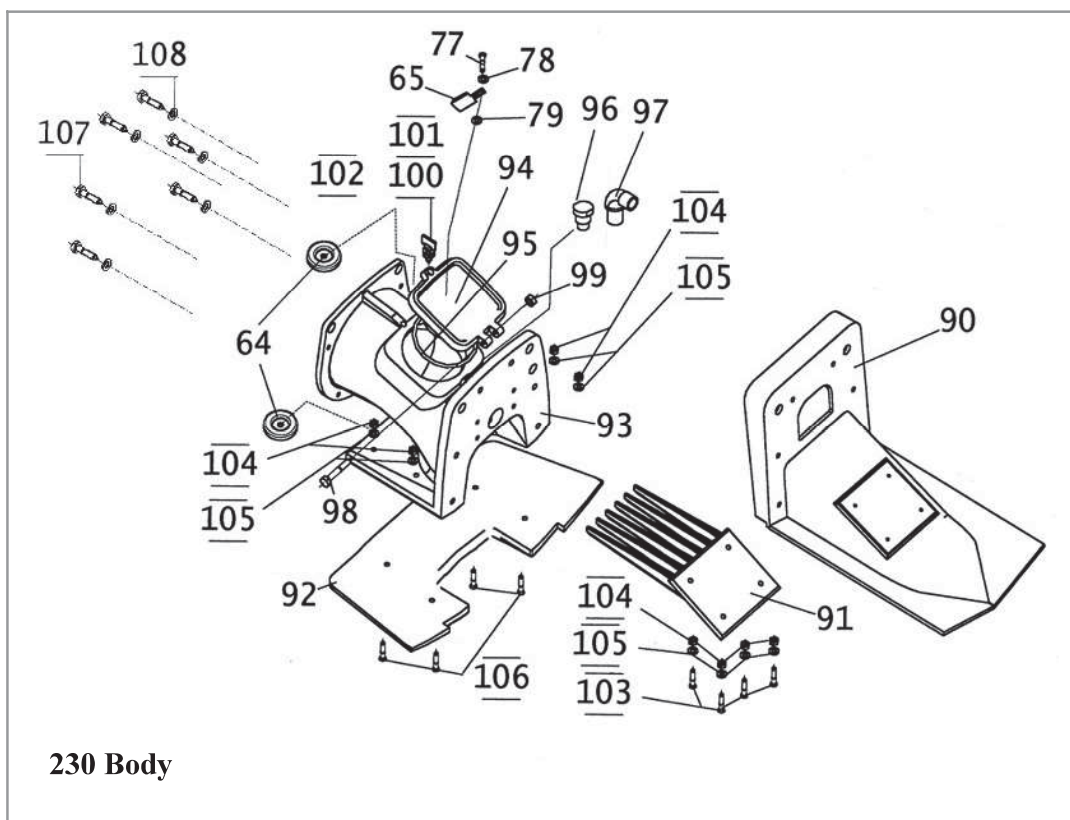
Reverse bucket, steering nozzle and stator

23060	reverse bucket	1
23061	steering nozzle	1
23062	stator	1
23063	zinc anode	1
23064	zinc anode	3
23065	zinc anode	2
23066	zinc anode	1
23067	hexagonal head screw M10	2
23068	washer M10	4
23069	A4- sleeve	2
23070	washer	2
23071	plastic bearing	4
23072	A4 sleeve	1
23073	A4 sleeve	1
23074	hexagonal head screw	2
23075	hexagonal socket-head screw	4
23076	hexagonal head screw	1
23077	hexagonal head screw M6	3
23078	washer M6	3
23079	washer M6	3
23080	spring washer M10	4
23081	washer M10	5
23082	hinge pin	1
23083	deflector (round model)	1
23084	hexagonal head screw M8	1
23085	washer M8	1
23086	nut M8	1
23087	washer M8	1



Body

23090	mounting piece	1
23091	grass rake	1
23092	cavitation plate	1
23093	framework	1
23094	inspection hatch	1
23095	seal	1
23096	threaded plug	1
23097	cooling water muff	1
23098	hexagonal head screw M8	1
23099	nyloc M8	1
23100	wing screw M10	1
23101	washer M10	2
23102	locking ring	1
23103	sunk screw M8	4
23104	nut M8	8
23105	washer M8	8
23106	sunk screw M8	4
23107	hexagonal head screw	6
23108	washer	6



Electric control

23120	electric cylinder handle	1
23121	electric cylinder	1
23122	single lever controller	1
23123	control cable 2-9m	1
23124	cable clamp	1
23125	locking plate	1
23126	clamp	1
23127	microframe	1
23128	microswitch	2
23129	limiter counterpart	1
23130	limiter	2
23131	cable set	1
23132	hexagonal head screw M10	2
23133	hexagonal socket-head screw M10	1
23134	tin screw	4
23135	hexagonal head screw M6	1
23136	nut M10	3
23137	nyloc M10	1
23138	nut M6	1
23139	nut M5	2
23140	washer M6	1
23141	washer M10	1
23142	cable limiter	1

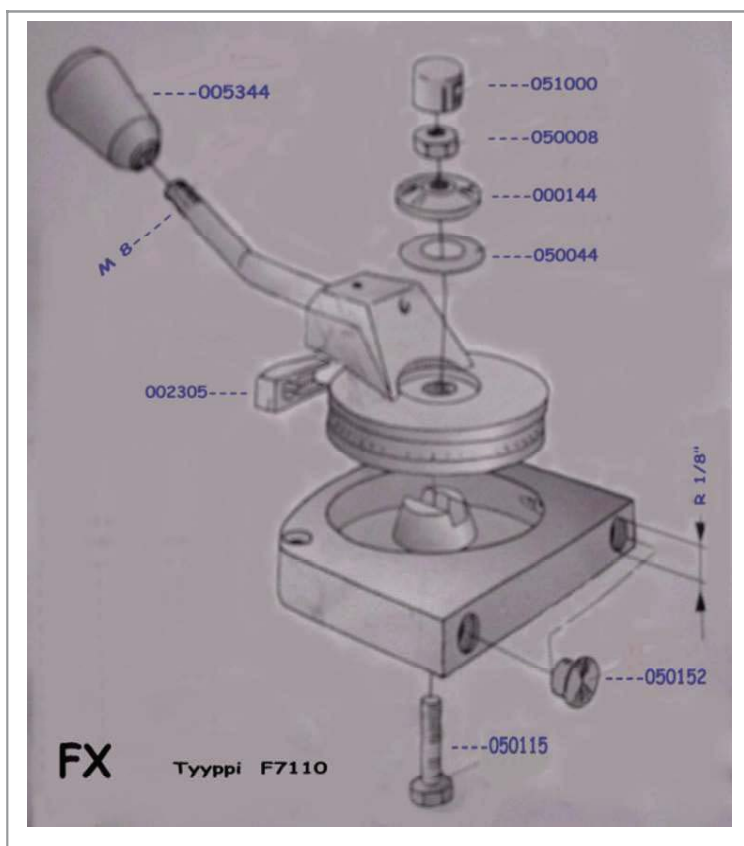
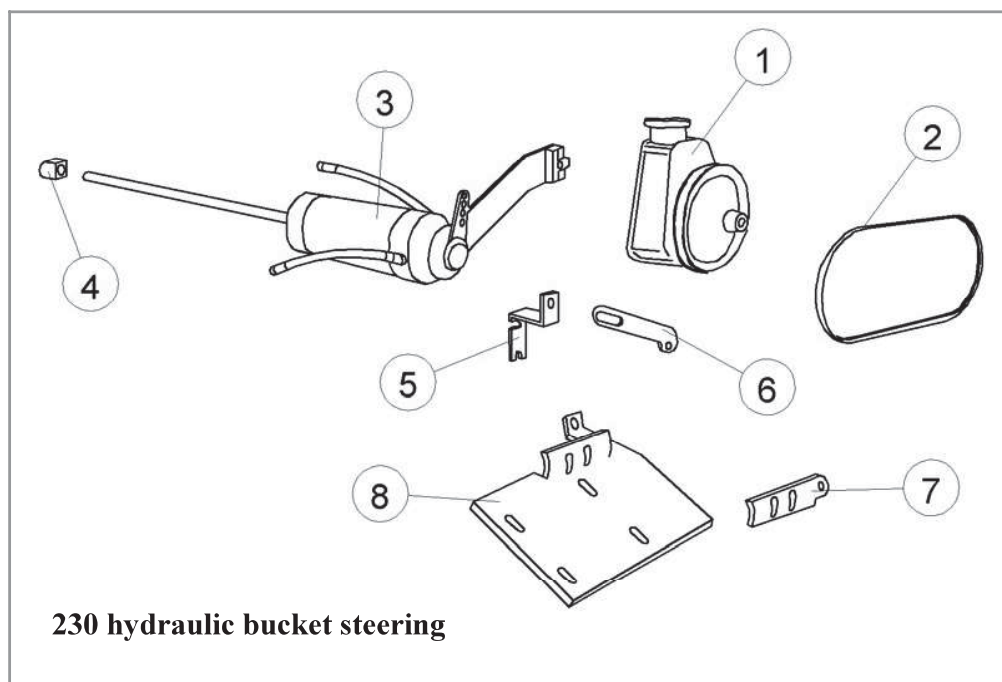
Hydraulic control

23H001	pump	1
23H002	drive belt	1
23H003	hydraulic cylinder	1
23H004	shaft knob	1
23H005	pump support 1	1
23H006	pump support 2	1
23H007	clamping part	1
23H008	pump mounting plate	1

JET-235**LIST OF PARTS** (in addition to jet-230 parts)

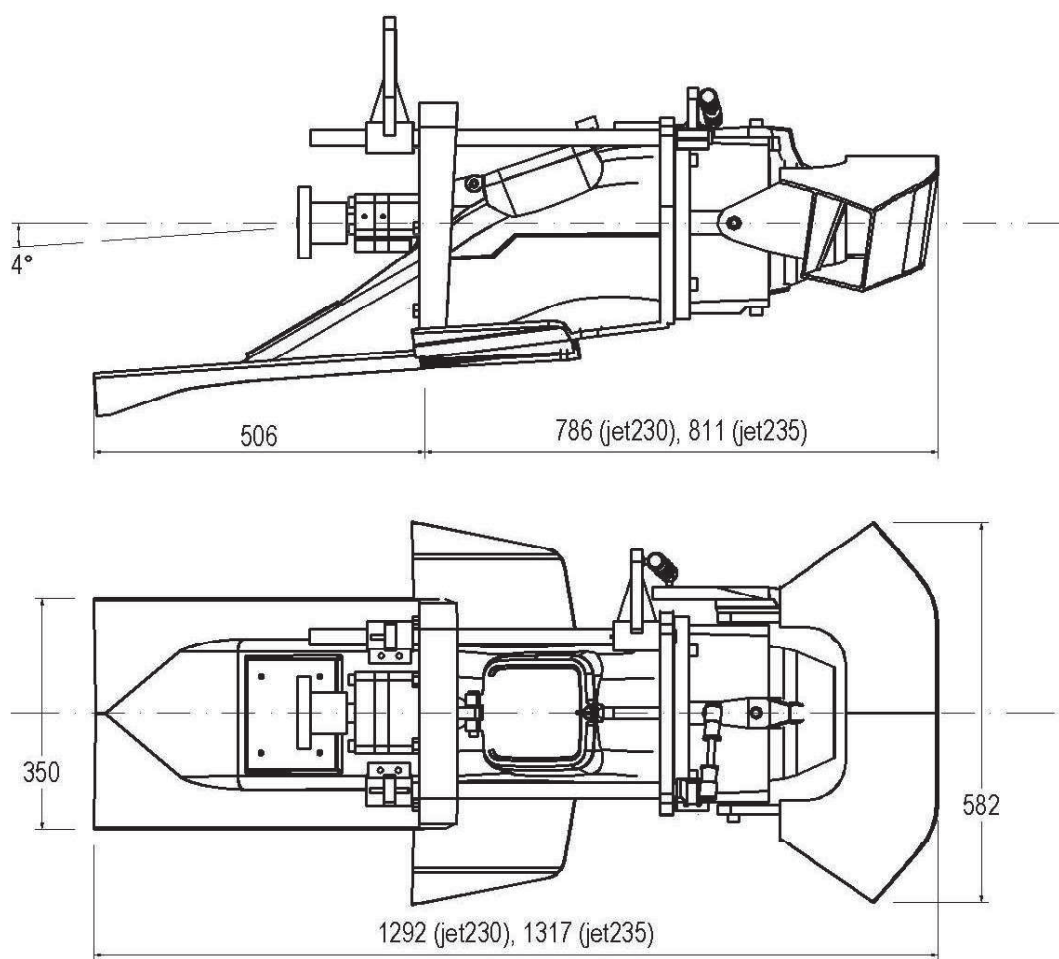
**Always state part number
when ordering**

23143	shaft	1
23144	extension flange	1
23145	steering control shaft	1
23146	driving direction control shaft	1



Sample for shifting mechanism (electrical bucket steering)

Principal dimensions



18. Optional equipments

Emergency holder for the bucket and manual steering

