
Perkins 4000 Series

4006-23 TAG1A, TAG2A and TAG3A Inline diesel engine

WORKSHOP MANUAL

6 cylinder turbo charged diesel engine for electric power applications

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General safety precautions

These safety precautions are important. You must refer also to the local regulations in the country of use. Some items only refer to specific applications.

- Only use these engines in the type of application for which they have been designed.
- Do not change the specification of the engine.
- Do not smoke when you put fuel in the tank.
- Clean away fuel which has been spilt. Material which has been contaminated by fuel must be moved to a safe place.
- Do not put fuel in the tank while the engine runs (unless it is absolutely necessary).
- Do not allow sparks or fire near the batteries (especially when the batteries are on charge) because the gases from the electrolyte are highly flammable. The battery fluid is dangerous to the skin and especially to the eyes.
- Do not smoke when you are in the working area of the engine.
- Isolate the engine and disconnect the battery before a repair is made to the electrical system.
- Do not clean, add lubricating oil, or adjust the engine while it runs (unless you have had the correct training, even then extreme care must be used to prevent injury).
- Do not make adjustments that you do not understand.
- Ensure that the engine does not run in a location where it can cause a concentration of toxic emissions.
- Ensure that the exhaust system from the engine is supported.
- Other persons must be kept at a safe distance while the engine or auxiliary equipment is in operation.
- Do not permit loose clothing or long hair near moving parts.
- Keep away from moving parts during engine operation.

Warning! *Some moving parts cannot be seen clearly while the engine runs.*

- Do not operate the engine if a safety guard has been removed.
- Do not remove the filler cap or any component of the cooling system while the engine is hot and while the coolant is under pressure, because dangerous hot coolant can be discharged.
- Only one person must control the engine.
- Ensure that the engine is operated only from the control panel or from the operator's position.
- If your skin comes into contact with high-pressure fuel, obtain medical assistance immediately.
- Diesel fuel and lubricating oil (especially used lubricating oil) can damage the skin of certain persons. Protect your hands with gloves or a special solution to protect the skin.
- Ensure that all personal protection equipment for your head, ears, eyes and feet etc, are used when you are in the working area of the engine.
- Do not wear clothing which is contaminated by lubricating oil. Do not put material which is contaminated with oil into the pockets of clothing.
- Discard used lubricating oil in accordance with local regulations to prevent contamination.
- Ensure that the control lever of the transmission drive is in the "out-of-drive" position before the engine is started.
- Use extreme care if emergency repairs must be made in adverse conditions.
- The combustible material of some components of the engine (for example certain seals) can become extremely dangerous if it is burned. Never allow this burnt material to come into contact with the skin or with the eyes.
- Always use a safety cage to protect the operator when a component is to be pressure tested in a container of water. Fit safety wires to secure the plugs which seal the hose connections of a component which is to be pressure tested.

Continued

2

Specifications

Basic engine data

Number of cylinders.	6
Cylinder arrangement..	Vertical, in-line
Cycle	Four stroke
Induction system..	Turbocharged, air cooled C.A. in radiator (air to air)
Combustion system.	Direct injection
Nominal bore	160 mm
Nominal stroke.	190 mm
Compression ratio	13:1
Cubic capacity	22,92 litres
Firing order	1, 5, 3, 6, 2, 4
Direction of rotation	Anti-clockwise viewed on flywheel
Lubricating oil capacity:	
Total system	122,7 litres (27 gallons)
Sump maximum..	113,7 litres (25 gallons)
Sump minimum	90,9 litres (20 gallons)
Lubricating oil pressure:	
At rated speed (Min)	200 kPa (29 lb/in ²)
Typical coolant capacity of engine..	36 litres (8 gallons)
Typical coolant capacity of engine and radiator	105 litres (23 gallons)

Torque data

Description	Thread size	Torque		
		Nm	lbf ft	kgf m
Crankcase and crankshaft				
Sump bolts into crankcase	M10	54	40	5,5
Sump bolts into gearcase (aluminium)	M10	40	30	4
Main bearing cap bolts	See Operation 5-6			
Main bearing cap side capscrews	M16	n/a	n/a	n/a
Oil feed block bolts	M10	27	20	2,7
Connecting rod bolts	See Operation 4-2			
Piston cooling jet bolts	M10	27	20	2,7
Camshaft				
Camshaft gear bolts	M12	150	110	15,2
Camshaft thrust plate bolts	M10	50	35	5,1
Idler gear hub bolts	M10	50	35	5,1
Engine feet bolts	M10	50	35	5,1
Cylinder head				
Cylinder head bolts (Factory Fitted)		175 + 120°	130 + 120°	17,8 + 120°
Cylinder head bolts (Waisted) - head marked 'W'	M24	720	530	73,4
General				
M20 - Grade 8.8 steel bolts to BS3692	M20	400	290	40,7
M16 - Grade 8.8 steel bolts to BS3692	M16	210	150	21,4
M12 - Grade 8.8 steel bolts to BS3692	M12	85	60	8,6
M10 - Grade 12.9 steel bolts to BS3692	M10	70	50	7,1
M10 - Grade 8.8 steel bolts to BS3692	M10	50	35	5,1
M8 - Grade 8.8 steel bolts to BS3692	M8	25	18	2,5
M6 - Grade 8.8 steel bolts to BS3692	M6	10	7	1,0
M6 - Grade 12.9 steel capscrews to BS4168: Part 1	M6	16	12	1,6
M5 - Grade 12.9 steel capscrew to BS4168: Part 1	M5	13	10	1,3
3/8" UNF		40	30	4
5/8" UNF		200	150	20,3
1/2" UNC		90	68	9,1
7/16" UNF		66	50	6,7
5/16" UNF		22	16	2,2
Starter motors	M12	95	70	7,1
Alternator nut	M24	75	55	7,6
Taper lockbush	M8	20	15	2
Fuel pipes		50	35	5,1

Rocker box and valve gear

To remove and fit the rocker box and valve gear

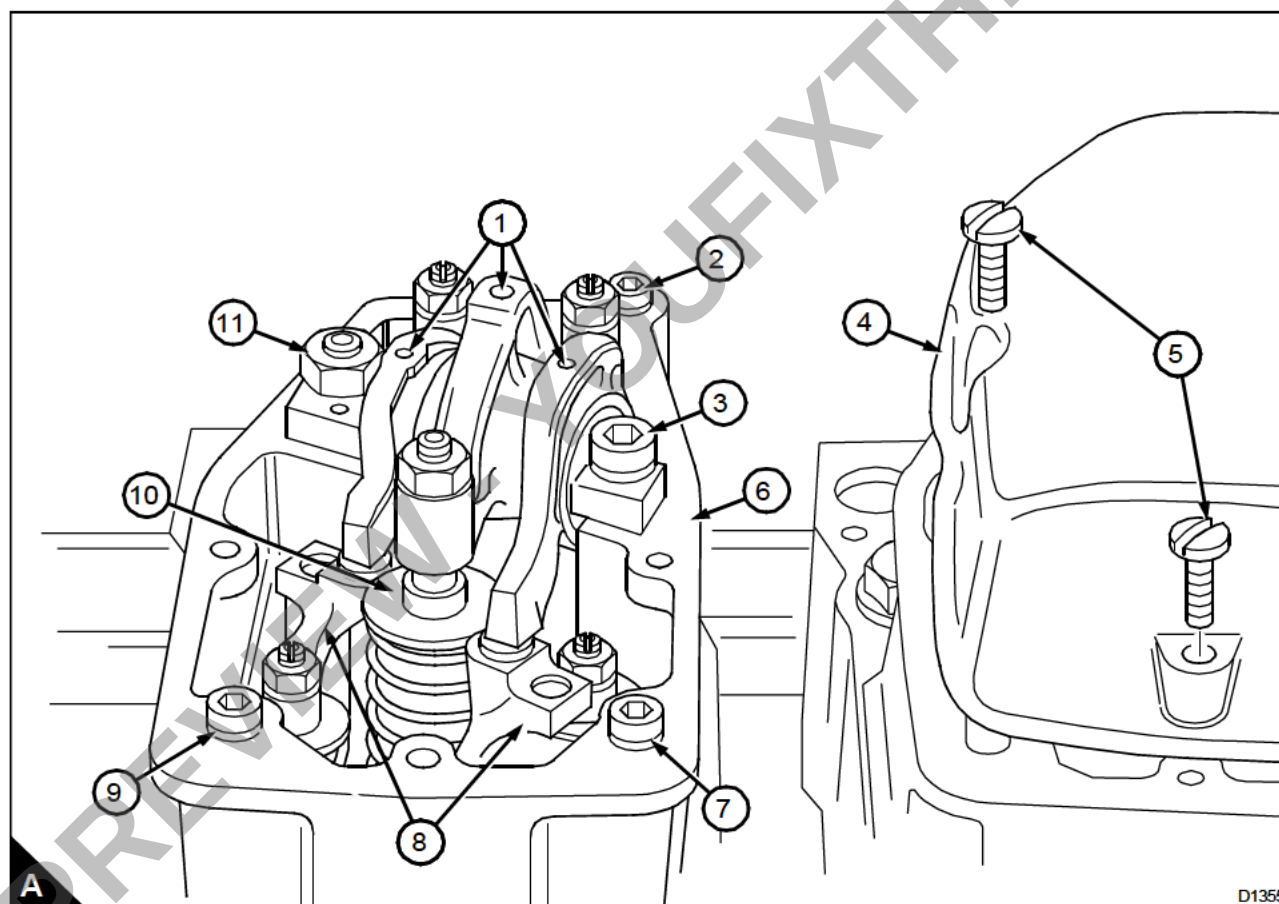
Operation 3-1

Special requirements

Consumable products	
Description	Part number
POWERPART Hydraulic threadseal	21820121

To remove

- 1 Remove the retaining screws (A5) and lift off the rocker cover (A4). Remove the rocker cover joint and discard.
- 2 Remove the nut (A11) and the Allen screw (A3) then lift off the rocker assembly (A1), the cup pad (A10), the bridge pieces (A8) and the push rods.
- 3 Remove the retaining Allen screw (A2, A7, A9) and remove the rocker box (A6).
- 4 A light blow with a hide mallet may be needed to free the rocker box from its joint.



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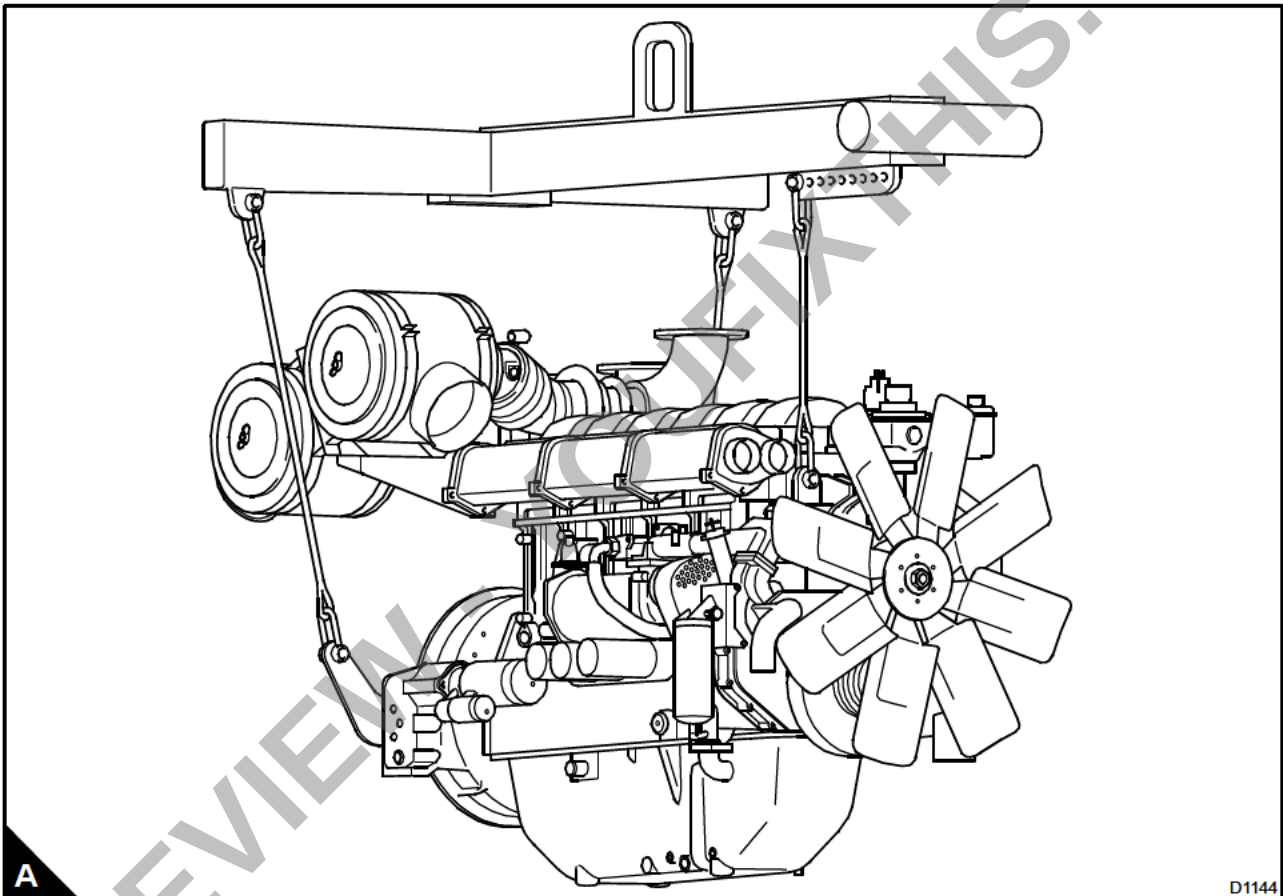
Engine lift equipment

When lifting engine or generating sets, special lifting equipment is required. It is recommended that a spreader lifting beam of the correct lifting load capacity is used and that chains, hooks, shackles and eye bolts etc. are checked that they are well within their safe working loads. The load should be secure, stable and balanced when lifting.

The lifting chains etc must be firmly secured to the load by means of hooks etc on to the purpose-designed lifting points, and that included angle is not exceeded (A).

In order to accommodate the chains for lifting it may be necessary to have to remove engine components such as air filters etc to prevent damage, but this should be avoided where the chains can be clear by non-detrimental means.

Warning! Lifting equipment should be used by trained personnel only. Generating sets must be lifted using the lifting lugs on the engine frame and a spreader lifting beam. The engine lifting brackets and alternator lifting lugs must not be used.



PID Maps

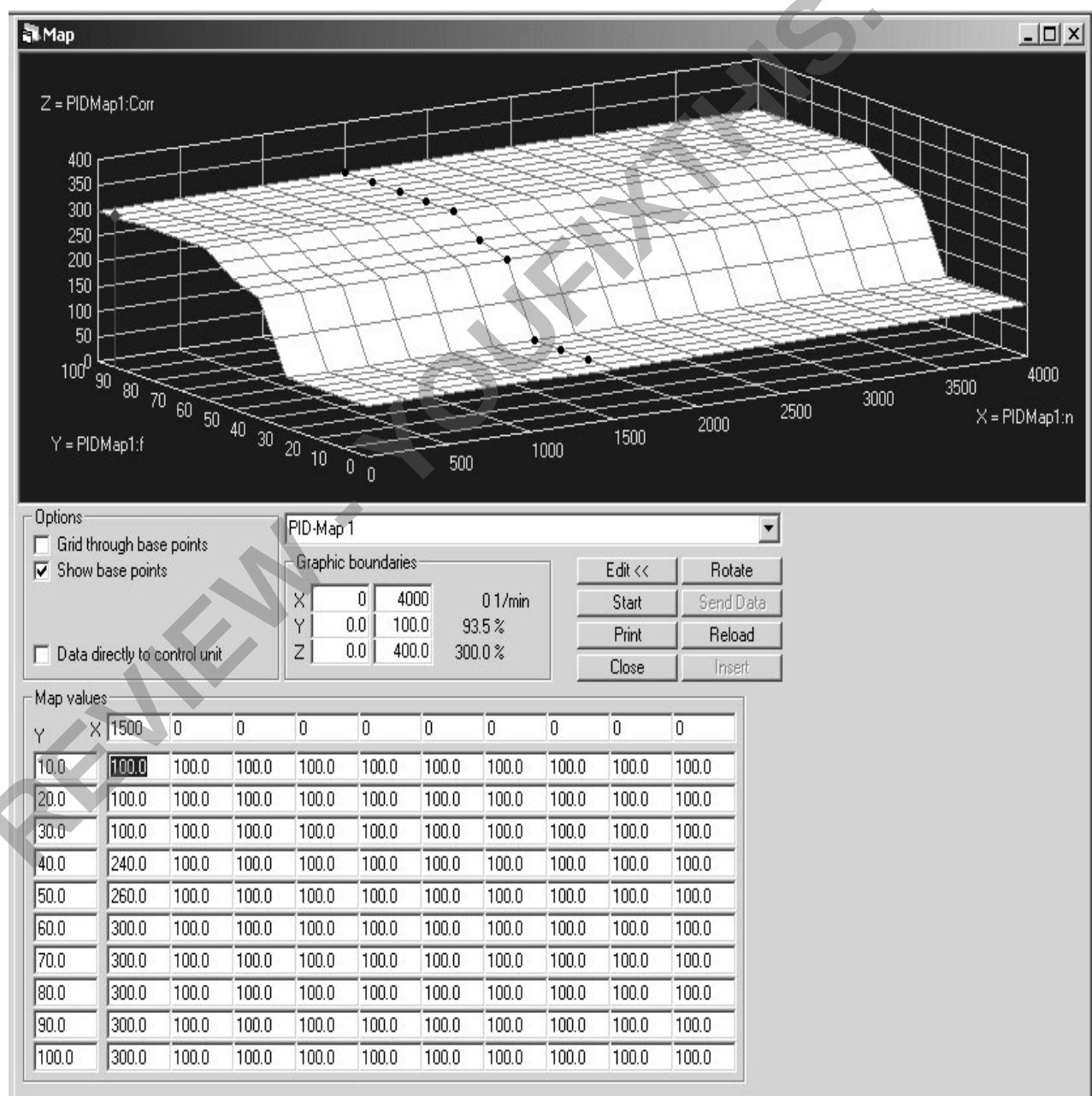
To adjust

Operation 14-28

Since the PID values which give optimum performance are different for various load values (In general, gains may be greater with increasing load), The governor gains are mapped, gain vs load. These maps are created during the engine development process but can be changed using the service tool.

There are two sets of PID maps, one for speed determined by parameter **SpeedFix1** and one for speed determined by parameter **SpeedFix2**.

To adjust the maps if required, on the Adjustment – **Speed** governor screen, click the PID Map 'Open' button and then click the 'Edit' button on the map screen. For fixed speed engines, only the first column is used. If necessary, change the gain entry against the actuator position (Y axis) where the instability is occurring. The values are percentages, i.e. 100 represents 100% and does not change the basic PID values.



Droop setting

For manual parallel operation in Droop mode this setting allows the engine to run in Droop similar to a mechanical speed governor, i.e, when set to Droop mode the engine will run at rated speed plus Droop %. E.g, 1500 rpm at 4% droop will run at 1560 rpm at no load and 1500 rpm at full load. When operating in droop mode, the following parameters must be set :

- **Droop**

Set to required percentage droop – there are separate droop settings for 1500 and 1800 rev/min, the 1800 rev/min settings being labelled Droop2.

- **DroopRefLo**

To set this parameter, with the governor powered up and the engine running at no load, read parameter **ActPos** from the Speed Governor – Adjustment tab as shown below and enter this value into parameter **DroopRefLo**.

- **DroopRefHi**

To set this parameter, with the governor powered up and the engine running at full load, read parameter **ActPos** and enter this value into parameter **DroopRefHi**.

- **DroopSpeedRef**

Set this parameter to the nominal running speed of the engine i.e. 1500 or 1800 rev/min.

Engine Stop

- **Switch or Impulse**

If this is set to switch, engine stop is active only as long as the stop command is coming in else if this is set to Impulse, engine stop is active by a single switching pulse until the engine stops.

- **Close or Open**

If this is set to Open then opening the stop switch will stop the engine. If this is set to Close then closing the stop switch will stop the engine.

Common alarm

If the WarnFlashOn box is ticked, the external warning light will flash otherwise it will be steadily illuminated.

The ResetOn box is not used in this application.

Synchroniser settings

Configuration **Adjustment** **Display**

Synchronizer Configuration

☒ Use AnalogIn2

AnalogIn2_Value	4.467	V
AnalogIn2_RefLow	0.000	V
AnalogIn2_RefHigh	5.000	V
AnalogIn2_ErrorLow	0.000	V
AnalogIn2_ErrorHigh	5.000	V
AnalogIn2_Filter	8	

ADC2 Type

☒ 0...5V
☐ 0...10V
☐ 4...20 mA

SyncInput Error

☒ Reset
☐ Hold

SyncInput ValueByError

☒ Last
☐ Subst

SyncInput	89.4	%
SubstSyncInput	0.0	%
SynchronFactor	40.0	%
SynchronReference	50.00	%

Engine Load Control **Synchronizer**

- **ADC2 Type**

This parameter enables selection of the type of analogue input 2. The settings are:

- 0 to 5 volt input
- 0 to 10 volt input
- 4 to 20 mA input

For external speed control from a 5K potentiometer, select 0 to 5 volt.

The other available adjustments are:

- **AnalogIn2_RefLo**

This sets the lowest value the analogue input 2 will accept as a valid input.

- **AnalogIn2_RefHigh**

This sets the highest value the analogue input will accept as a valid input. F

- **AnalogIn2_ErrorLow**

This sets the low value at which the analogue 2 input signal will give an error, e.g. if *AnalogIn2_RefLo* was set at 0.5 volt, *AnalogIn2_ErrorLo* could be set at 0.3 volt. This enables detection of an open circuit or faulty input signal.

- **AnalogIn2_ErrorHigh**

This sets the high value at which the analogue 2 input signal will give an error, e.g. if *AnalogIn2_RefHi* was set at 4.5 volt, *AnalogIn2_ErrorHi* could be set at 4.7 volt. This enables detection of a faulty input signal.

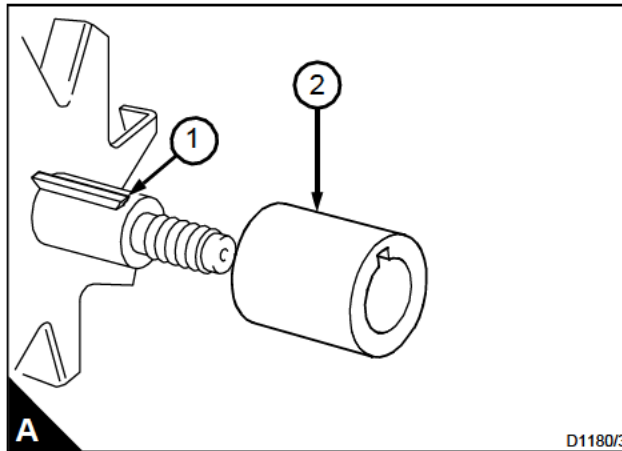
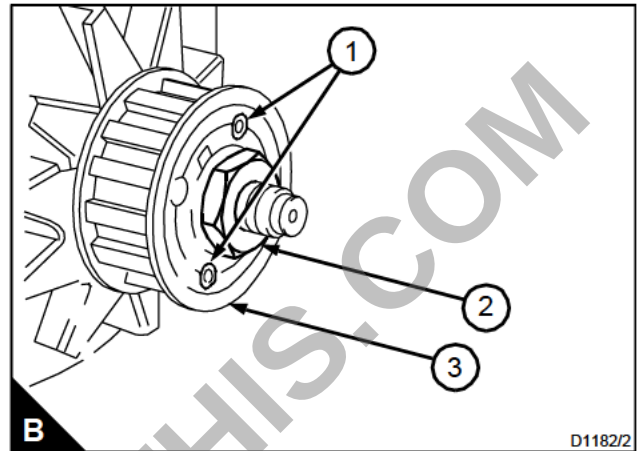
- **SynchronFactor / SynchronReference**

If using analogue input 2, these two parameters set the range of the external speed control and the reference % for nominal speed i.e. if 1500 rev/min is the nominal running speed and speed variation of +/- 5% speed variation is required, set *SynchronFactor* at **10%** and *SynchronReference* at **50%**

To fit the alternator drive pulley

Operation 14-5

- 1 Align the hub (A2) to the key (A1) in the alternator shaft. Fit the hub.
- 2 Fit the washer and the nut (B2). Tighten the nut to 75 Nm (55 lbf ft) 7,64 kgf m.



- 3 Fit the toothed pulley on to the inner hub (A2).
 - 4 Fit the two locking screws (B1) and tighten them evenly to 20 Nm (15 lbf ft) 2 kgf m.
 - 5 Use small hammer action on the pulley face and check the locking screw torque again.
 - 6 Ensure that the pulley rotates freely.
- Caution:** The locking screw torque must be checked after a few hours of engine operation.

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