INSTRUCTION BOOK

For the

BRITISH LEYLAND

Thornycroft

230 & 345

Marine Engines

Publications Part No. 54009020

BRITISH LEYLAND Thornycroft

SPECIAL PRODUCTS DIVISION
OF BRITISH LEYLAND UK LTD.

INTRODUCTION

The instructions contained within the following pages are restricted to those necessary for the efficient operation and maintenance of the engine; operators are urged to read them carefully.

Certain overhaul operations are impracticable without the use of special tools, and those operators who are not equipped to undertake major repairs, are urged to consult their Thornycroft or British-Leyland Dealers or Distributor.

Besides being kept informed of the latest developments, Dealers and Distributors have skilled personnel and fully equipped workshops thus enabling them to maintain efficient after-sales service.

RUNNING IN

All diesel engines manufactured by the company are checked for performance on a test-bed but the duration of this test is insufficient to complete the "running-in" process. After installing the engine, running-in process must be continued by commencing with a light load and gradually increasing to normal load during the initial 50 hours running. This will result in greater efficiency and dependability throughout the life of the engine.

Information or literature on any Thornycroft engine can be obtained from the address below:

Technical Publications Department
British Leyland Thornycroft Marine
Beans Engineering
P.O.Box 2
Hurst Lane
Tipton
West Midlands. DY4 9AD

Telephone 021-557 2881. Telex 338026 Cables Bean Tipton

GENERAL DATA

Types		230 & 345
Number of cylinders	230	4
	345	6
Compression ratio		16.8:1
Bore		98.00 to 98.02mm (3.8583 to 3.859 in)
Stroke		125mm (4.921 in)
Capacity	230	3.77 litres (231 in^3)
	345	5.66 litres (345.3 in^3)
Torque	230	23.5 kgf m (170 lbf ft) at 1650 rev/min
	345	36.2 kgf m (262 lbf ft) at 1650 rev/min
Valve rocker clearance (hot or cold) :		
Inlet and exhaust		0.33mm (0.013 in)
Injection order :	230	1, 3, 4, 2
	345	1, 5, 3, 6, 2, 4
Static injection timing :	230	16° B.T.D.C
	345	14° B.T.D.C
Idling speed	230 & 345	520 to 550 rev/min
Oil pressure (engine hot) :		
Idling		2.11 to 2.46 kgf/cm^2, 207 to 241 KN/m^2 (30 to 35 lbf/in^2)
Normal running speed		3.87 to 4.22 kgf/cm^2, 380 to 414 KN/m^2 (55 to 60 lbf/in^2)

Maximum recommended installed angle (allowing for a further 3° rise when under way) 12°

FOR AN INSTALLED ANGLE GREATER THAN THAT RECOMMENDED CONSULTATION WITH OUR DESIGN STAFF IS ADVISABLE .

TORQUE WRENCH SETTINGS

Engine	
Connecting rod bolts	8.3 kgf m (60 lbf ft)
Crankshaft nut	21.3 to 24.1 kgf m (155 to 175 lbf ft)
Cylinder head nuts	13.8 kgf m (100 lbf ft)
Heat exchanger / ex-manifold	4.1 kgf m (30 lbf ft)
Flywheel bolts	13.8 kgf m (100 lbf ft)
Injector securing bolts	1.65 kgf m (12 lbf ft)
Main bearing nuts	13.8 kgf m (100 lbf ft)
Main bearing studs	4.1 kgf m (30 lbf ft)
Oil filter centre bolt	1.38 to 2.07 kgf m (9 to 10 lbf ft)
Rocker bracket bolts	
5/16 in diameter	2.1 kgf m (15 lbf ft)
3/8 in diameter	4.1 kgf m (30 lbf ft)

Starter Motor : M50

Through - bolts	1.38 kgf m (10 lbf ft)
Solenoid securing bolts	0.62 kgf m (4.5 lbf ft)
Brush gear screws	0.34 kgf m (2.5 lbf ft)
Pivot pin locknut	2.21 kgf m (16 lbf ft)

Starter Motor : CA45D and CA45F

Pole-shoe screws	4.1 kgf m (30 lbf ft)
Pinion stop nut	6.9 kgf m (50 lbf ft)
Through-bolts	1.0 kgf m (7.5 lbf ft)
Recoil end cap	1.38 kgf m (10 lbf ft)
Main terminal nut	0.7 kgf m (5 lbf ft)

FUEL SYSTEM

Engine	Injection pump	Nozzle type	Nozzle holder type	Nozzle opening pressure
230	C.A.V DPA	BDLL 150S 6476	BKBL 67S 5153	175 atm
345	C.A.V DPA	BDLL 150S 6476	BKBL 67S 5153	175 atm

Injector securing bolt tightness .. .. 1.65 kgf m (12 lbf ft)
Main fuel filter .. .. C.A.V.

RECOMMENDED ENGINE LUBRICANTS

230 and 345

Climatic Conditions	SHELL	FILTERATE	STERNOL	DUCKHAMS	CASTROL	ESSO	MOBIL	BP
Above 27°C (80°F)	Rotella T Oil 30	HDX 30	Elixir Oil 30	Fleetol HDX 30	Castrol Deusol CRB 30	Essolube HDX 30	Delvac 1230	Vanellus S.A.E 30
-1°C(30°F) to 27°C (80°F)	Rotella T Oil 20/20W	HDX 20	Elixir Oil 20W/ 20	Fleetol HDX 20W	Castrol-Duesol CRB 20	Essolube HDX 20W	Delvac 1220	Vanellus 20W
Below - 1°C (30°F)	Rotella T Oil 10W	HDX 10W	Cougar 10W	Fleetol HDX 10W	Castrol Deusol CRB 10	Essolube HDX 10W	Delvac	Vanellus 10W

The engine oils listed above meet the requirements of the U.S Ordnance Specification MIL-L-2-104B. Alternatively the appropriate multigrade oil, supplied by the above companies, is approved for the particular conditions prevailing.

RECOMMENDED GEARBOX LUBRICANTS

SCG AND PRM	Minus	18°C to 0°C	SAE	20 engine oil
	Above	0°	SAE	30 engine oil

Borg Warner Automatic transmission fluid Type "A"

BILGE PUMP (when fitted)

The grease cups on the pump should be filled with MARFAK 2HD grease or equivalant.

CAPACITIES

Engine sump capacity

230	8.6 litres	15.2 pints
345	10.3 "	18.2 "

Engine cooling system capacity

230	15.3 litres	27 pints
345	21.5 "	38. "

BEFORE STARTING THE ENGINE FOR THE FIRST TIME THE FOLLOWING PROCEDURE SHOULD BE OBSERVED.

1. Using paraffin, a stiff brush and dry rag, clean off rust preventative from tailshaft coupling before the engine is lined up.

2. All engines are despatched from our works with an unmarked dip stick. This is necessary as oil level in the engine sump varies with individual installation angles. The procedure for marking the dip stick is as follows:-

   Fill the engine with the correct quantity of specified lubricant pouring it through the filler cap on the rocker box allowing a few minutes for it to drain through the valve gear into the sump.

   Withdraw the dip stick observe where the oil has come to and then mark that point by filing a notch. This is maximum oil level, then file a notch 12.7mm (½ in) below the first notch and this will be the minimum oil level.

   Finally fill the gearbox with the specified lubricant in accordance with the instructions in the gearbox manufacturers hand-book, as supplied with the engine.

3. Oil control gear joints and fill grease cups on bilge pump (if fitted).

4. Using clean fresh water fill the cooling system, add antifreeze if required.

   N.B.
   Mix the antifreeze with about half the volume of water required and pour into the engine, then top up the system with fresh water. This ensures the proper circulation of antifreeze.

   Antifreeze Solution

230	3.8 litres (6¾ pints)	4.6 litres (8 pints)	5.35 litres (9½ pints)
345	5.4 " (9½ pints)	6.5 " (11½ pints)	7.5 " (13½ pints)
Complete protection	10°F (-12 C)	3°F (-16 C)	- 4°F (-20 C)
Safe limit	1°F (- 17 C)	- 8°F (- 22 C)	- 18°F (- 28 C)

5. Examine the batteries, ensure that they are fully charged and correctly wired up. Then check the tightness of all electrical connections.

6. Using the starter with the stop control out, turn the engine at least several revolutions to ensure all moving parts are free from obstruction.

STARTING THE ENGINE

1. Fill the fuel tanks with the correct fuel, vent the fuel pipe line and fuel filters, then prime the fuel lift pump, finally vent the fuel injection pump.

2. Fully open the sea inlet cock.

3. Open the throttle fully ensuring the gearbox control lever remains in neutral.

4. Operate the starter motor, when the engine starts release the starter switch, and return the throttle control to its idling position

5. Check the engine oil pressure.

6. Check the sea water flow and discharge.

7. After 10 minutes running stop the engine, top up oil level in the engine and gearbox to the maximum on the dip stick. (This is necessary as an amount of oil has been trapped in the oil coolers and their pipes.)

8. To stop the engine pull the stop lever.

N.B.
After starting from cold the engine will warm up quicker under load than when running in neutral, but the speed must be restricted until the engine has warmed through.

GENERAL PRECAUTIONS

a. NEVER attempt to start the engine with the gearbox control lever in any position other than neutral.

b. NEVER stop the engine without first engaging neutral.

c. When changing the control lever from ahead to astern or vice versa pause in neutral.

The following procedure for routine maintenance has been devised to maintain the engine in an efficient condition under normal conditions of work and climate. It is based on the assumption that the lubricants used are in accordance with those recommended.

Extreme climatic or operating conditions may, however, necessitate varying the intervals at which some of the attentions are given. Therefore it must be left to the discretion of the operator to vary the stated intervals to suit local conditions .

DAILY OR EVERY 10 HOURS

Check belt tensions

Check the oil level and top up as necessary. Check the water level in the header tank and if necessary top up with fresh water.

AFTER FIRST 50 HOURS

Check water hose connections

Check all electrical equipment

Change fuel filter element (in most instalations a water tap is fitted in the fuel line just before the fuel filter this should be cleared out or changed in accordance with the makers instructions.)

EVERY 50 HOURS

Check electrolyte level in batteries.

Grease the bilge pump if fitted.

EVERY 200 HOURS

Change engine oil.

Change engine oil filter

Check air cleaner gauze and clean if necessary.

Check drive belts

Check state of charge of batteries.

Check oil level in gearbox

EVERY 400 HOURS

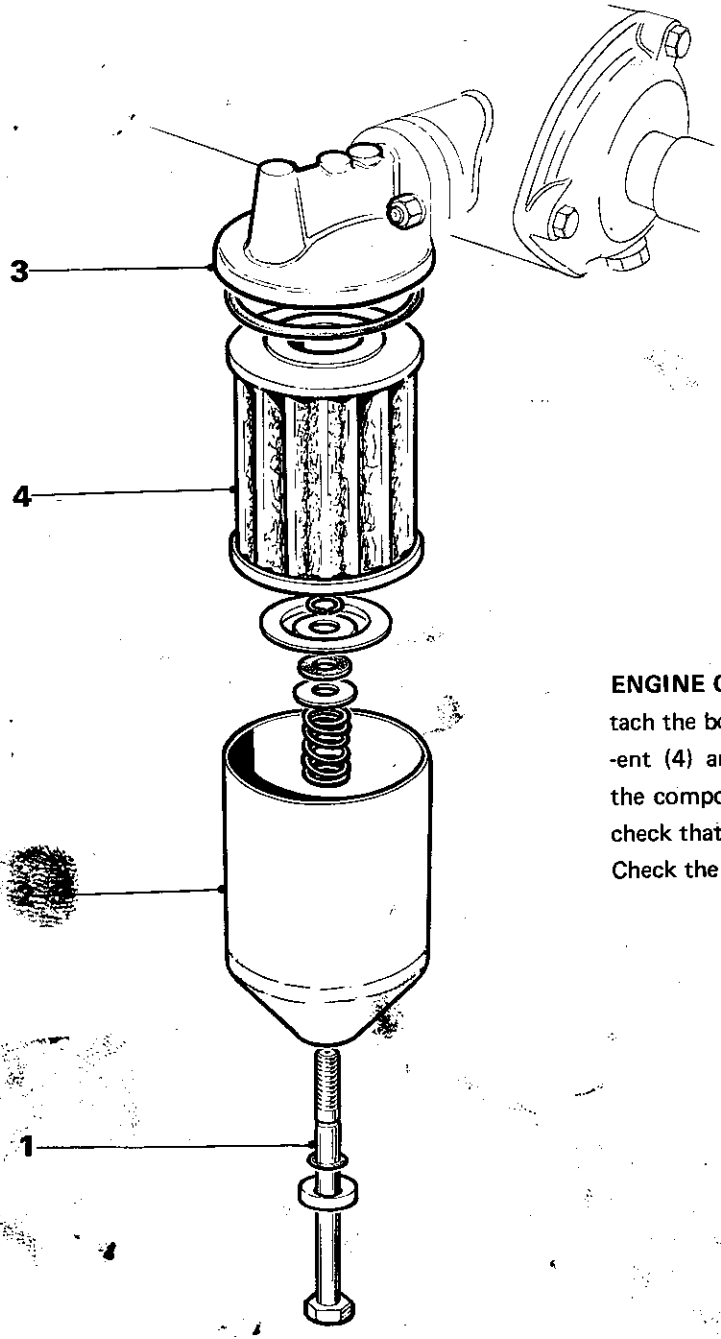
In addition to the 200 hour maintenance change the gearbox oil.

EVERY 800 HOURS

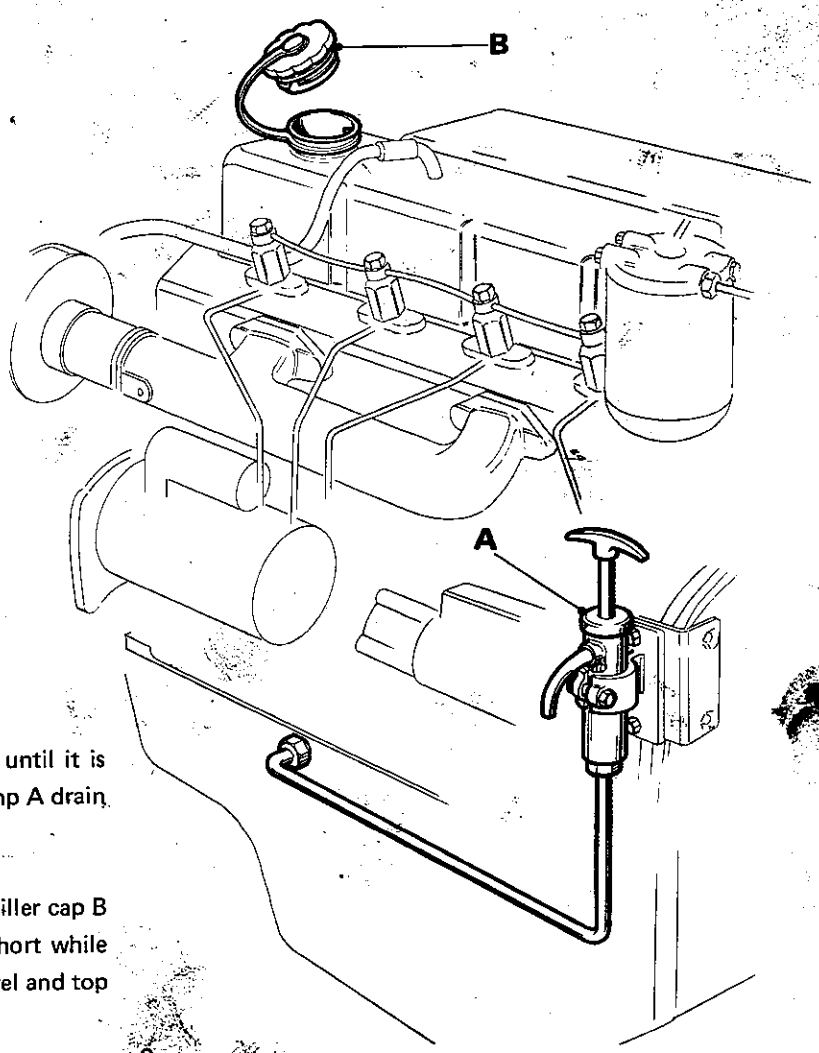
In addition to the 200 hour and 400 hour maintenance the following extra operations should be carried out.

Adjust valve rocker clearances

Change fuel filter element



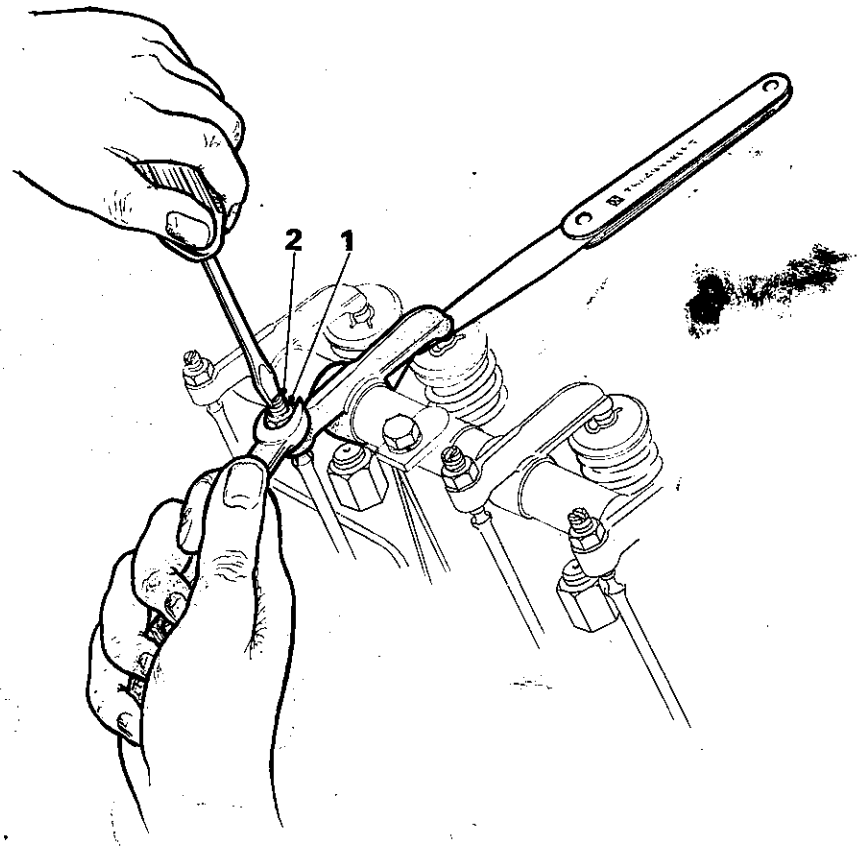
ENGINE OIL FILTER. Unscrew the centre bolt (1) and detach the bowl (2) from the filter head (3). Discard the element (4) and clean the filter bowl components. Assemble the components using a new element. Start the engine and check that the oil pressure gauge registers within 30 seconds. Check the filter bowl for oil leaks.



TO CHANGE THE ENGINE OIL run the engine until it is warm. Stop the engine, then using the hand pump A drain the oil into a suitable recepticale.

TO FILL THE ENGINE WITH OIL remove the filler cap B and pour the oil into the filler orifice, allow a short while for the oil to drain into the sump. Check the level and top up if necessary.

To remove the rocker cover first release the breather hose then remove the securing screws, finally lift off the rocker cover.



230

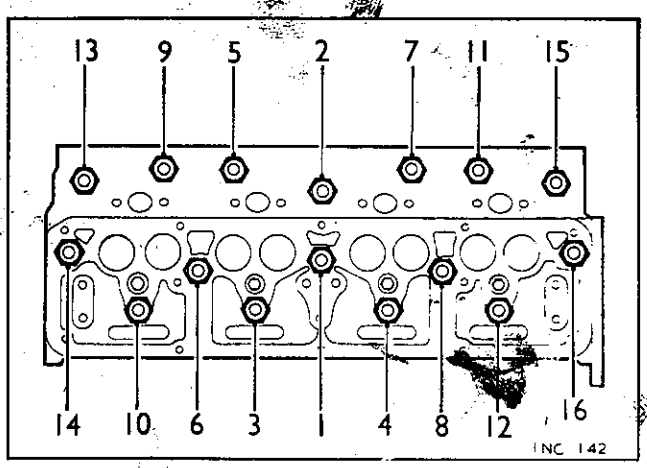
Check No. 1 valve with No. 8 valve fully open.
" " 3 " " " 6 " " "
" " 5 " " " 4 " " "
" " 2 " " " 7 " " "
" " 8 " " " 1 " " "
" " 6 " " " 3 " " "
" " 4 " " " 5 " " "
" " 7 " " " 2 " " "

345

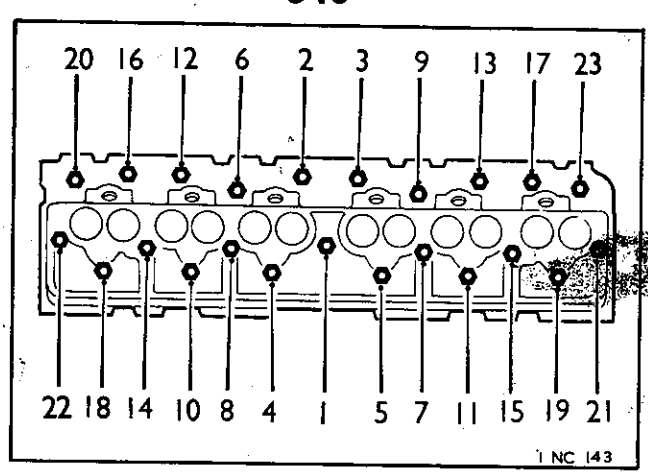
Check No. 1 valve with No. 12 valve fully open.
" " 7 " " " 6 " " "
" " 9 " " " 4 " " "
" " 2 " " " 11 " " "
" " 5 " " " 8 " " "
" " 10 " " " 3 " " "
" " 12 " " " 1 " " "
" " 6 " " " 7 " " "
" " 4 " " " 9 " " "
" " 11 " " " 2 " " "
" " 8 " " " 5 " " "
" " 3 " " " 10 " " "

To adjust the clearance, slacken the locknut (1) and turn the adjusting screws (2) until the clearance is correct. Hold the screw against rotation and tighten the locknut. Assemble, ensuring that the rocker cover gasket (7) is serviceable.

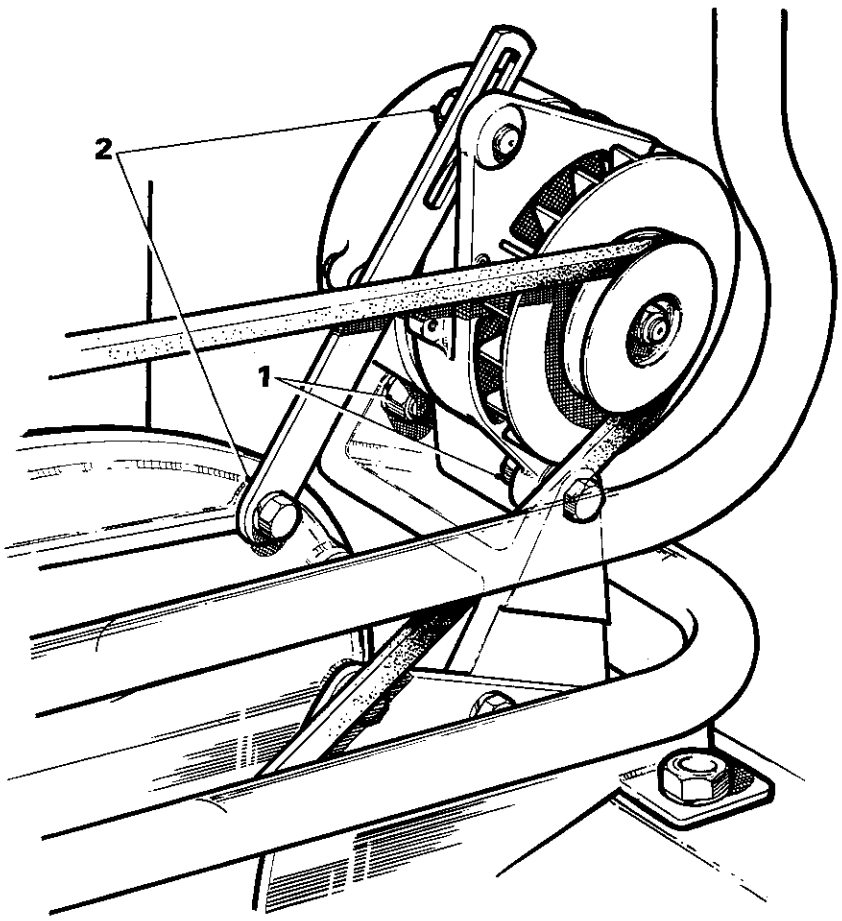
230



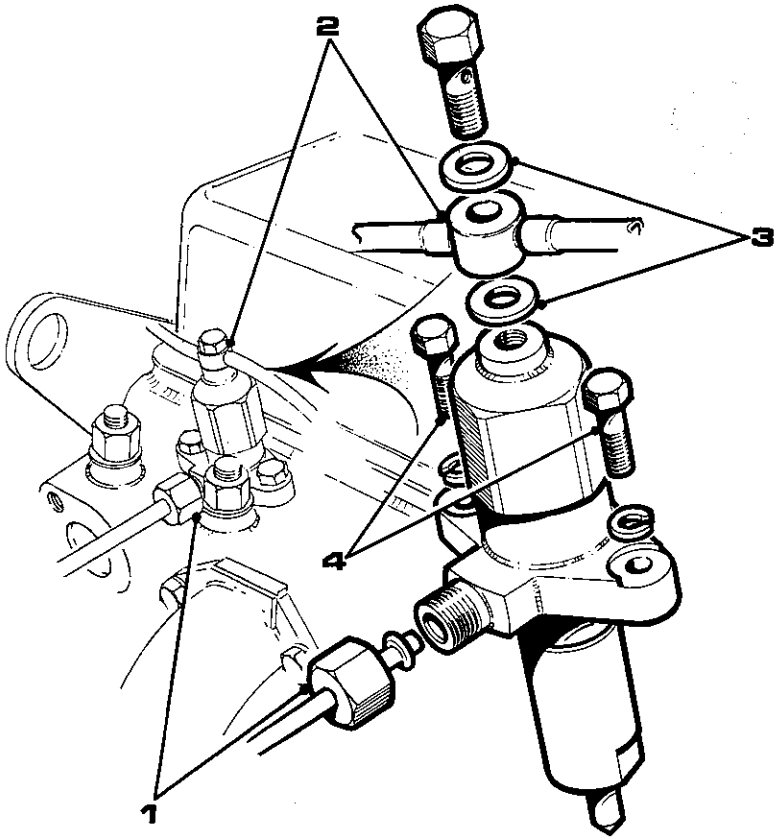
345



To ensure a satisfactory cylinder head to block seal it is imperative that the procedure detailed above is followed. The torque

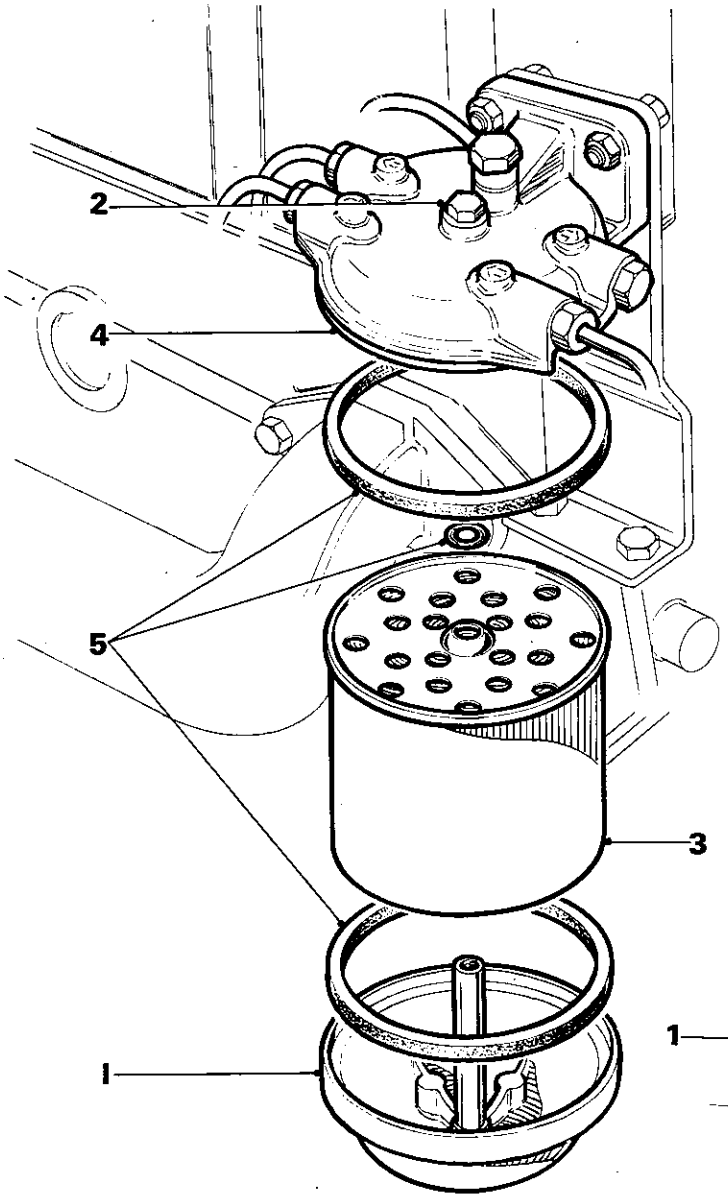


GENERATOR AND WATER PUMP DRIVE BELT. Slacken the nuts (1) on the pivot bolts. Slacken the two bolts (2) securing the adjusting link. Lever the generator away from the engine (apply leverage only to the generator drive-end bracket) until the belt can be pressed in approximately 19mm (¾ in) at the centre of its vertical run by thumb pressure. Tighten bolts (2) and the nuts (1).

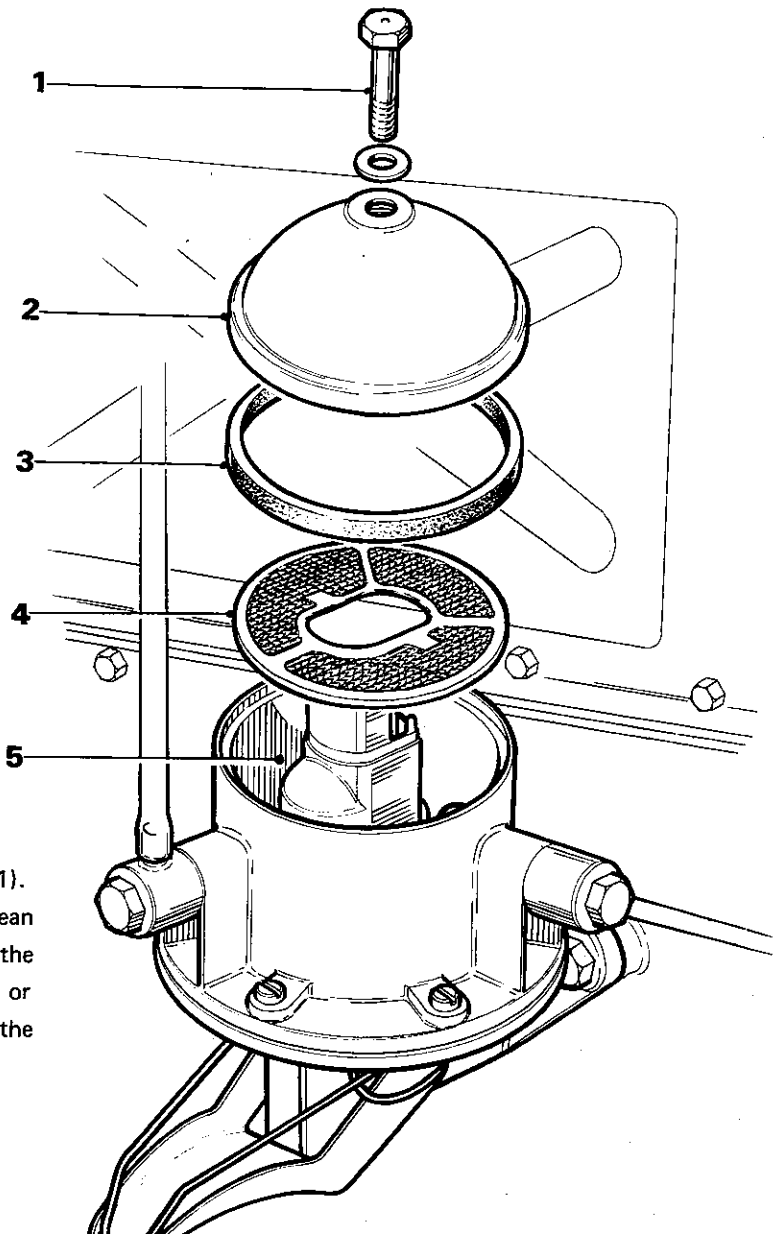


FUEL INJECTORS. Injector cleaning and spray testing can only be carried out with specialized equipment, therefore this should be done by a Distributor or Dealer.

Disconnect the feed pipe (1) and spill rail (2). Note the sealing washer (3) on each side of the spill rail banjo union. Remove the injector securing bolts (4) and withdraw the injector. Assemble and tighten the injector securing bolts to the torque figure given in **'GENERAL DATA'.**



MAIN FUEL FILTER. Support the filter base (1) and unscrew the centre bolt (2). Detach the base and twist the element (3) to separate it from the filter head (4). Remove the three sealing rings (5) from the head and base. Clean the base and assemble the filter using a new element and sea -ling rings, fitting the element with its strengthened rim upper-most. Bleed the air from the system.



FUEL LIFT PUMP FILTER. Remove the cap screw (1). Lift off the cap (2), gasket (3), and filter gauze (4). Clean the gauze in a suitable solvent using a stiff brush. Clean the fuel chamber (5). Check that the gasket is serviceable or renew. Assemble the components. Do not overtighten the cap screw.

LAYING UP THE ENGINE

1. Run the engine until hot, drain the oil from the engine sump, reverse gear and reducing gear (if fitted), and re-fill with clean new oil, renew the fuel filter and lubricating oil filter elements.

2. Turn off the main fuel cock on the fuel tank and disconnect the fuel suction pipe from the suction connection on the fuel feeder pump. Rig up a small temporary fuel tank connected to the suction side of the feeder pump and fill it with a high quality low viscosity corrosion inhibiting oil such as Shell Fusus A. (It is essential to pipe up the temporary line as described, so as to include the feeder pump and filter in the circuit).

3. Run the engine at about half speed for a further 15—20 minutes to circulate the new oil through the bearings, and the corrosion inhibitor through the injection equipment.

4. Drain the cooling system thoroughly, including the exhaust manifold jacket and any jacketted exhaust bends or silencers, and the engine and reverse gear oil cooler jackets. It is desirable to flush out with fresh water any jackets in the sea water circuit.

5. Turn off the sea cock, disconnect the water suction connection on the sea inlet and drain the suction pipe to the engine

6. Check and clean the sea inlet strainer (if fitted).

7. Remove the electrical equipment components from the engine and store them ashore in a warm dry place. Wrap the components securely if they are liable to get dirty or dusty while ashore.

8. Remove the engine sea water pump and bilge pump (if fitted). These pumps are of the rubber impeller type and these should be stored, preferably with the impellers removed and tied up to the exterior of the pump and kept in the dark. On no account must the impellers be oiled as this will cause swelling and consequent failure.

9. Blank off the engine air intake and also the exhaust outlet and any cooling water discharge pipes at the skin of the boat.

10. Well grease any parts of the engine liable to rust or corrode.

ROUTINE MAINTENANCE DURING LAY UP.

Turn the engine at least 3—4 revolutions every four weeks to maintain satisfactory oil films on bearings, bores etc.

If the boat is lying afloat, check that bilge water does not rise enough to enter the engine or reverse gear through the dipstick holes or shaft seals.

RE-COMMISSIONING

Make good all cooling circuit connections and refill the cooling system.

Replace the electrical equipment and check that all connections are good.

Adjust belt tension as necessary.

Replace the engine sea water pump and bilge pump (if fitted). Adjust belt tension as necessary.

Slack off the stern tube gland if it was tightened up when preparing the boat for laying up.

Remove all plugs and covers from skin—side fittings and air intake.

Turn the engine by hand at least two complete turns to ensure that everything is free before attempting to start up.

If the boat is to be hauled out of the water for storage

Disconnect the tailshaft coupling before hauling the boat out of the water.

If the sterngear is equipped with external sand excluders, care must be taken to prevent the shaft from sliding aft more than ½ in. (12mm) when the couplings are disconnected.

Check the propeller and external sterngear for damage.

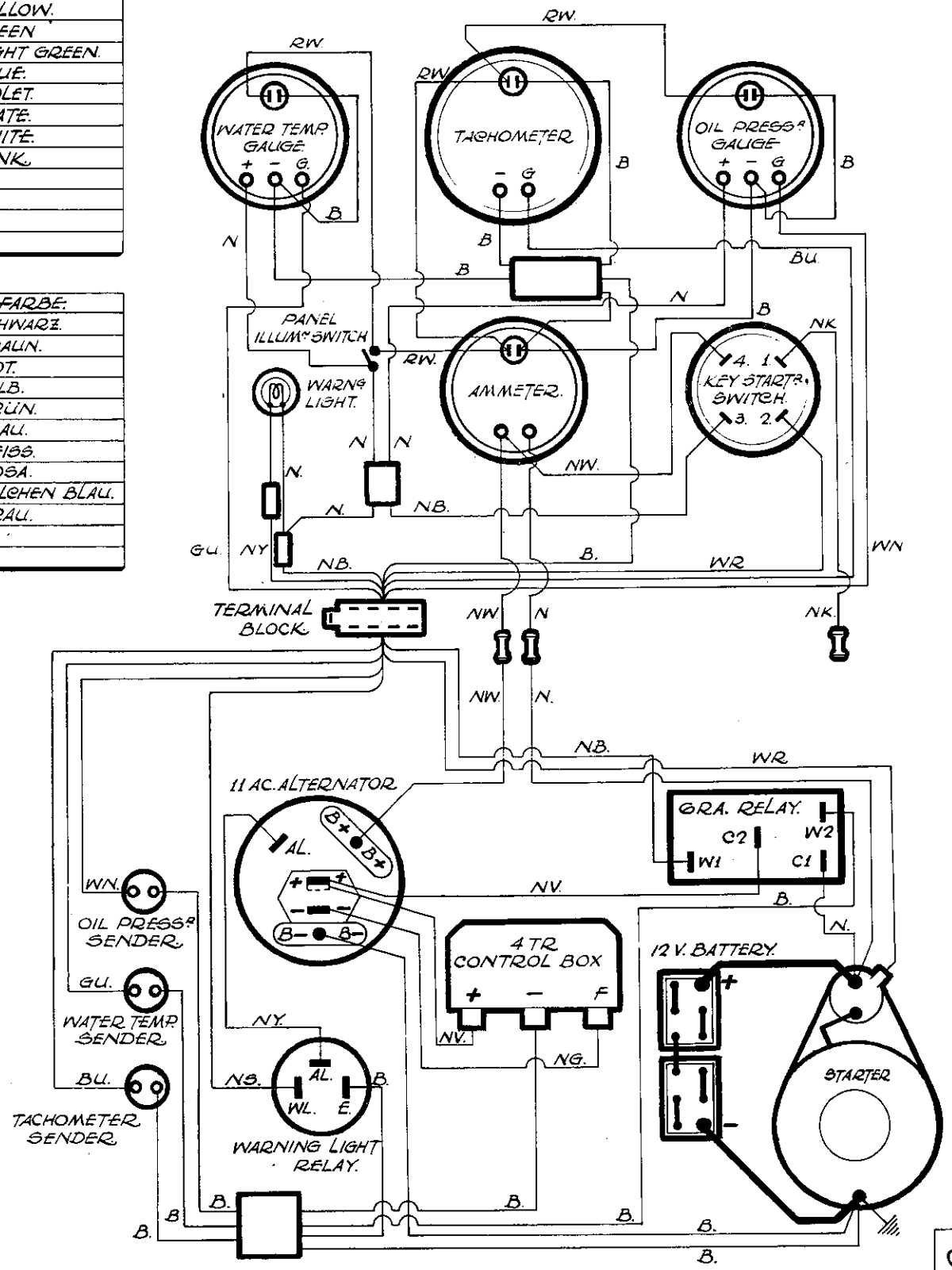
Open the sea cock (if fitted) to drain the sea inlet.

SK01953

BRITISH LEYLAND **Thornycroft**

CODE	COLOUR
B.	BLACK.
N.	BROWN.
R.	RED.
O	ORANGE.
Y	YELLOW.
G.	GREEN
LG.	LIGHT GREEN.
U.	BLUE.
V	VIOLET.
S.	SLATE.
W.	WHITE.
K.	PINK.

ZIFFER	FARBE.
B.	SCHWARZ.
N.	BRAUN.
R.	ROT.
Y.	GELB.
G.	GRÜN.
U.	BLAU.
W.	WEISS.
K.	ROSA.
V.	VEILCHEN BLAU.
S.	GRAU.



WIRING DIAGRAM FOR 12 VOLT ELECTRICS INCLUDING ALL STANDARD ELECTRICAL INSTRUMENTS WITH 11AC. ALTERNATOR FOR TYPE 230/345 ENGINE.

SK01953

CODE	COLOUR
B.	BLACK.
N.	BROWN.
R.	RED.
O.	ORANGE.
Y.	YELLOW.
G.	GREEN.
LG	LIGHT GREEN.
U.	BLUE.
V	VIOLET.
S.	SLATE.
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BRITISH LEYLAND **Thornycroft**

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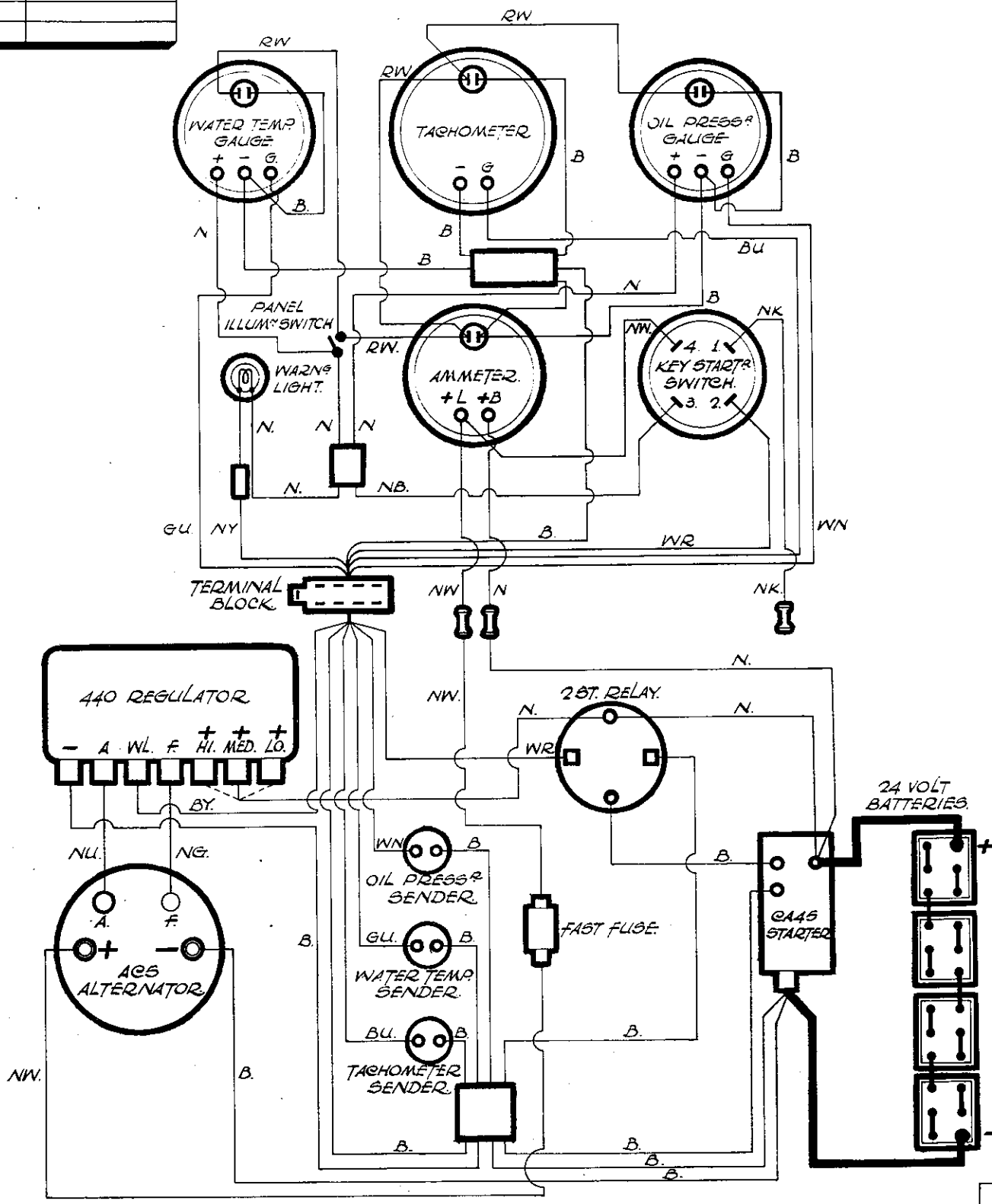
G.	GRÜN.
U.	BLAU.
W	WEISS.
K.	ROSA.
V.	VEILCHEN BLAU
S.	GRAU.

NOTE! NO CONNECTIONS OTHER THAN THOSE SHOWN ARE TO BE TAKEN FROM THE REGULATOR. TERMINALS HI. MED. & LO. ARE ALTERNATIVES TO VARY THE OUTPUT FOR DIFFERENT CIRCUMSTANCES, SUCH AS AMBIENT TEMPERATURE, LAMP LOAD, BATTERY AGEING ETC. SELECT THE ONE TO GIVE MINIMUM BUT SUFFICIENT OUTPUT.



WIRING DIAGRAM FOR 24 VOLT ELECTRICS INCLUDING ALL STANDARD ELECTRICAL INSTRUMENTS WITH AC5 ALTERNATOR FOR TYPE 345 ENGINE.