

Engine Operation & Maintenance Manual

Water Cooled Non - Emission
Dynapac Engine 4R1040T/4R1040NA



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1. FOREWORD

Dear Customer,

We are happy to provide you with latest revision of Dynapac Engine 4R1040T/4R1040NA O & M manual.

The Dynapac 4R1040T/4R1040NA series Engine liquid cooled are developed and supplied for wide range of application meeting your requirements.

We assure you that all necessary safety precautions and regulations have been adhered to in the design, material and manufacturing of Dynapac 4R1040T/4R1040NA Series Engine. All the engines under go stipulated performance test before being delivered to customers.

This manual provides specifications and operations guidelines for services maintenance procedure. The performance of engine largely depends on its proper maintenance and up keep. Hence, please maintain your Dynapac 4R1040T/4R1040NA Engine properly as per the guidelines and schedules given in this manual.

We recommend that only trained manpower should perform the operation and maintenance tasks on the engine. Always use the genuine spare parts whenever required for periodic maintenance as well as for engine repairs.

We maintain the facility for operators training for maintenance of diesel engines. Please contact our authorized service dealer / distributors nearest to you to avail this facility.

Continuous improvements in the product design are incorporated from time to time which may not be included in this manual.

The manual is updated periodically to include such changes in the latest editions.

Should you have any queries, fully equipped and trained team from Dynapac Customer Support will be happy to provide the help.

Dynapac Road construction equipment India Pvt Ltd

Customer Support

**Dynapac road construction Equipment
(India) Pvt Ltd.**

Plot no 01, Gat no. 163-168, Alandi Markal road,
Village: Fulgaon, Taluka: Haveli, Dist: Pune-
412216, India

STANDARD WARRANTY FOR Dynapac 4R 1040T/4R1040NA SERIES ENGINE

This warranty applies to the Dynapac 4R1040T/4R1040NA Series Engine for off Highway application.

Duration of Warranty

Off HighwayEngines

Within 18 Calendar Months from Date of Dispatch from Dynapac India 12 Months of hours date of installation or 1500 Hrs of operation whichever occurs first if customer source the filters, Engine oil, coolant and avail the services from Dynapac Authorised Service dealer for off Highway application.

Scope of Warranty

After the Engine has been taken delivery by you, we expressly guarantee, in lieu of any warranty implied by law, to make good any defective parts in machinery of our own manufacture, which defect develops under proper use and necessary maintenance practices as written in this manual and arises solely from faulty material or workmanship, provide always that such defective parts are promptly returned carriage paid to our works and provided that Fuel and lubricants

approved by us, have been continuously used. The repaired or (at its option) new parts will be delivered

At the termination of such period of 12 calendar months (or six calendar months as the case may be) all liability on our part ceases.

In the case of goods not of our manufacture (e.g. Fuel Injection Equipment's, Electrical Components like Starter, Alternator, Turbocharger), you are entitled to the benefits of respective manufacturers warranty given to us. In respect thereof and our liability in respect of such goods is limited to the warranty given by the respective manufacturer. In no case shall we be liable for the fitting charges of replacement parts of thereof.

The defective parts replaced by us shall become our property. All goods are supplied on the Condition that we shall not be liable for any loss incurred through stoppages or any consequential damages. Warranty for rubber parts like AVM's, Belts, Hoses, O rings etc. will be six months from date of installation.

Limitations and Exclusions

This warranty does not apply to

1. To fair wear and tear or to damage due to negligence or improper handling or incorrect application or incorrect installation by the purchaser, or his employees or agents or in the case of repairs or alterations carried out by the purchaser without our knowledge and written approval.
2. To reconditioned or second-hand combination sets or Engines. The Engines will be deemed to have been taken over by the customer upon dispatch from our works, in the case of direct deliveries EX-Factory and from the godowns of our authorized Dealers in the case of supplies from their stock and this warranty will come into effect from that time.
3. Incorrect operational & maintenance practices, lapse in scheduled maintenance or maintenance done by other than Dynapac - Authorised dealership.
4. The cost of maintenance or regular service of the engine.
5. Any damage due to idle storage of engine beyond period of 6 months without treatment of long storage.
6. Any damage due to use of lubrication oil, coolant, fuel quality and grade not recommended by Dynapac.
7. Any damage resulting from improper shutdown.
8. Any failure to meet its obligations hereunder which are due to circumstances beyond its reasonable control including but not limited to industrial disputes, fire, severe weather conditions, government decisions, material shortage, power or machinery breakdown or failure or war.
9. Gradual reduction in operating performance commensurate with the age, kilometers covered or operating hours, including but not limited to, gradual loss of engine compression or gradual increase in oil consumption due to normal operating functions.

10. We will not be responsible for loss or damage to goods beyond the delivery stated in our tender and we will repair or replace free of charge goods damaged in transit up to the point of delivery by us, as specified above.
11. Any modification in engine without Dynapac consent, use of engine other than designed application or changes in engine performance related settings without Dynapac consent.

This warranty is the only document given by us warranting the Dynapac 4R1040T/4R1040NA series Engine . No other document giving any warranty terms conflicting these contents shall be considered and entertained.

- * Dynapac recommends use of Engine oil, Coolant & Dynapac genuine filters to be used in engine.
- * Dynapac will provide for 5 free service checks (Namely C1, M1, M2, M3 & M4) for off highway application. For availing free service checks contact nearest Dynapac authorised service dealer

- * Consumables & spares required for free service checks will be on chargeable basis.

General

Your engine needs :

- * Clean high speed diesel.
- * Lubricating oil of specified quality and viscosity grade.
- * Dynapac recommends use of Recommended engine Oil.
- * Fresh air for combustion of fuel, for cooling of genset / radiator.
- * Genuine spare parts for its maintenance.
- * Dynapac recommends recommended Coolant to avoid rust formation.

Service and Maintenance

- * Sound service and maintenance practices will ensure that the engine continues to meet your requirements. Recommended preventive maintenance at regular intervals must be observed. The service and maintenance work should be carried out conscientiously.
- * Special care should be taken under abnormally demanding operating conditions.

Maintenance and Repairs

- * Shut down the engine before carrying out maintenance or repair work.
- * When the work is complete, be sure to install safety devices that may have been removed.
- * If you have to work on a running engine, ensure that all clothing is tight fitting and cannot entrap the moving parts.
- * Observe all industrial safety regulations when engine are operating in enclosed spaces or underground.
- * Please contact your Dynapac Dealer for Spare parts enquiry. Use only genuine spare parts.

Safety

- * All Safety instructions (for both engine and operator) in this manual are designed by the accompanying symbol. Please follow them carefully.
- * The attention of operating personnel should be drawn to these instructions.
- * General safety and accident prevention regulations laid down by law must also be observed.

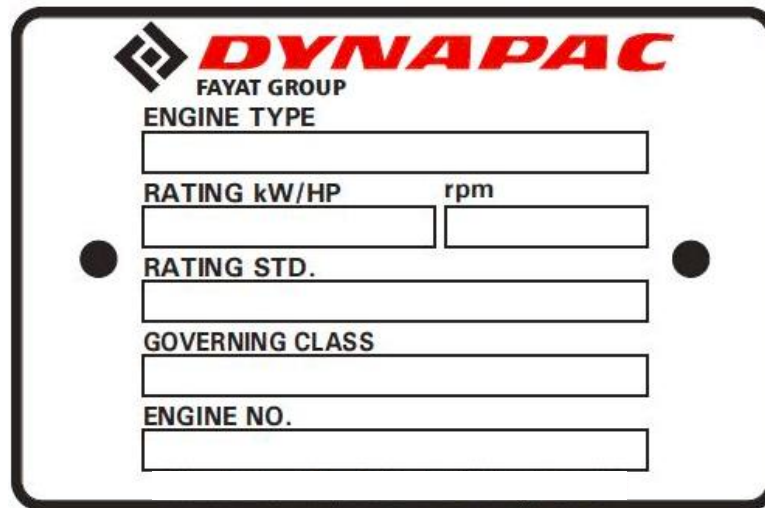
2. Engine Description


- 2.1 Engine numbering system
- 2.2 Engine illustrations
- 2.3 Engine lifting device
- 2.4 Lube oil system
- 2.5 Fuel system
- 2.6 Cooling system
- 2.7 Electrical system

2. Engine Description

2.1 Engine numbering system

2.1.1 Engine name plate



 **DYNAPAC**
FAYAT GROUP

ENGINE TYPE
[]

RATING kW/HP rpm
[] []

RATING STD.
[]

GOVERNING CLASS
[]

ENGINE NO.
[]

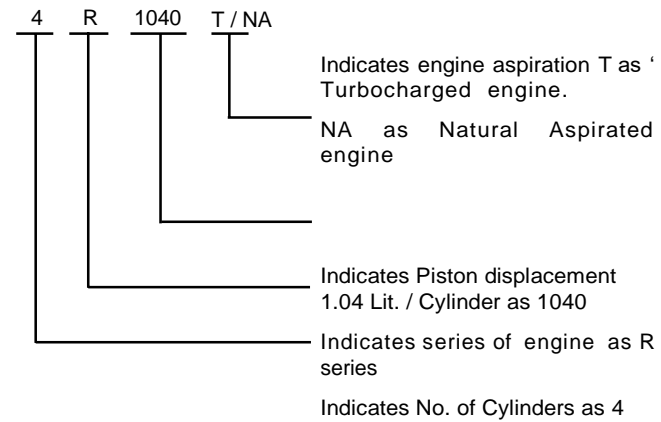
Engine no is punched on the Name Plate which is fixed on the engine crankcase.

2. Engine Description

2.1 Engine numbering system

2.1.2 Engine number system

2.1.3 Model designation



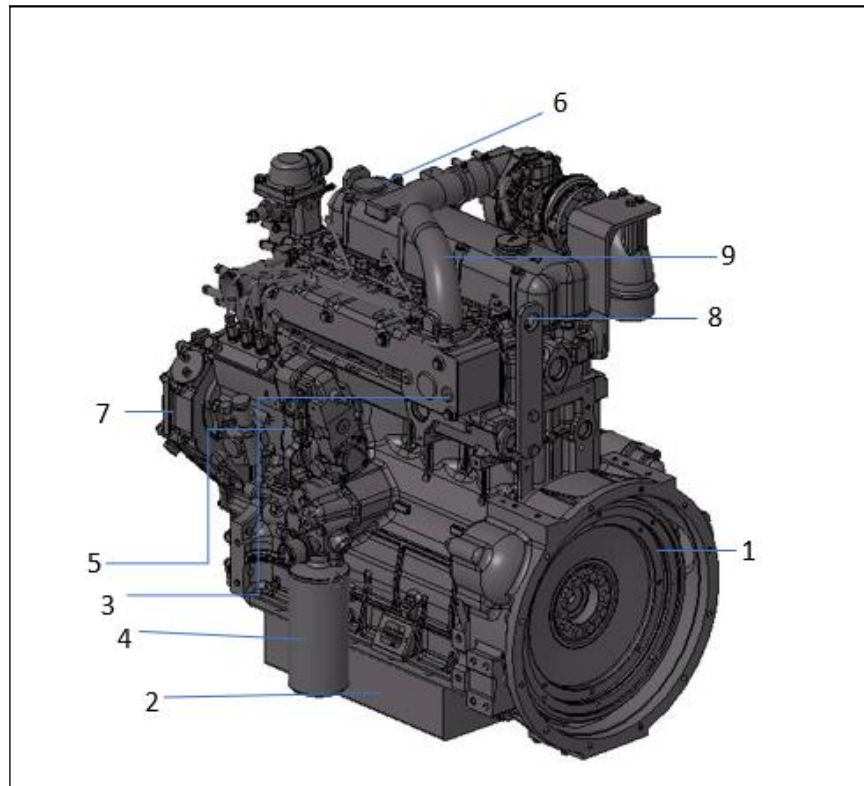
Please furnish the complete engine number, so that matter concerning Customer Service and Spare Parts can be more easily dealt with.

The engine model is punched on nameplate in column 'TYPE'. The information about engine series, No of cylinders, Piston displacement in liter per cylinder and Aspiration is mentioned. The examples are stated above will clarify the matter.

2.1 Engine illustration

Engine Description

2.2.1 Air inlet manifold side

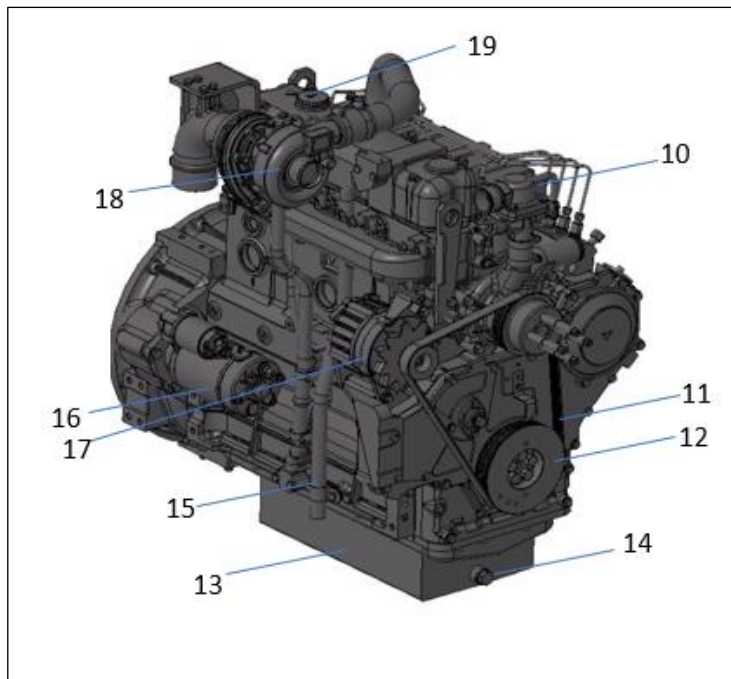


1. Fly wheel
2. Crank case
3. Air inlet manifold
4. Spin on oil filter
5. Fuel pump
6. Oil filling port
7. Gear casing
8. Lifting point
9. H.P. pipe

2. Engine Description

2.2 Engine illustration

2.2.2 Exhaust manifold side



10. Thermostat/ Thermostat hsg

11.V Belt

12. Crank pully

13. Lube oil Sum

14. Drain plug

15.Breather tube

16. Starter

17. Charging alternator

18. turbocharger.

19. Lube oil filling point

2.2 Engine lifting device

2. Engine Description

2.3.1 For bare engine – Dynapac engine 4R 1040T/4R 1040NA

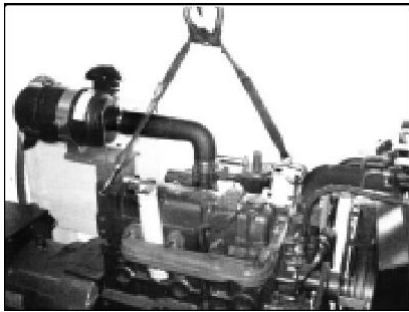


Fig. above shows the recommended lifting device

Before lifting the engine first fix the lifting hooks on the engine and then lift the engine. The lifting hooks provided on the engine are meant for lifting bare engine only. Use of engine lifting hooks for lifting engine + equipment must be avoided as it can cause damage to engine or equipment in the event of breakage.

2. Engine Description

2.4 Lube oil system

2.4.1 Lube oil circuit

Force feed lubrication is provided by a 'G' rotor type pump to main bearings, large end bearings, camshaft journals, valve gear etc. Other components like connecting rod small end bushes, cylinder liners and gear train are splash lubricated. Oil supply to valve gear is achieved through rocker shaft core hole; the oil supply is controlled to the valves and rocker arm by oil metering screw, which results into lower oil consumption and lower carbon deposition. The system includes adequate filtering by replaceable 'Spin-on' filter cartridge. The water-cooled lube oil cooler is provided to maintain the oil temperature within limits. A relief valve controls the maximum oil pressure, which is provided on delivery side of the lube oil pump.

2.4.2 Lube oil pump

Lube oil pump delivery

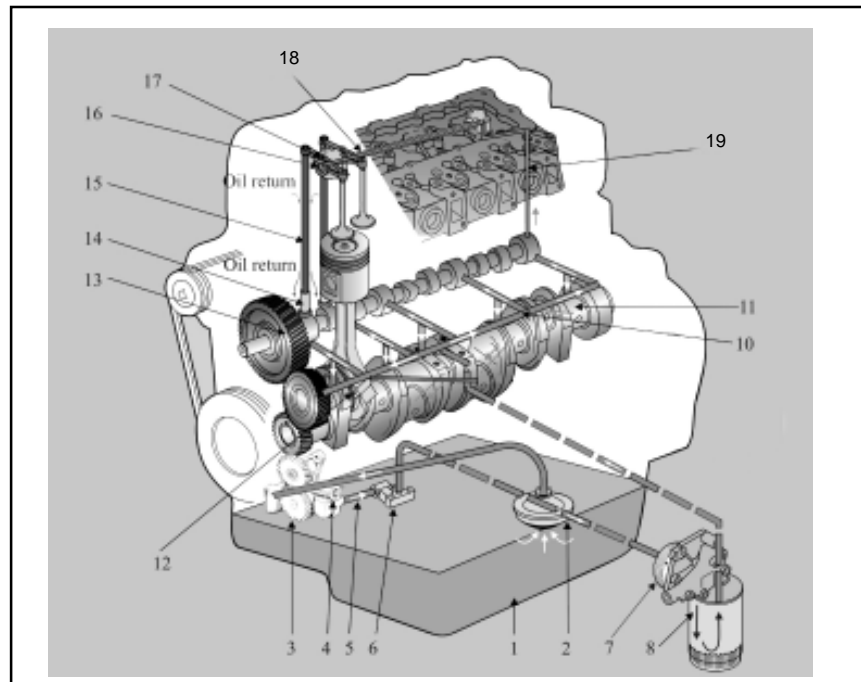
Engine type	4R1040T/4R1040NA
Engine rpm	2200
Lube oil pump rpm	2464
Delivery Liters/min. at 4kg/cm ² pressure	44@4bar

2.3 Lube oil system

2. Engine Description

2.4.3 Lubrication system for Dynapac 4R1040T/4R1040NA Series engine

A schematic diagram, shown below, shows the lubricating oil circuit of a typical Dynapac 4R1040T/4R1040NA series engines



1. Lube oil sump
2. Suction tube
3. Lube oil pump
4. Pressure relief valve
5. Delivery pipe
6. Delivery body
7. Plate type oil cooler
8. Lube oil filter
9. Safety valve (not shown)
(In-built in lube oil filter)
10. Oil gallery (Main)
11. Main bearing
12. Large end bearing
13. Camshaft bearing
14. Tappet
15. Push rod
16. Rocker arm bearing
17. Metering plug
18. Rocker shaft
19. Oil passage in cylinder head
20. Oil spray nozzle for piston cooling
(Not shown) (Used on Turbo charged
& Turbo charged after cooled engines
only.)
21. Fuel pump connected to lube oil
circuit



The above parts are arranged in typical lube oil flow, as observed in Dynapac 4R1040T/4R1040NA series engine lube oil circuit.

2. Engine Description

2.4 Lube oil system

2.4.4 Lube oil pressure

At low idling speed	Minimum 1.5 Kg/cm ²
At loaded condition in operating range	2.5 to 6.0 Kg/cm ²

If the lube oil pressure at any time drops below 1.5 kg/cm² at operating speed of 1500 rpm, under loaded condition, then replace the lube oil filter cartridge and check the pressure. If the pressure is still low, then contact your Dynapac Dealer.

2.4.5 Lube oil temperature

The maximum lube oil temperature for Dynapac 4R1040T/4R1040NA series engines is ambient temperature plus 75°C. For example if ambient temperature is 40°C, the maximum lube oil temperature should be 120°C

Note :- During the running in period of first 50 hours, never exceed 'full load' even for a short duration; this is applicable for stationary applications like power generation application.

2.4 Lube oil system

2. Engine Description

2.4.6 Lube oil sump capacity

The lube oil sump capacities of Dynapac 4R1040T/4R1040NA series engine are as below

These capacities are for the standard sheet metal sumps.

Engine type	4R1040T/ 4R1040NA
Oil sump type	S.M./C.I.
Initial fill (lit.)	11.5
Refill (lit.)	9.5

The oil must be changed at least once in a year. This is applicable to the engines, which are running for standby duty application.

Note :

- * Initial fill = Sump capacity + Gallery capacity + Lube oil filter capacity
- * Fill the Lube oil filter with oil before fitting on the engine.

2.4.7 Lube oil

- * Whenever Lube oil filter is drained off, add approximately 0.5 lit. / 1 lit. extra Lube oil (as per the size of the Spin-on filter cartridge) in the sump to maintain the correct oil level.)
- * The oil level in the sump should be checked at room temperature by using dipstick. Top up with fresh oil when the level reaches the low level mark on dip stick, fill till it increases to top level mark. Avoid over filling.

The engine should be lubricated only with the specified oil. This specially blended engine oil designed for the best performance of engine.

Using the specified oil has the following advantages:

- * Extra protection against corrosion and rusting
- * Excellent performance at both high and low temperatures
- * Reduced fuel consumption

Usage of improper lube oil could result in:

- * Overheating of the engine
- * Sluggish performance
- * Excessive fuel consumption
- * Increased wear of bearings and other parts

The specified oil is available only through Dynapac authorized service dealers in suitable packing.

2. Engine Description

2.4 Lube oil system

2.4.8 Quality Grade

Lube oil of correct viscosity and detergency grades should be used It is recommended Oil

Recommended OIL for Dynapac non emission engines - Next generation lubricant.

Recommended Oil is formulated using superior quality Group 11+ base oils and highly developed additive technology, specially developed to meet the stringent demands of modern non emission engines.

- Suitable for engines fitted with EGR technology.
- Excellent soot dispersing capability ensures lower pressure drops across filters and enhances filter life.
- Superior protection of engine components from wear & corrosion even under severe working conditions.
- Enhanced oxidation stability reduces sludge varnish & deposit formation and extends oil service life.
- Backward compatible with all previous API Service categories.
- Extensively evaluated and tested under severe conditions to establish the performance”.

2.4.9 Viscosity

Multi-grade oil should be used.

As the viscosity of lube oil is dependent on temperature. the choice of SAE grade should be governed by the ambient temperature prevailing at the engine operating site..

Optimum operating behaviour will be attained if you take the accompanying oil viscosity diagram as a guide Should be temperature fall temporarily below the limits of the SAE grade selected, cold starting may be affected but the engine will not be damaged.

In order to keep wear to a minimum, do not exceed application limits for extended period of time.

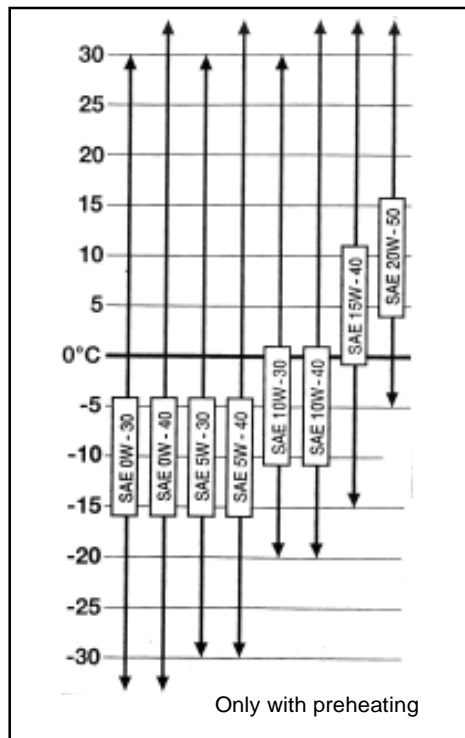


Warranty is applicable on use of 'Oil Premium' engine oil only.

2.4 Lube oil system

2. Engine Description

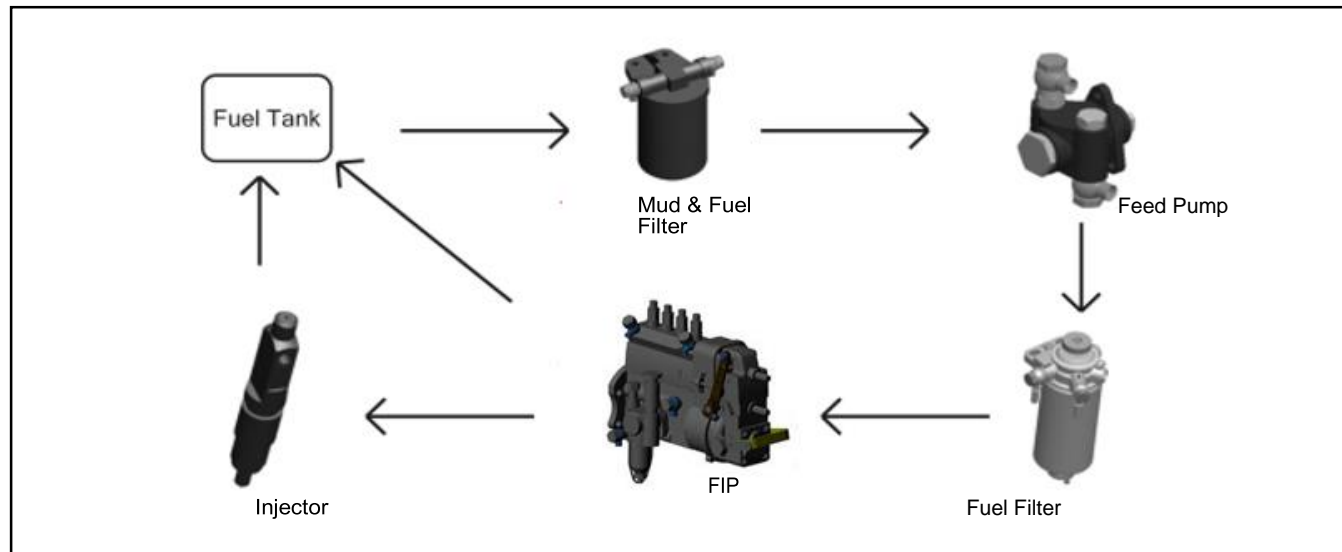
2.4.9 Viscosity



2. Engine Description

2.5 Fuel system

2.5.1 Fuel system



Fuel is supplied to the Rotary fuel pump by a fuel lift pump (feed pump) a spin-on fuel filter ensures the supply of clean fuel to the rotary fuel pump. The schematic diagram shows the fuel circuit of the engine.

The fuel tank is to be installed below the fuel pump level, and then the bottom level of the fuel tank should be less than 1 meter below the feed pump inlet. Fuel pipe from fuel tank to feed pump should be of 9mm I.D.



The indicated figure is typical fuel circuit diagram, where as the scope & routine of fuel system can be changed according type & application.

2.5 Fuel system

2. Engine Description

2.5.2 Fuel Specifications

The performance of the engine depends upon supply of clean and correct grade of fuel. The fuel injection equipment is manufactured to very close tolerances and slightest amount of dirt in fuel can cause wear on the injection equipment. Following points are important in use of fuel on Dynapac 4R1040T/4R1040NA engine.

The following specifications are approved: -

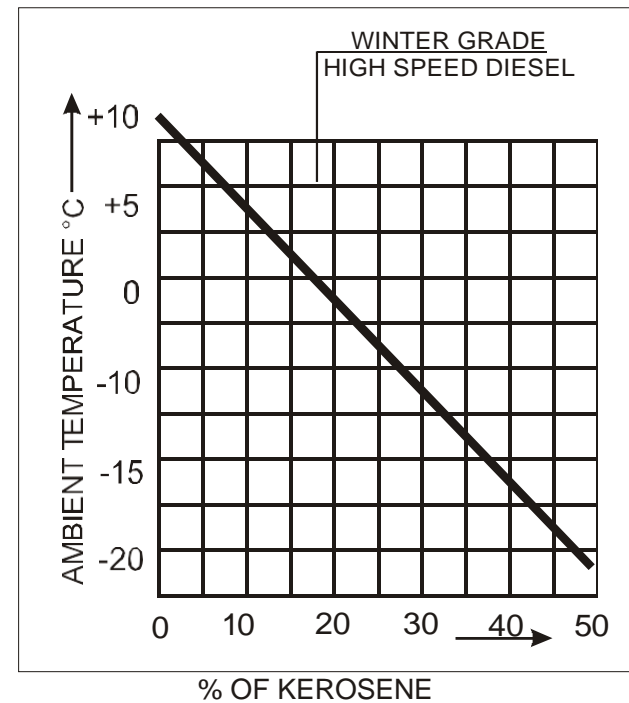
* IS:1460 - 2005

* ASTM D975-88:1-D & 2-D

Winter Grade Fuel

- * At low temperatures, waxing may occur and clog the fuel system, thus causing operational troubles.
- * In the case of ambient temperature below 10°C, use 'Winter Grade' diesel fuel, mixed with Kerosene.
- * Proportion of Kerosene to be mixed in Diesel, depends on the ambient temperature as shown in the graph. (Maximum proportion limited to 50%) For cold starting aid see 3.4.1

PREPARE THE BLEND IN THE TANK ITSELF. FILL IN THE NECESSARY AMOUNT OF KEROSENE FIRST, THEN ADD DIESEL FUEL.



2. Engine Description

2.5 Fuel system

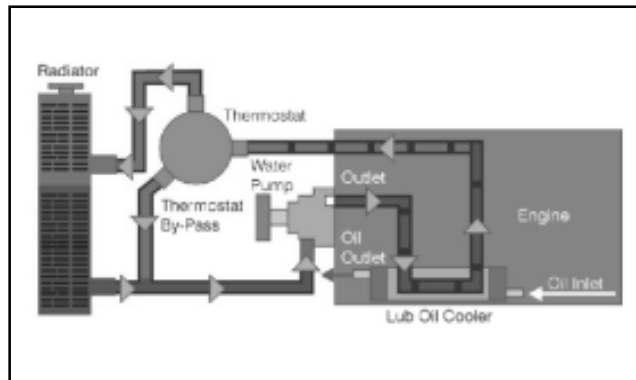
2.5.3 Storing Fuel OIL

- * The storage of fuel oil is of utmost importance since many engine problems are traced to dirty fuel or fuel stored for too long a period. Store fuel in a convenient place outside the building.
- * It is recommended that the fuel tank should be filled in at the end of the day's work. This keeps moisture out of the tank.
- * To eliminate water from the fuel, drain out small quantity of fuel from fuel tank through a drain plug every day before starting the engine.

2.6 Cooling system

2. Engine Description

2.6.1 Radiator type cooling system



The radiator type cooling system is used in Dynapac 4R1040T/4R1040NA series engines.

The schematic diagram, of the typical coolant circuit with radiator type cooling system, is shown in the figure above.

2.6.2 Coolant

The engine uses a specially formulated coolant "recommended coolant" with demineralised water & glycol. Use only "recommended coolant" and do not use ordinary water. "Recommended coolant" is available only through Dynapac authorized dealer in suitable packings.

Coolant Recommendation – It is recommended to use in the cooling system.

2. Engine Description

2.7 Electrical system

2.7.1 Electrical equipment

Engines are equipped as per customer requirement with 12V negative earth electrical starting system.

Electrical system 12 V

Alternator – 12V DC, 65Amp

Starter – 12V DC, 2.7 KW

Recommended Battery Capacity –
Dynapac Engine 4R1040T/4R1040NA,
120 AH above 10⁰C

2.7.2 Battery & battery cables

Recommended Battery Cable (Copper) – 35mm² - up to 1mtr.
50mm² - up to 2mtr.
70mm² - up to 3mtr.

3. Engine Operation

- 3.1 Commissioning
- 3.2 Operating conditions
- 3.3 Starting & stopping
- 3.4 Running in period
- 3.5 Engine cleaning & preservation



3.1 Commissioning

3. Engine Operation

3.1.1 Engine Oil

Before you start a new or overhauled engine, attend following points



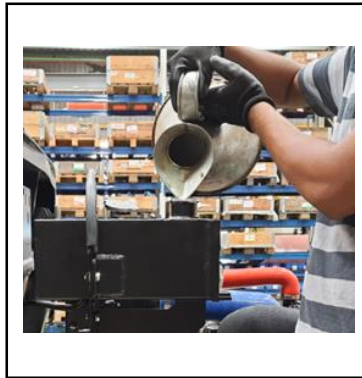
Oil filling

Fill the engine with Lube oil through oil filling neck as shown in figure above. For oil quantity, grade and viscosity refer point no. 2.4.8 & 2.4.9 respectively.

3. Engine Operation

3.1 Commissioning

3.1.2 Cooling system



- * Fill the cooling system with recommended coolant. Fill the coolant through neck of radiator till it flows through the radiator over flow pipe and then connect the pipe to balance water tank. Coolant filling through radiator neck is recommended only for initial fill. For regular coolant top up, coolant is to be added in balance water tank.
- * Do not open the radiator cap while engine is running or hot. The cooling system is under pressure hence danger of burning body skin.
- * Add coolant when the coolant system is cold. The temperature difference between the coolant in the engine and the coolant being added must not exceed 50°C. Coolant is to be added in balance water tank, do not open the radiator cap for coolant filling.

3.1.3 Belts

Check that belts are in position and the belt tension is proper. If the belt tension is not proper adjust the same as described in section 5.4

3.1 Commissioning

3.1.4 Valve clearance

It is not necessary to check / adjust the valve clearance on a new engine as it is already adjusted at its required value in factory. However after overhauling the engine, it is necessary to recheck and adjust the valve clearance before starting the engine. Refer section 5.6 for adjustments.

3. Engine Operation

3.1.5 Other preparations

- * Check battery and lead connections. Also check the cable connections at the starter & alternator. Loose connections lead to improper contact and damage to the terminals.
- * Remove lifting hooks after engine installation.
- * After completing the preparations, run the engine for a short period of 10 minutes without load.
 - Check the engine for oil and water leakages. If the leakages are noticed, remove them.
- * After stopping the engine check following.
 - With engine stationary, check the oil level. Top up the oil if necessary
 - Retighten the V belts

3. Engine Operation

3.2 Operating conditions

3.2.1 Deration charts

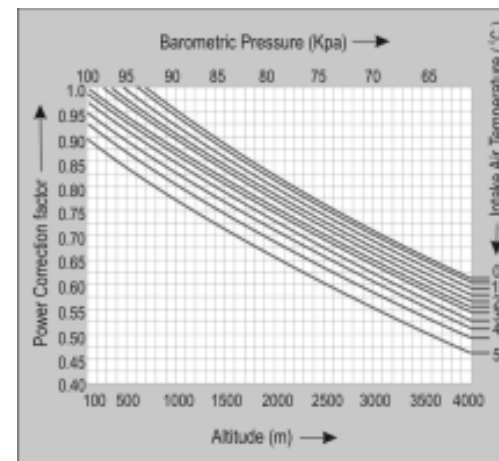
- * The declared power ratings of the engine are obtained at standard reference conditions as per ISO 3046 / BS 5514 / DIN 6271 / IS 10000.
- * Where engines are operated at greater altitudes and / or higher ambient temperatures, they must be derated in accordance with respective standards.
- * In case of doubt concerning such engine application, contact your engine equipment supplier.

The engine power mentioned on name plate is at NTP conditions. Based on altitude, ambient temperature & relative humidity engine requires to be derated accordingly.

Deration chart for Naturally Aspirated engines

The chart is prepared on the basis of standard ambient conditions mentioned in ISO 3046/DIN 6271/BS 5514, with 30% relative humidity. For higher relative humidity the deration increases by 2% for 20% rise in relative humidity above 30% relative humidity.

The deration chart applicable for Dynapac 4R10140NA engines is illustrated below.



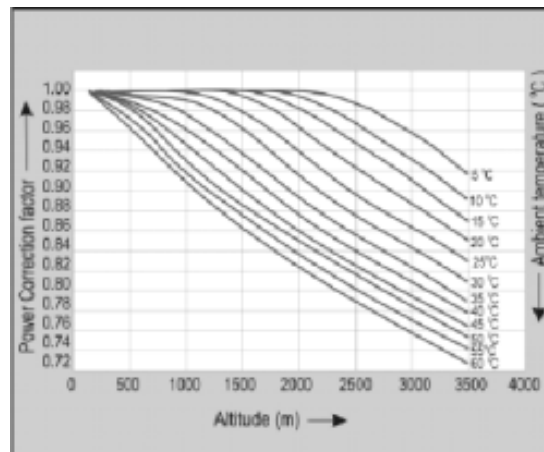
3.2 Operating conditions

3. Engine Operation

3.2.1 Deration charts

Deration chart for Turbocharged engines

The deration chart applicable for Dynapac engine 4R1040T is illustrated below.



3. Engine Operation

3.3 Starting & stopping

3.3.1 Lubrication - Precautions to be observed.

- * Fill recommended grade of fresh oil in the sump up to the high mark of the dipstick.
- * Add an additional 1/2 liter or 1 liter oil to compensate for the extra volume of the lube oil filter.
- * Lube oil level in the oil sump should be checked and topped up after initial starting and stopping the engine.

3.3 Starting & stopping

3. Engine Operation

3.3.3 Cooling: Liquid cooled engines

- * Fill the radiator with recommended coolant only.
- * After starting the engine recheck the coolant level in the radiator and top up if required.
- * The Compensation tank on the radiator should also be filled as per the specified marking.

3.3.4 Electrical

- * Check the battery for correct voltage and current capacity.
- * Check that the battery cables are correctly connected and secure.
- * Ensure correct polarity.
- * Apply petroleum jelly on battery terminals.

3. Engine Operation

3.3 Starting & stopping

3.3.5 Mechanical

- * Ensure that all electrical wiring of the alternator is intact.
- * Ensure that all the fasteners in the foundation, couplings etc are properly secured.

3.3.6 Procedure of starting & stopping

Before starting

- * Check the oil and coolant levels - top up if required.
- * Ensure that there is sufficient fuel in fuel tank.
- * Check the restriction indicator of air cleaner.
- * Clean the engine with a dry cloth.
- * Crank the engine. Release the starter switch as soon as engine fires. Keep the ignition switch in the 'ON' position. Do not crank the engine for more than 10 seconds at a time.
- * If engine fails to start, wait for a minute before trying again.

After starting

- * Check for leakages of fuel, oil and coolant.
- * Allow the engine to run idle for about 3 minutes and then start loading the engine.
- * While the engine is operating, check the oil pressure, coolant temperature and battery charging rate regularly.

3.3 Starting & stopping

3. Engine Operation

3.3.6 Procedure of starting & stopping

Stopping

Before stopping

- * Unload the engine and let it run at idling speed for about 5 minutes.
- * Check if lube oil pressure and coolant temperature have stabilized.
- * Shut the engine from the 'Stop' push button on the Engine Controller.

After stopping

- * Check for any fuel, oil and coolant leakages.
- * Check the oil level 30 minutes after stopping and top up if required.

3. Engine Operation

3.4 Running in period

3.4.1 After first 50 hours running

- * Change engine oil see 5.1.2
- * Change the lube oil filter cartridge / element see 5.1.3
- * Check and retighten fasteners for lube oil sump if necessary
- * Check V belt tension and retighten if necessary see 5.4
- * Check engine for leakages of lube oil, fuel, water.
- * Check the engine mounting bolts, retighten if necessary.
See 5.7.2
- * Retighten intake and exhaust manifold fasteners at cylinder heads.
- * Check battery electrolyte level, top up if required.

3.5 Engine cleaning & preservation

3. Engine Operation

Remove the dust deposit from the engine and radiator fins with compressed air. Cleaning with diesel fuel or kerosene or water may cause dust to deposit again on the cleaned parts.

- * Cleaning should be done from the side opposite to the normal air flow.
- * When deposits are hard, scrape and clean with a water jet. Run the engine after such cleaning till all the water has evaporated.
- * When the engine is not used for some time, it should be protected from atmospheric moisture and condensates that could damage the engine parts such as bearings, piston crankshaft, etc.

4. Routine Maintenance

4.1 Maintenance Schedule

4.2 Maintenance Work Completed



FAYAT GROUP



4.1 Maintenance Schedule

4. Routine Maintenance

Every 10th Hour/Daily	In Running Hours							Job	Refer section
	1st 50	250	500	750	1000	2500	5000		
•								Engine oil level	5.1.1
•								Coolant level in radiator and compensatory tank	5.3.1
•								Restriction indicator of dry type air cleaner	5.4.2
•								Rubber hose & clips of dry type air cleaner / radiator	—
								Engine oil (Every 250 Hrs.)	5.1.2
								Lube oil filter cartridge (Every 500 Hrs.)	5.1.3
	•							Battery and lead connections (Every 50 Hrs.)	5.7.2
		•	•	•	•			'V' Belt condition and tension (adjust / replace if required)	5.4
								Radiator fins (depends on site condition) externally	5.3.1
								Radiator tubes internally	5.3.2
								Replace fuel filter cartridge after every 500 Hrs.	5.2.2
						•	•	Injector	—
								Fuel strainer (Button filter)	
							•	Thermostat element (change if necessary)	5.3.3
						•	•	Valve clearance (adjust if necessary)	5.6.1
						•	•	Starter / Alternator	—
						•	•	Fasteners	—
							•	Exhaust silencer	—

• Check / Adjust

Change

Clean

4. Routine Maintenance

4.2 Maintenance Work Completed

Hours	Date	Remark	Signature / Stamp
50			
250			
500			
750			
1000			
1250			
1500			
1750			
2000			
2250			
2500			
2750			
3000			
3250			
3500			
3750			
4000			

4.2 Maintenance Work Completed

4. Routine Maintenance

Hours	Date	Remark	Signature / Stamp
4250			
4500			
4750			
5000			
5250			
5500			
5750			
6000			
6250			
6500			
6750			
7000			
7250			
7500			
7750			
8000			

4. Routine Maintenance

4.2 Maintenance Work Completed

Hours	Date	Remark	Signature / Stamp
8250			
8500			
8750			
9000			

Top Overhaul and Major Overhaul periods

The duration of the operating period before overhaul is dependant entirely on the quality of maintenance and service given to the engine and also type of environment and engine load cycle. However, after about 5000 running hours engine will need top overhaul (servicing of combustions system) and after about 9000 running hours engine will need major overhaul. These periods are based on assumption that engine is maintained properly as per the instructions given in this manual. Hence the above estimated overhaul periods are to be referred as general guide lines. Get the engine top overhauled or major overhauled from Dynapac authorised service dealer. Use genuine spare parts for top & major overhaul of the engine.

5. Service & Maintenance

- 5.1 Maintenance of lube system**
- 5.2 Maintenance of fuel system**
- 5.3 Maintenance of cooling system**
- 5.4 Maintenance of dry type air cleaner**
- 5.5 Belt drives**
- 5.6 Adjustments**
- 5.7 Maintenance of electrical equipment**
- 5.8 Additional jobs**



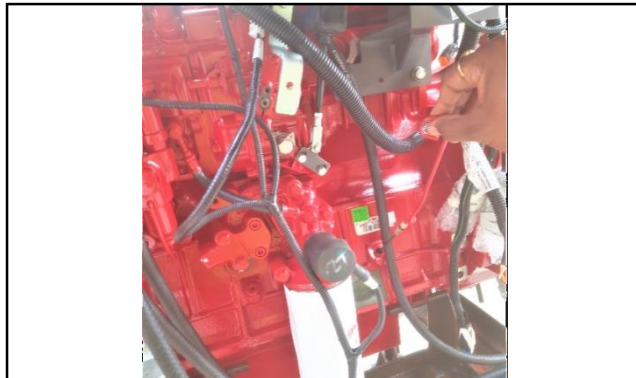
FAYAT GROUP



5.1 Maintenance of lube system

5. Service & Maintenance

5.1.1 Checking oil level

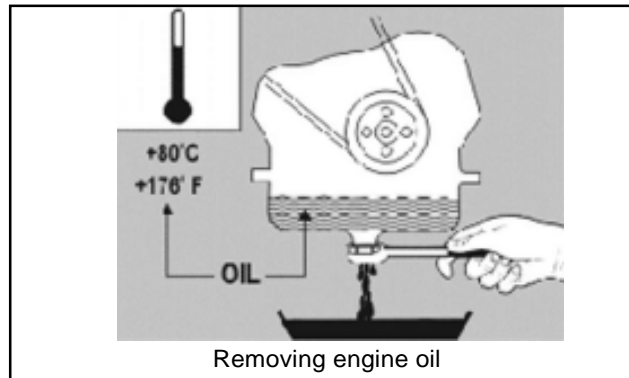


- * Stop the engine and wait for a while (Approximately 30 to 45 mins.) till oil level in the sump is settled. Ensure that engine is in horizontal position.
- * Pull out dipstick, wipe it with a non-fraying cloth and push it in as far as it will go and then withdraw again
- * The film of oil left on the dipstick should extend to the upper (max.) mark. If the level approaches near to the lower mark, the oil should be topped-up without delay.



Failure to attend to this may result in serious damage to the engine (piston & bearing seizure)

5.1.2 Changing engine oil



- * Run engine until it gets warm. (lube oil temp. approx. 80°C)
- * Stop the engine, remove battery connections.
- * Place oil tray under the engine.
- * Unscrew oil drain plug on the end of drain pipe & drain oil completely. Wait until last drop of oil.
- * Collect used oil in suitable receptacle ready for proper disposal to prevent environmental pollution.
- * Refit oil drain plug with new joint washer and tighten firmly.

5. Service & Maintenance

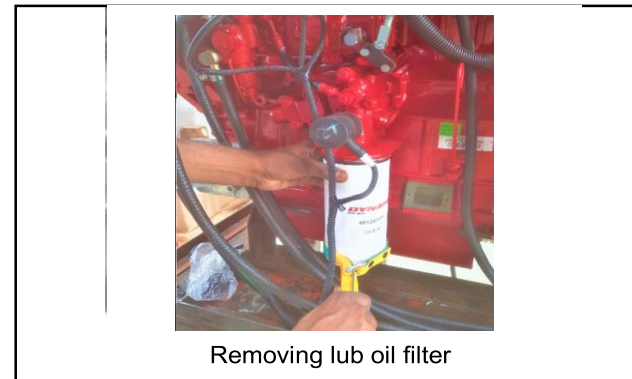
5.1 Maintenance of lube system

5.1.2 Changing engine oil



- * Fill in fresh lube oil.
 - Lube oil specifications – Use Recommended oil
 - Lube oil sump capacity, refer 2.4.5
- * Do not flush the lube oil system with diesel or kerosene.

5.1.3 Changing lube oil filter



- Replace 'Spin-on' lube oil filter cartridge for every oil change.
- * Release lube oil filter cartridge with special tool and spin off as shown in figure above.

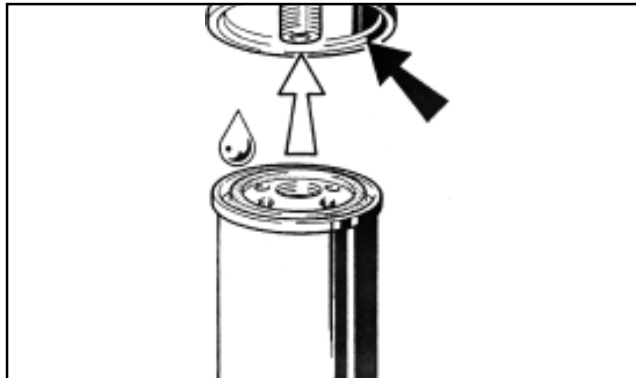


Take care when draining off hot oil : Danger of scalding!

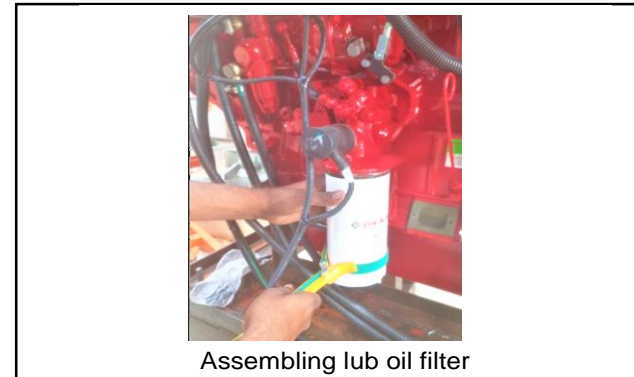
5.1 Maintenance of lube system

5. Service & Maintenance

5.1.3 Changing lube oil filter



- * Clean sealing surface of filter carrier.
- * Fit the filter cartridge in dry condition. Do not fill oil in the filter before assembly.
- * Apply light film of oil to rubber seal of new cartridge.
- * Screw cartridge into place by hand until seal is evenly seated.
- * Use genuine Dynapac lube oil filter.



Assembling lub oil filter

- * Tighten lube oil filter cartridge firmly by giving a final half turn as shown in figure above.
- * Check oil level and lube oil pressure.
- * Check seal of lube oil filter cartridge for leaks

5. Service & Maintenance

5.2 Maintenance of fuel system

5.2.1. Changing Fuel Filter - Spin On Type



- * Remove the cartridge by rotating in anticlockwise by hand.
- * Collect dripping fuel in a tray.
- * Destroy the removed cartridge.
- * Use genuine Dynapac fuel filter.



- * Clean the sealing surface of filter.
- * Apply light film of oil or diesel fuel to the rubber gasket of the new fuel filter cartridge.
- * Screw in the new cartridge finger tight against the gasket.



Keep naked flames away when working on they fuel system. Do not smoke.

5.2 Maintenance of fuel system

5. Service & Maintenance

5.2.1. Changing Fuel Filter - Spin On Type



- * Tighten the fuel filter cartridge with a final half turn using commercial tool.
- * Open fuel stopcock.
- * Check for leaks.

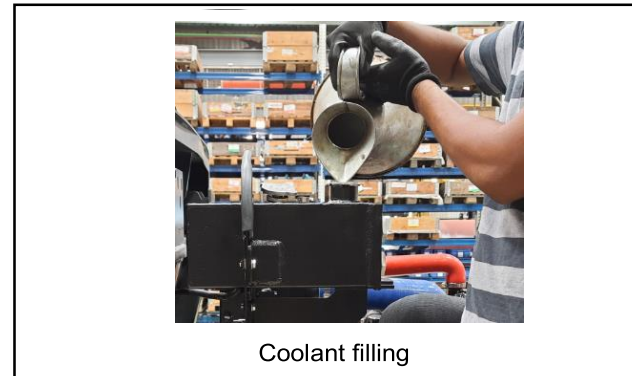
5. Service & Maintenance

5.3 Maintenance of cooling system

5.3.1 Radiator

Engine cooling system consists of radiator, fan, water pump and temperature controller i.e. thermostat. High coolant temperature trip for engine safety has been provided.

Check coolant level in the balance water tank every day before starting the engine. If required add the coolant in balance water tank, never top up the coolant level above the Max. mark on the tank.



- * Add coolant only when the cooling system is cold. The temperature difference between the coolant in the engine and the coolant being added must not exceed 50 °C.

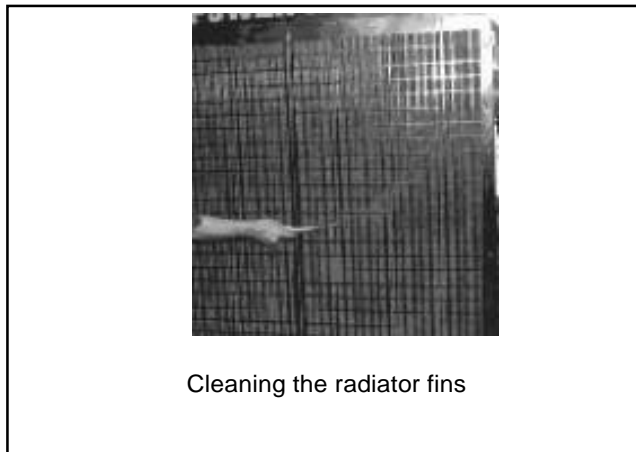


Do not open radiator cap while the engine is running or hot. The cooling system is under pressure. Danger of burning body skin!

5.3 Maintenance of cooling system

5. Service & Maintenance

5.3.1 Radiator



- * Cleaning the radiator fins
- * Clean the radiator fins after every 400 hours. (Under very dusty conditions, fins cleaning frequency will have to be increased.)
- * For cleaning, blow the pressurized air through radiator fins in the reverse direction of the flow of radiator fan as shown in figure above. Do not spill water on radiator fins.
- * After every 5000 hours while replacing the coolant, the cooling system should be clean.

5.3.2 How to clean the cooling systems with the help of K clean cleaner.

- * K Clean is designed to remove the contaminants like scale, oil, grease, rust, loose material presents in the engine cooling systems.
- * Add K Clean in the ratio of 375 ml for every 16 lit capacity of radiator and balance clean water (mineral or similar water) in the radiator.
- * Run the engine for minimum 20-30 minutes.
- * Allow the water to cool down and drain it completely.
- * Refill it with plain clean water and run the engine for another 15-20 minutes for flushing the system.
- * Allow the water to cool down and drain it entirely.
- * Observe the drained water, if it still contents rust, scale and dirt, repeat the above procedure for one more time.
- * Fill the system with coolant.
- * This will provide maximum life and benefits of coolant for better engine performance.

5. Service & Maintenance

5.3 Maintenance of Cooling System

5.3.3 Thermostat



A thermostat having single element is used in the cooling circuit. Thermostat is provided to attain working temperature quickly during warm-up period and maintains desired temperature of coolant during running of the engine.

Normally thermostat does not require regular maintenance. Its operation shall be checked if sudden deviations from the specified coolant temperature occurs. Visual inspection will reveal whether or not the element rests in its seat properly. See figure above.

* It is necessary to replace defective element.

5.4 Maintenance of dry type air cleaner

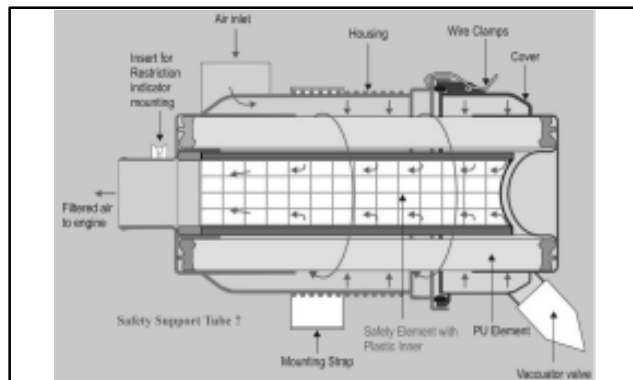
5.4.1

Dry type air cleaner with plastic housing

Construction of typical dry type plastic air cleaner, supplied, is shown above in figure and construction of typical dry type air cleaner with sheet metal housing is shown above in figure.

Inlet cap or pre - cleaner is supplied for the air intake inlet cap prevents ingress of rain / heavy particles.

Two filter elements are co - axially fitted in the air cleaner housing. The outer element is the main filter element, with a built in cyclone separator which gives a swirling effect to incoming air, to separate out heavy dust particles by centrifugal action. This dust is collected in the end cover (which is removable). The vaccuator valve at the

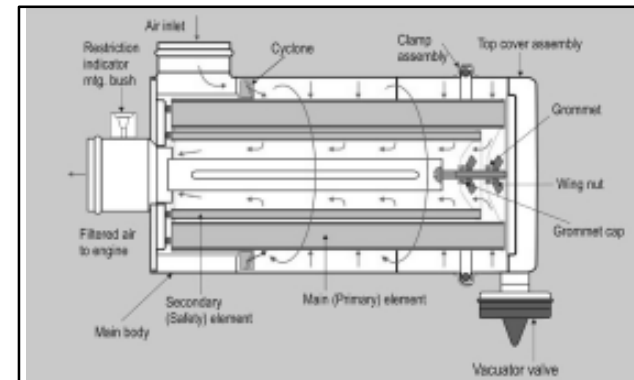


5. Service & Maintenance

Dry type air cleaner with sheet metal housing

bottom of cover helps in expelling the accumulated dust. This is achieved by opening / closing of vaccuator valve outlet due to the airflow fluctuations inside the air cleaner.

Inner element is a 'Safety Element' to prevent ingress of dust into the engine, when the outer (main) element is removed for cleaning / replacement.



5. Service & Maintenance

5.4 Maintenance of dry type air cleaner

5.4.2 Maintenance

Regular check up and maintenance of the air cleaner is essential to ensure maximum protection to the engine from the dust.

- * Damaged hose / clips must be replaced immediately. Any bypassing of unfiltered air through cracks in the hose / loose hose will quickly lead to serious damage to the engine.
- * The pre-cleaner (if provided) should be cleaned, to remove the accumulated dust, after each day's work, when the engine is stopped. This cleaning can be done by removing the top cover of pre-cleaner.
- * The restriction indicator, mounted on air cleaner near the hose, indicates the condition of the air cleaner element, when the air element is in good condition, a red signal will be seen through the transparent window on the indicator when the engine is running and will disappear when engine is stopped. However, if the element is choked, then the red signal will remain 'ON' even after engine is stopped. This is an indication that the main filter element must be removed & cleaned or replaced.
- * Do not clean the air cleaner element if restriction indicator does not show red band.

NOTES: -

- * If engine performance is poor, but restriction is still within limits, do not change the element. The air cleaner is probably not at fault.
- * To get those extra service hours out of air cleaner element, make sure the air inlet is away from any heavy dust clouds caused by operation. Also, make sure that exhaust carbon cannot enter the air cleaner.

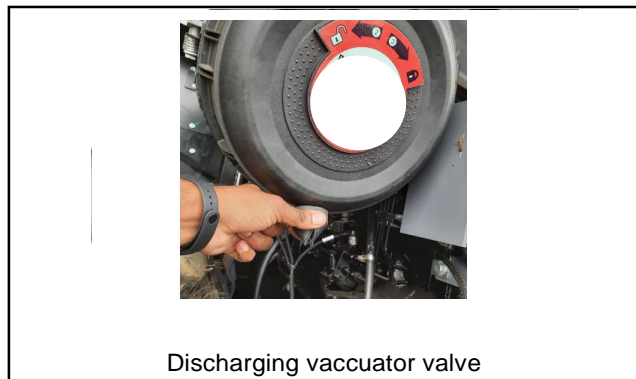


Since this is a dry type air cleaner, do not fill a single drop of oil in it. Also, protect the air cleaner from ingress of rain / moisture.

5.4 Maintenance of dry type air cleaner

5. Service & Maintenance

5.4.2 Maintenance



- * Discharge the dust vaccuator valve by pressing apart the lips of the ejection slot, applying pressure as shown above.
- * Clean the vaccination slot time to time.
- * Remove any cakes of dust by pressing together the upper part of the valve.
- * Make sure that vaccuator valve is not damaged, if required change it

5.4.3 Cleaning of filter element



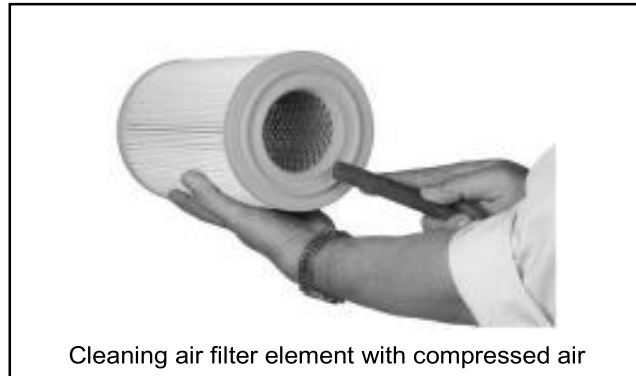
Cleaning of filter element is to be done only when a restriction indicator shows a red signal even after the engine is stopped. For cleaning proceed as follows -

- * Loosen the mounting band of the dust cup, take out the outer element for checking and cleaning. See figure above. Do not remove inner element (Safety element)
- * Use a damp cloth to wipe out all excess dust in the air cleaner.
- * Thorough cleaning of the filter element with compressed air is recommended.

5. Service & Maintenance

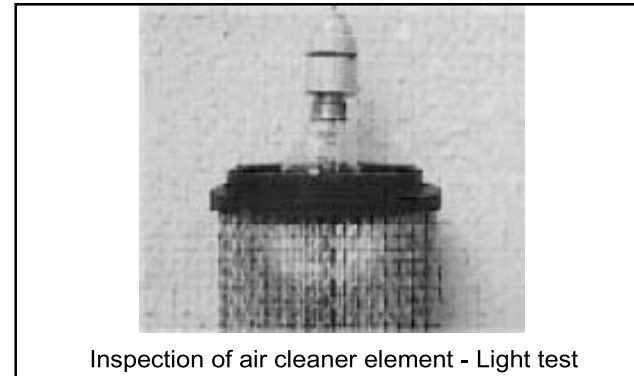
5.4 Maintenance of dry type air cleaner

5.4.3 Cleaning of filter element



Clean the element from inside to outside using compressed air as shown in figure.

- * Replace the main element after two cleaning intervals.
- * Rapping, Tapping or Pounding dust out of element is dangerous. It will result in severe damage to the filter element.



- * Carefully check new or properly cleaned element for damage before installing. Conduct a light test by passing the light through element as shown in figure above. If there is any crack in the element, the light will pass through it. In that case replace the element.



Too much air pressure can tear the filter paper and destroy the element. (Max. Air Pressure 3.0 kg/cm²)

5.4 Maintenance of dry type air cleaner

5. Service & Maintenance

5.4.3 Cleaning of filter element



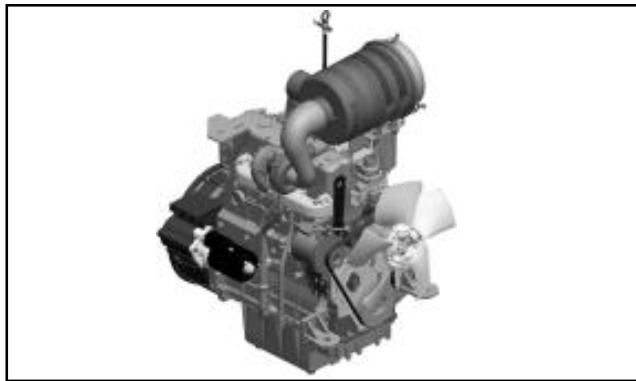
* Inspect the rubber-sealing ring at the end cover of the element.
In case the seal is damaged, replace the sealing ring.

- * The inner element (Safety element) is not to be removed, when the main element is removed for cleaning / replacement. It should be replaced by a new safety element at every change of the main element.
- * Assemble the cleaned or new element in the air cleaner body and reinstall the end cover, making sure it seals all around the air cleaner body. Reset the restriction indicator by pressing the button at the top.
- * For certain application involving extremely dusty environment, we recommend use of series air cleaner systems, i.e. dry type air cleaner in series with oil bath air cleaner.

5. Service & Maintenance

5.5 Belt drives

5.5.1 Checking belt tension



A single V belt of NPA/XPA section or Poly V belt is used to drive engine water pump, radiator fan and battery charging alternator for Dynapac 4R1040T/4R1040NA engines.

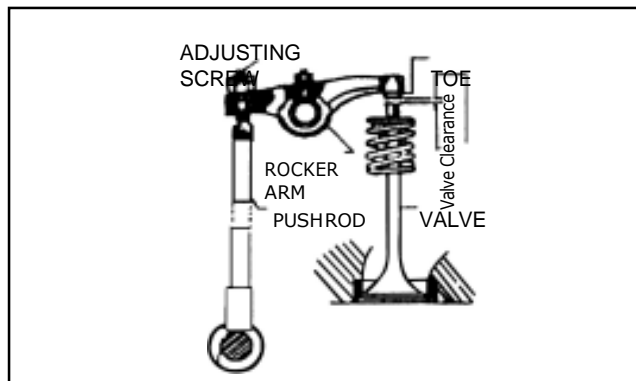
- * Inspect V-belts over whole length for damage or cracks. Renew damaged or cracked v-belt.
- * Check by pressing midway between the pulleys to see whether the belt deflects inwards by not more than 10 to 15 mm as shown above.
- * If necessary, re-tension V-belt by loosening and re-tightening the battery charging alternator.

* Never check / retention / renew V- belt while engine is running.
Refit V-belt guard, if provided.

5.6 Adjustments

5. Service & Maintenance

5.6.1 Checking and adjusting valve clearance



The valve clearance is the requisite gap between the rocker arm toe and valve stem end. See figure above. Engine performance and power output depend on its correct setting, which can be done by a skilled mechanic according to the instructions in 5.6.3.

5.6.2 Checking valve clearance

- * Check clearance when engine is cold. (At room temperature)
- * Remove the rocker cover.
- * Turn crankshaft until the valves of the cylinder (on which the clearance is being checked) are "overlapping" (exhaust valve about to close, inlet valve about to open).
- * Then continue turning the crankshaft through 360° (one complete revolution). At this position both valves are closed.
- * Insert a feeler gauge of 0.25 mm in the gap between rocker arm toe and valve for inlet. The valve clearance is correct when the filler gauge can be inserted with a slight drag. Failing this, the valve clearance must be readjusted as mentioned in 5.6.3.

5. Service & Maintenance

5.6 Adjustments

5.6.3 Adjusting valve clearance



- * Loosen lock nut of adjusting screw through one or two turns and adjust the screw with screwdriver so that, when locknut is retightened, the feeler gauge of 0.3 mm can be inserted and withdrawn with slight drag.
- * Similarly, check the valve clearance of exhaust valve with 0.3mm feeler gauge. Readjust if necessary.
- * Check the valve clearances of each of the remaining cylinders at their respective TDC and readjust, if necessary.

Tappet clearance (in cold condition only)

Inlet	Exhaust
0.25 mm	0.30 mm

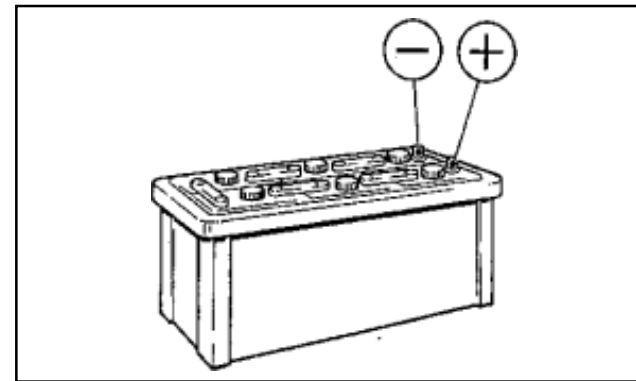
5.7 Maintenance of electrical equipment

5. Service & Maintenance

5.7.1 Battery charging alternator

- * Check belt tension, readjust if necessary
- * Check the battery condition
- * Keep the alternator reasonably clean and ensure that ventilation slots or air spaces are clear and unobstructed. Check mounting bolts for tightness.
- * Any work involving repairs / replacement of components of alternator contact Dynapac authorised service dealer.

5.7.2 Battery



Checking battery and lead connections

- * Clean the battery. Use damp cloth for cleaning.



A slack belt will rapidly wear and because of slip may not drive the alternator at the required speed. Too tight a belt will impose severe side thrust on the bearings and seriously shorten their life.

5.7 Maintenance of electrical equipment



5. Service & Maintenance

5.7.2 Battery

- * Check battery lead & terminal connections are tight.
- * Apply petroleum jelly to terminals.
- * When reconnecting, ensure good contact of the terminals. Tighten clamping bolts firmly.
- * Ensure correct polarity before connecting.

For technical details, specification & maintenance of battery please refer battery manufacturers recommendations.

5.8 Additional Jobs

5.8.1 Exhaust silencer

- * Knock out soot from exhaust silencer and clean the exhaust piping after every 1200 hours.
- * The time span of exhaust silencer chocking is entirely dependent on the working conditions and maintenance & operating practices, so the time span will be vary accordingly.

5. Service & Maintenance

5.8.2 Checking of fasteners

- * Check & tighten-up the fasteners for following -
 - Air intake and exhaust manifolds, exhaust piping
 - Radiator hose connections
 - Engine and radiator mountings
 - Lube oil sump
 - Front cover
 - Hose clip for air cleaner
 - Lube oil filter mounting
 - Engine mountings
 - Fuel connections
 - All external nuts and bolts



Do not overtighten the fasteners.

6. Faults, Causes & Remedies

6.1 Diagnosis Chart

7. Engine Specifications

7.1 ENGINE SPECIFICATIONS FOR DYNAPAC 4R1040T SERIES ENGINES

7. Engine Specifications

7.1 ENGINE SPECIFICATIONS FOR DYNAPAC 4R1040T SERIES ENGINES

Sr. No.	Model	Unit		
1	Engine Model		4R1040NA	4R1040T
2	Bore x Stroke	mm		105 X 120
3	Firing order	—		1-3-4-2
4	Displacement	cc		4156
5	Direction of Rotation	—		ACWR
6	Aspiration	—	Natural Aspirated	Turbocharged
7	Compression Ratio	—	18:1	17:1
8	Starting Arrangement	—		Electric Start
9	Governor Type	—		Mechanical
10	Class of Governing	—		M2 As Per ISO 3046
11	Lube Oil Consumption	—		<0.3% of Fuel Consumption
12	Lube Oil Sump Capacity	lit.		14
13	Rated Output as per ISO 3046	hp	76	105
14	Rated Speed	rpm	2200	2200
15	Rating Standard	—		ISO 3046
16	B. M. E. P at Rated Output :	kg/cm ²	7.5	10.3
17	Maximum Torque (+/- 100 rpm)	Nm	290@1320 rpm	375@1400 rpm
18	Dry Engine Weight - With Flywheel & Flywheel Hsg.	kg	490	510
19	Noise Level at 1m	dBA		<100

8. Tightening Torque

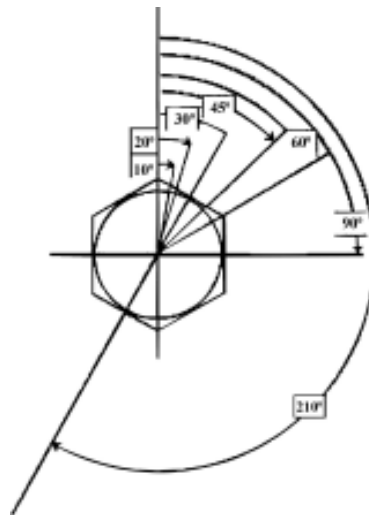
8.1 Tightening torque table for fasteners

8.2 Tightening torque sequence for Dynapac 4R1040T/4R1040NA engine

8. Tightening Torque

8. Tightening Torque

To prevent faulty assembly, following information on tightening of high tensile bolts is important. The bolts are to be tightened in stages as specified in the table below. For connecting rod bolt and main bearing cap bolt use angle torque method with the help of goniometer. The tightening angles for these two bolts are particularly important, hence figure below indicates the various angles can be readily obtained by comparison with a clock face.



Tightening torque angles

Tommy bar is to be clamped in the tool slot and specified angle is to be turned with reference to the initial graduation on outer dial of the tool or a relation of hex head of bolt can be referred.

NOTE:

1. Lubricate threads and seating face of bolt with engine oil before it is assembled.
2. Screw the bolt by hand till it is engaged up to the seating face.
3. Apply initial torque and tighten the bolts according to the angles/torques in stages as specified in the "Tightening table".
4. In case of replacing main and big end bearings/overhaul/piston seizures, fit new bolts for main bearing cap, connecting rod cap, balance weight & cylinder head.

1 Nm = 0.102 kgm = 0.74 lb.ft.

8.1.2 Tightening Torque Dynapac Engine 4R1040T/4R1040NA Table or fasteners

8. Tightening Torque

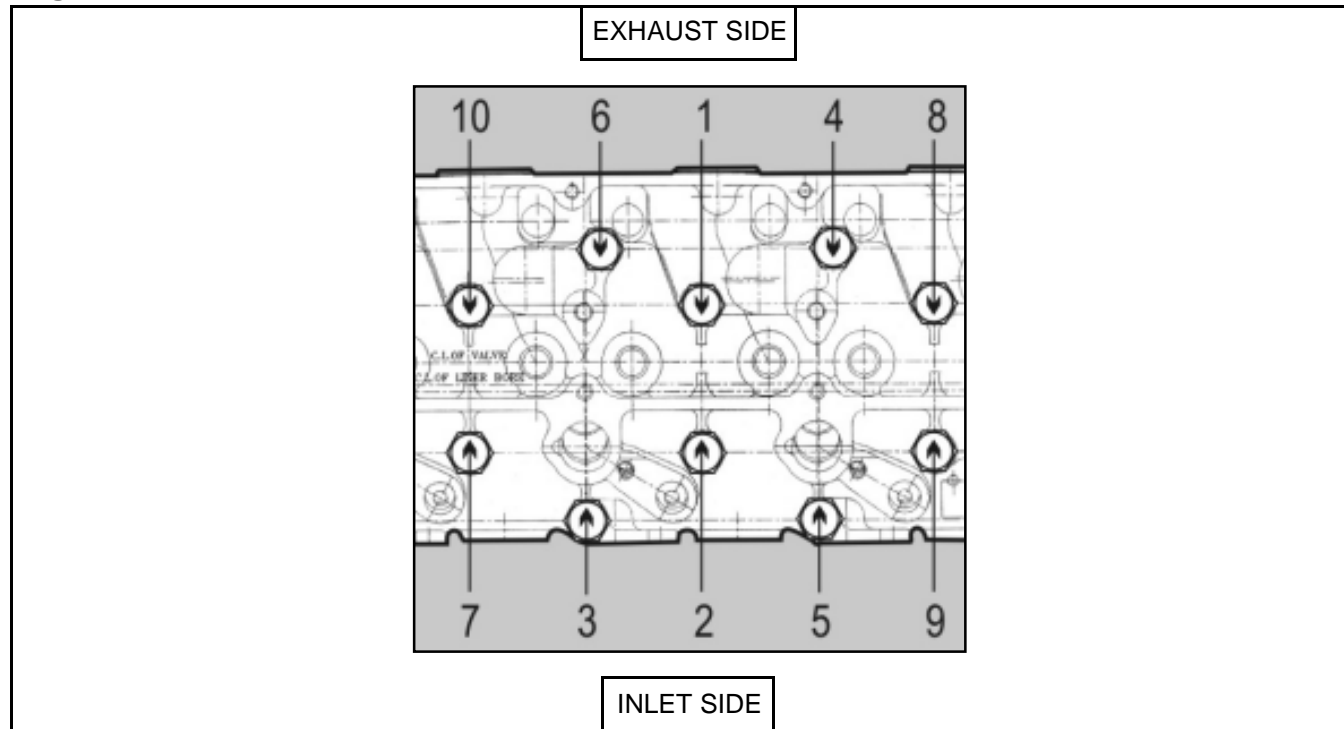
Sr. No.	Description	Initial Torque kgm	Tightening Method Angle/kgm			Total Angle Torque
			Stage1	Stage2	Stage3	
1	Bolt for balance weight (M12x1.75x60mm long, 10.9 grade)	3	30°	30°	-	60°
2	Bolt for main bearing cap (M14x2x128 mm long, 10.9 grade)	3	60°	45°	-	105°
3	Bolt for Connecting rod (M13x1.25x55mm long, 10.9 grade)	3	3 kgm	6 kgm	-	9 kgm
4	Bolt for Crank pulley (M24x2x110 mm long, 10.9 grade) without power take off	5	25 kgm	48 kgm	-	48 kgm
5	Bolt for flywheel (M10x1x45mm long, 10.9 grade)	3	30°	60°	-	90°
6	Bolt for flywheel housing (M10x1.5x40mm long, 10.9 grade)	5	-	-	-	5 kgm

Sr. No.	Description	Initial Torque kgm	Tightening Method Angle/kgm			Total Angle Torque
			Stage1	Stage2	Stage 3	
7	Nut for injector	3	-	-	-	3 kgm
8	Nut for fuel pump hub M14	8	-	-	-	8 kgm
9	Bolt for cylinder head (M12x1.5-12.9grade) for sequence of tightening torque refer Fig 8.2	3	90°	62°	-	-
10	All H.P. pipe nut	2.3	-	-	-	2.3 Kgm
11	All M8x1.25 screws & bolts 8.8	2.5	-	-	-	2.5 kgm
12	All M10x1.5 screws & bolts 8.8	3.5	-	-	-	3.5 kgm
13	All M12x1.75 screws & bolts 8.8	7	-	-	-	7 kgm

8. Tightening Torque

8.2 Tightening torque sequence

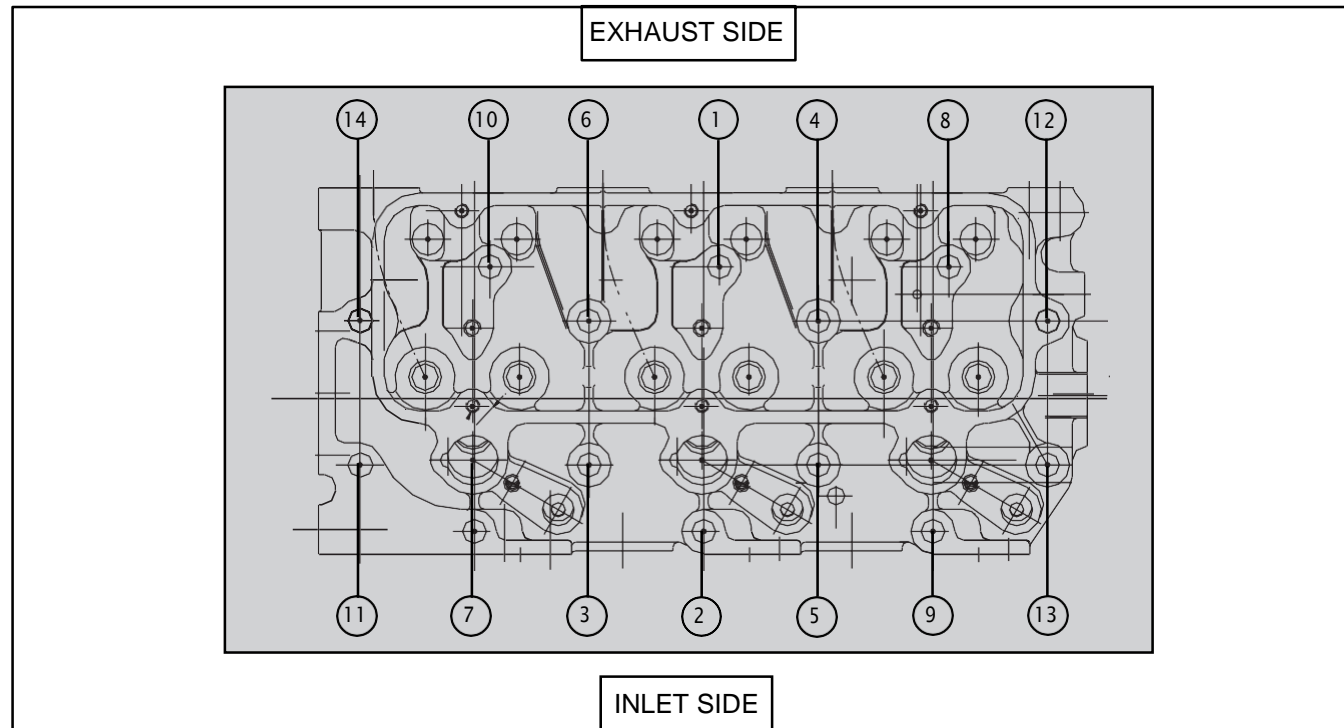
Tightening torque sequence for cylinder head bolts for Dynapac 4R1040T/4R1040NA Engines is shown below



8.2 Tightening torque sequence

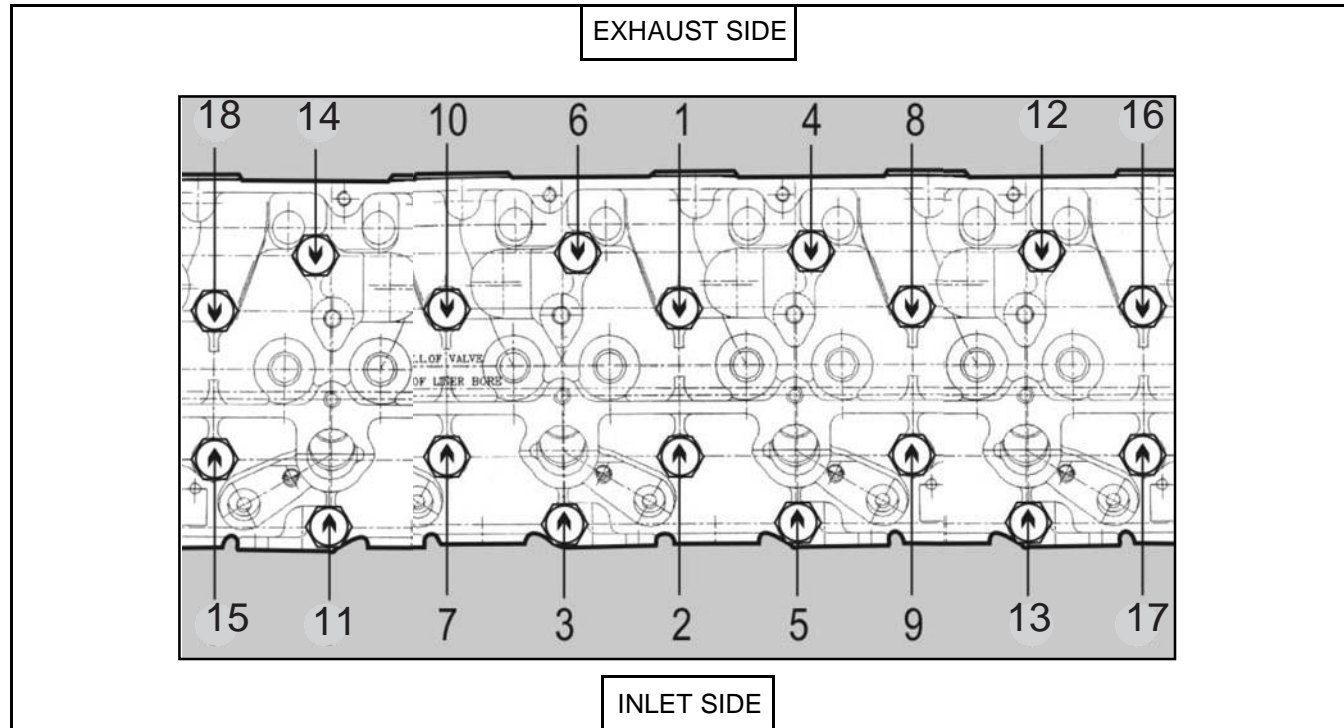
8. Tightening Torque

Tightening torque sequence for cylinder head bolts for Dynapac 4R1040T/4R1040NA Engines is shown below



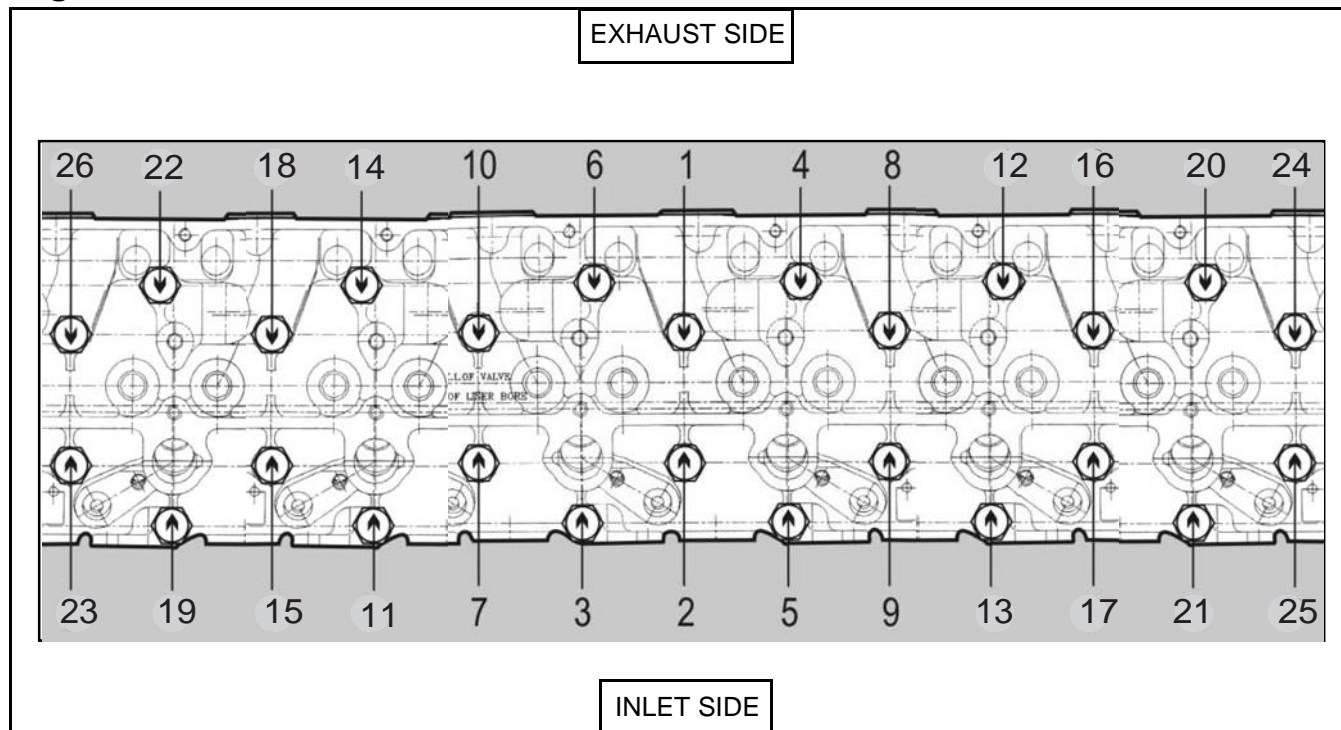
8. Tightening Torque

Tightening torque sequence for cylinder head bolts for Dynapac 4R1040T/4R1040NA Engines is shown below



8. Tightening Torque

Tightening torque sequence for cylinder head bolts for Dynapac 4R1040T/4R1040NA Engines is shown below



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