Mahindra Rise.

Mahindra JIVO 245 DI

SERVICE MANUAL

INDEX

Mahindra Rise.

INDEX

GENERAL

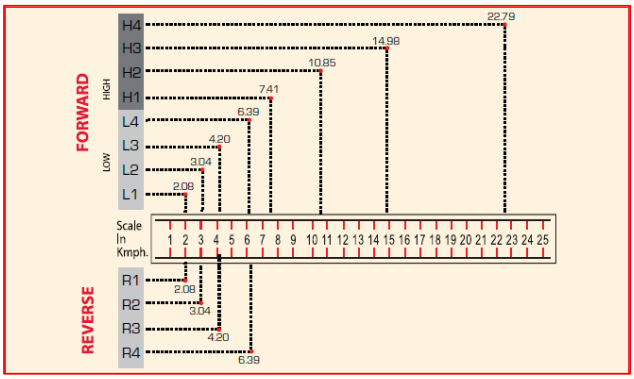
MAHINDRA JIVO 245DI

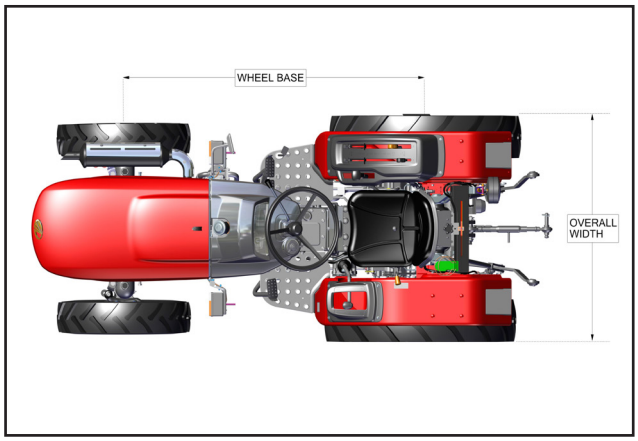
ENGINE	
Type	Mahindra - MDI 1365 NX24
No. of Cylinders	2
Engine Power	20 H.P. & 24 H.P.
Bore	88.9
Stroke	110
Displacement CC	1366
Rated Governed Speed	2300 ± 50
Low Idle R.P.M.	900 ± 50
High Idle R.P.M.	2550 ± 50
Air Cleaner	Dry type
Cooling System	Forced circulation of coolant
CLUTCH	
Clutch Type	8” Dry friction plate
TRANSMISSION	
Type	Mechanical, Sliding Mesh
No of Gears	8 Forward & 4 Reverse
Power Take Off	Rear mounted six splines, Non - CRPTO - 540 R.P.M & 540 E as Opt.
PTO rpm at rated engine speed	605 & 750
Brakes	Mechanical dry disc type and oil Immersed brakes (OIB)
HYDRAULICS	
Type	Hytech Hydraulics. Fully live Hydraulic with Position & Draft Controls
Lifting Capacity (Kgs)	450 at Frame and 750 at Hitch
TRACTOR	
Steering Type	Worm & Roller - for Mechanical Steering and Hydrostatic Steering
Tyre Size Front	6.0 x 14 (4WD) - 6 PR, 5.2 x 14 (2WD)
Tyre Size Rear	8.3 x 24 - 6 PR
CAPACITIES (litres)	
Engine (including filter)	4
Cooling System (Approx)	5.7
Fuel Tank	22
Transmission & Hydraulic System	19 (Dry brake & Mech. Steering), 23 (PS + OIB)
Total weight of Tractor Without Ballast (KG)	1000
TRACTOR DIAMENSIONS (mm)	
Overall Height (mm)	1373
Overall Length (mm)	2746
Ground Clearance (mm)	285
Overall Width (mm)	1130
Wheel Base (mm)	1570
Front Track Width (mm)	864 Std
Rear Track Width (mm)	762 to 915

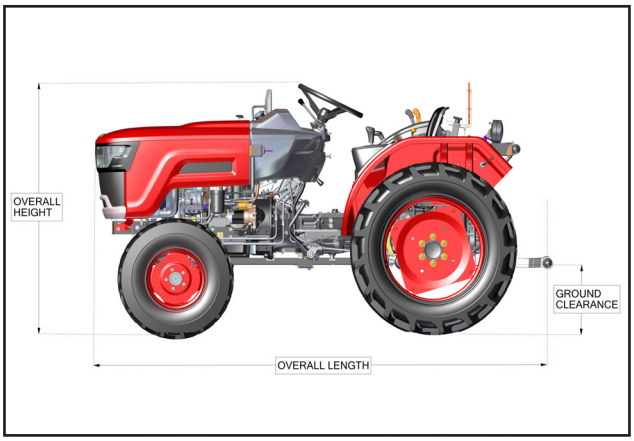
PRODUCT SPECIFICATION

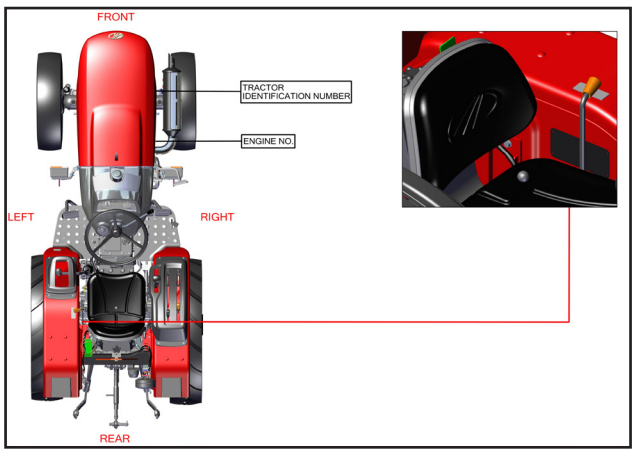
Gear	Speed km/hr	Speed in KMPH Engine RPM 2046 PTO RPM 540 PTO Mode- 540	Speed in KMPH Engine RPM 1654 PTO RPM 540 PTO Mode- 540E
L1	2.08	1.85	1.50
L2	3.04	2.71	2.19
L3	4.20	3.75	3.03
L4	6.39	5.69	4.60
H1	7.41	6.54	5.29
H2	10.85	9.57	7.74
H3	14.98	13.21	10.68
H4	22.79	20.11	16.25
R1	2.08	1.85	1.50
R2	3.04	2.71	2.19
R3	4.20	3.75	3.03
R4	6.39	5.69	4.60

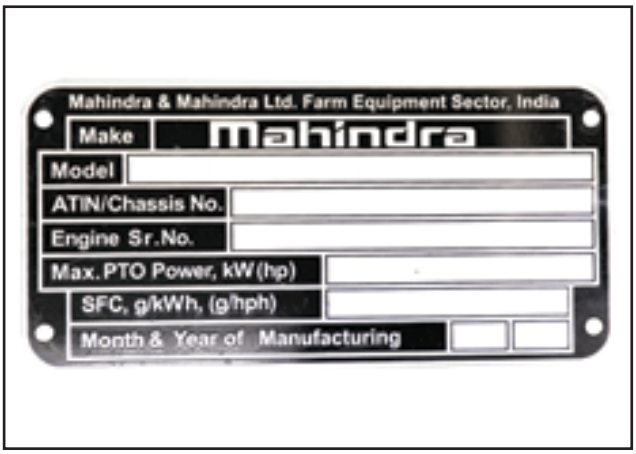
Application Suitability Chart		
Sr No	Application	Recommanded Gear
1	Puddling	L1/L2
2	Ploughing	L2/L3
3	Loader	L4 and LR
4	Cultivator	L3,L4,H1
5	Spraying	L3,L4,H1
6	Haulage	H2,H3,H4
7	Rotavator	L3,L4











SAFETY - ALERT SYMBOL AND TERMS

Why is SAFETY important to you?
ACCIDENTS DISABLE AND KILL
ACCIDENTS ARE COSTLY
ACCIDENTS CAN BE AVOIDED

This Safety Alert Symbol means ATTENTION! BE ALERT! YOUR SAFETY IS INVOLVED!

The safety alert symbol identifies important safety messages on machines, safety signs, in manuals, or elsewhere. When you see this symbol, be alert to the possibility of personal injury or death. Follow the instructions given in the safety messages.

Remember that YOU are the key to safety. Good safety practices not only protect you, but also the people around you. Study the features in this manual and make them a working part of your safety program. Keep in mind that this safety section is written only for this type of machine. Practice all other usual and customary
safe working precautions, and above all - REMEMBER - SAFETY IS YOUR RESPONSIBILITY. YOU ONLY CAN PREVENT SERIOUS INJURY OR DEATH.

SAFETY - DANGER, WARNING and CAUTION

Whenever you see the words and symbols shown below, used in this book and on decals, you MUST take note of their instructions.

⚠ DANGER :- The symbol and the word DANGER indicates an imminently hazardous situation with, if not avoided, will result in DEATH OR SERIOUS INJURY.

⚠ WARNING :- The symbol and the word WARNING indicates a potentially hazardous situation. If the instructions or procedures are not correctly followed it could result in PERSONAL INJURY, OR LOSS OF LIFE.

⚠ CAUTION :- The symbol and the word CAUTION identifies special instructions or procedure which if not strictly observed, could result in DAMAGE, DESTRUCTION OF EQUIPMENT, OR PERSONAL INJURY.

⚠ NOTE :- The word NOTE indicates points of particular interest for more efficient and convenient repair or operation

MAINTENANCE

MAINTENANCE CHART

Details	Activity	To be done by Operator	To be done by Dealer Technician			
		10 Hrs/ Periodic	100 Hrs	350 Hrs	600 Hrs	850 Hrs
Tractor						
Tractor Cleaning & washing	Do	✓	✓	✓	✓	✓
Grease all Nipples	Do	✓	✓	✓	✓	✓
Toe- In (4WD & 2WD)	Check		✓	✓	✓	✓
All Visible Nuts & Bolts	Tighten	✓	✓	✓	✓	✓
Oil Leakages	Check & rectify	✓	✓	✓	✓	✓
Engine						
Oil Level	Check	✓	✓	✓	✓	✓
Oil (API CH4/SAE 15W40/ Mahindra M-Star)	Change		✓	✓	✓	✓
Oil Filter	Change		✓	✓	✓	✓
Valve Clearance (Tappet Setting)	Check			✓	✓	✓
Low-Hi Idle Engine R.P.M.	Check		✓	✓	✓	✓
Power, Response & Exhaust Smoke	Check		✓	✓	✓	✓
Cylinder Head bolt torque	Check			✓	✓	✓
Air Cleaner						
Pre-cleaner*	Clean	✓	✓	✓	✓	✓
Air Cleaner Connections	Check	✓	✓	✓	✓	✓
Fuel System						
Fuel Filter	Change			✓	✓	✓
Injector	Check			✓	✓	✓
Transmission						
Oil level	Check	✓	✓	✓	✓	✓
Oil (Common Transmission & Hydraulic) Grade :EP-90 (Dry Brakes)/Mahindra M-Star Oil (OIB)	Change	Oil to be change at 850 hrs.				
Cooling System						
Thrash Guard	Clean	✓	✓	✓	✓	✓
Radiator Fins	Clean	✓	✓	✓	✓	✓
Coolant - Water	Check & Top Up	✓	✓	✓	✓	✓
Fan Belt & Fan Belt Tension	Check & Correct	✓	✓	✓	✓	✓
Hydraulics						
Suction Filter	Change		✓	✓	✓	✓
Suction Strainer	Clean					
Battery Electrolyte Level	Check	✓	✓	✓	✓	✓
Battery Terminals	Clean	✓	✓	✓	✓	✓
Battery Vent Plug Holes	Clean	✓	✓	✓	✓	✓
Alternator Belt & Alternator Belt Tension	Check	✓	✓	✓	✓	✓
Instruments & Gauges	Check		✓	✓	✓	✓
Light & Horn	Check		✓	✓	✓	✓
Clutch						
Free Play	Check		✓	✓	✓	✓
Brakes						
Free Play	Check		✓	✓	✓	✓
Breather	Check		✓	✓	✓	✓
Tyre						
Air Pressure	Check	✓	✓	✓	✓	✓
Steering Gear Box (Mechanical Bold Steering	Change	1100 hrs.				
Oil Level	Check	✓	✓	✓	✓	✓
Front Axle						
Front Wheel Bearing Pre-load	Check		✓	✓	✓	✓
Stay Rod Ball Joint	Check		✓	✓	✓	✓
Front Axle (4WD)						
Oil Level	Check	✓	✓	✓	✓	✓
Toe - in (3 to 5 mm)	Check & Set		✓			✓
Oil (80 W 90 GL5)	Change	Oil to be change at 850 hrs.				

* - Air cleaner primary element to be cleaned only after indication of its chocking. Air cleaner element to be changed after three cleaning Or 850 hrs.

MAINTENANCE CHART

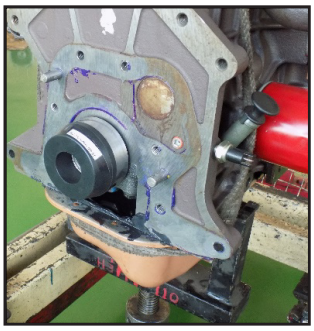
Type	Quantity in litres	Grade	Change Frequency
Fuel Tank	22	NA	NA
Engine Oil	4	API CH4 / SAE 15W40 / Mahindra M star Genuine Oil	Every Service
Transmission Oil	23 (OIB + PS), 19 (Dry Brake Mech. Steering)	EP 90 (Dry Brake) / Mahindra M Star Transmission oil (OIB)	850 Hrs
Front Axle 4WD	5	80 W 90 GL5	850 Hrs
Cooling System	5 (20HP) & 6 (24HP)	Redimix Coolant	1000 Hrs

SPECIAL SERVICE TOOL PART LISTS

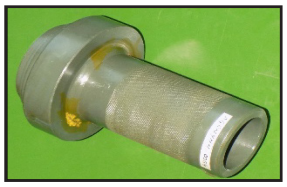
Sr. no.	Tool No	Tool Description	Aggregate
Engine SST			
1	AGENYNH0061	Protective sleeve Rear Oil seal	Engine
2	AGENYNH0054	Rear Oil seal Dolly	Engine
Transmission Tools			
3	AGTNYNH0092	Crimping Tool for Spline Shaft	Transmission
4	AGTNYNH0101	Dolly Oil Seal drop box retainer	Transmission
5	AGTNYNH0016	Dolly for Rear axle Oil Seal Retainer	Transmission
6	AGTNYNH0038	Dolly for Oil Seal Pressing Input Shaft Retainer	Transmission
7	AGTNYNH0013	PTO oil seal Dolly	Transmission
8	AGTNYNH0069	Slip Gauge for CCD	Transmission
9	AGTRYNH0001	Clutch centralizer	Tractor
4WD Axle Tools			
10	AGFAYNH0001	Oil Seal Press Dolly Beam Housing	4WD
11	AGFAYNH0053	Sninger Top Seal Fitment	4WD
12	AGFAYNH0037	Spline Shaft Crimping Nut Torque	4WD
13	AGFAYNH0001	Oil Seal Press Dolly Beam Housing	4WD
14	AGFAYNH0034	Dolly for Swivel Housing Oil Seal Pressing	4WD
15	AGFAYNH0034	Dolly for Swivel Housing Oil Seal Pressing	4WD
16	AGFAYNH0049	Sninger Bottom Seal Fitment	4WD
17	17 No allen key	Special ratchet for Drain Plug 4WD axle	4WD

SPECIAL SERVICE TOOL DETAILS

1	AGENYNH0061	2	AGENYNH0054



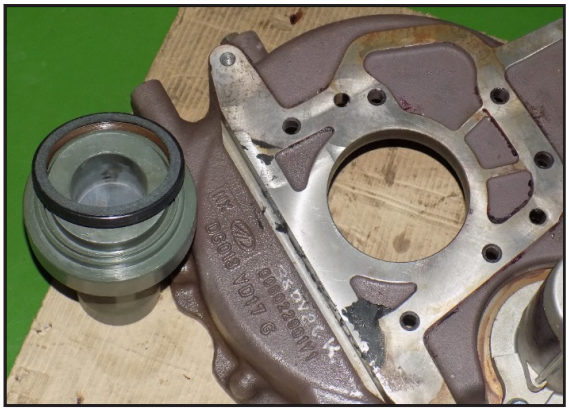
Protective sleeve for flywheel housing insertion in crank shaft.
It is essential to use protective sleeve to avoid damage of seal while assy.



Dolly for flywheel housing oil seal pressing- Use of this dolly will ensure proper fitment of seal in housing and will avoid repeat seal leakages

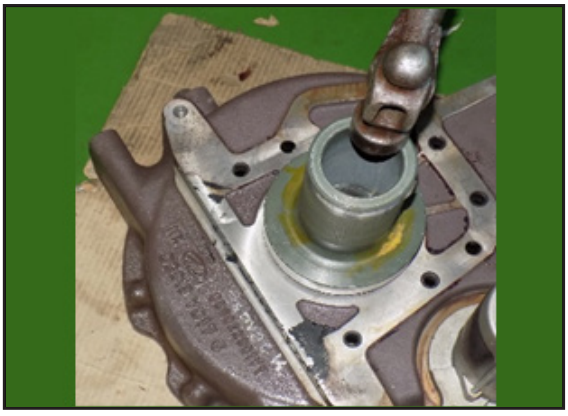
PROCEDURE TO USE TOOL

1



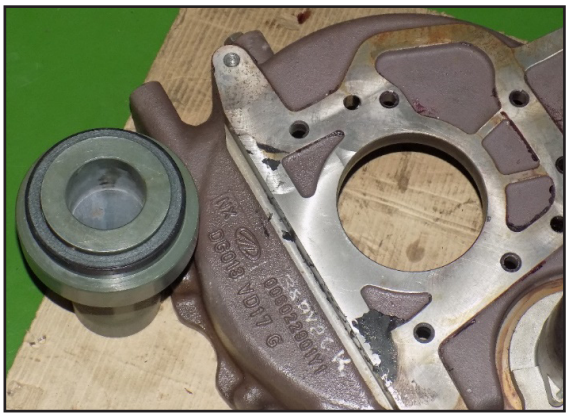
Place the oil seal on the dolly

2



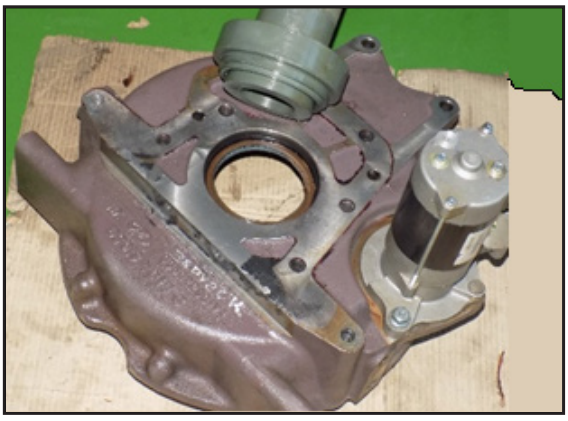
Hammer seal with the help of dolly

3



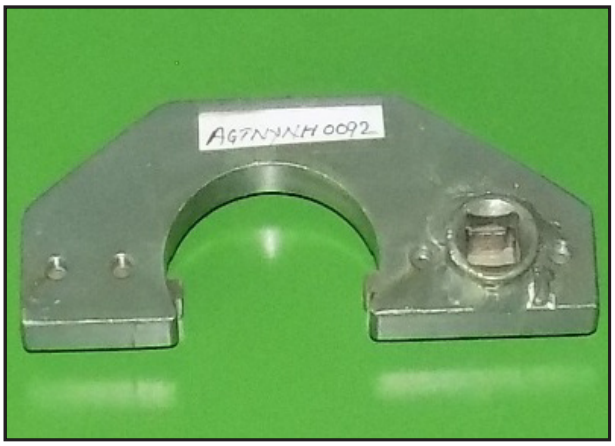
Assemble the oil seal on the dolly

4



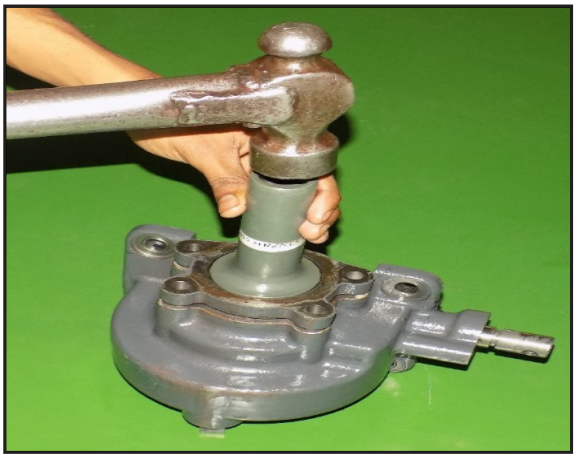
After pressing the oil seal remove dolly

3	AGTNYNH0092	PROCEDURE TO USE TOOL



Use tool to tighten lock nut on Spiral Bevel Shaft with torque wrench. Torque value-: (80-90) Nm

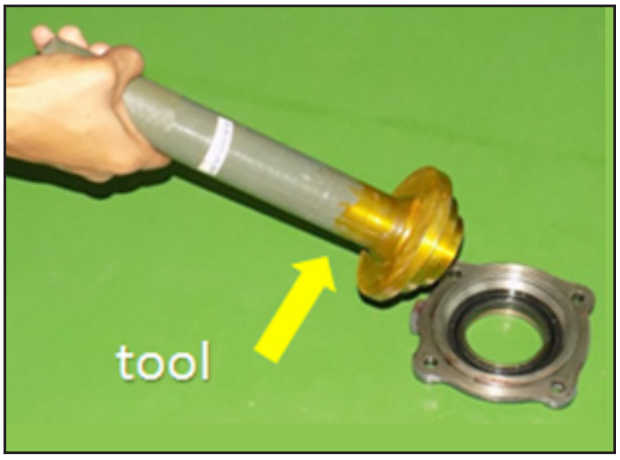
4	AGTNYNH0101	PROCEDURE TO USE TOOL



Place the oil seal on the dolly

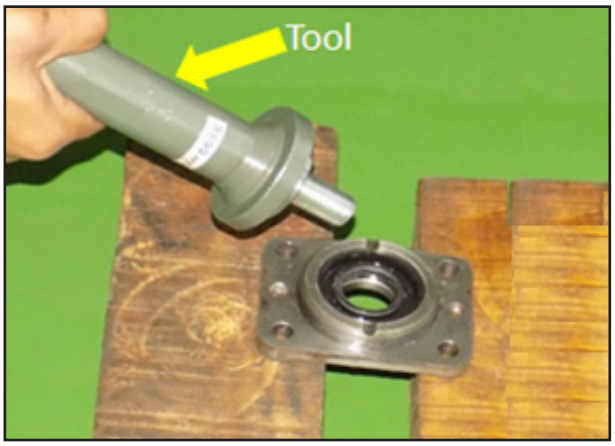
Hammer seal with the help of dolly

5	AGTRYNH0016	PROCEDURE TO USE TOOL



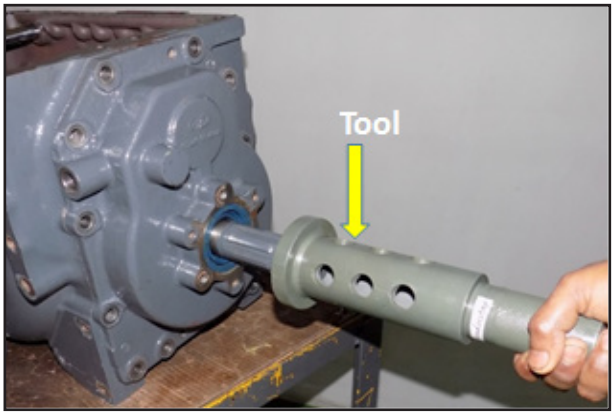
Place oil seal in rear axle casing.Then using the tool AGTRYNH0016 and hammer press the oil seal in it

6	AGTNYNH0038	PROCEDURE TO USE TOOL



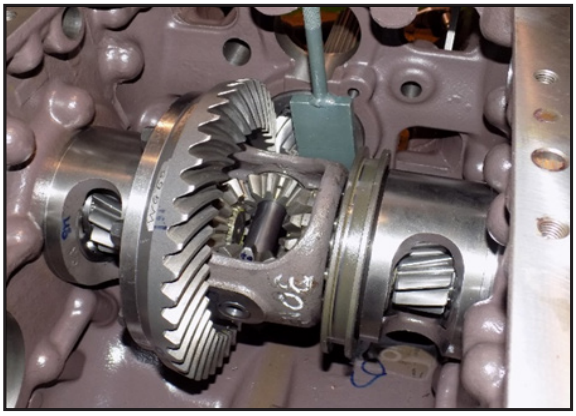
Place oil seal in Input Shaft Retainer. Then using the tool AGTNYNH0038 and hammer press the oil seal in it

7	AGTNYNH0013



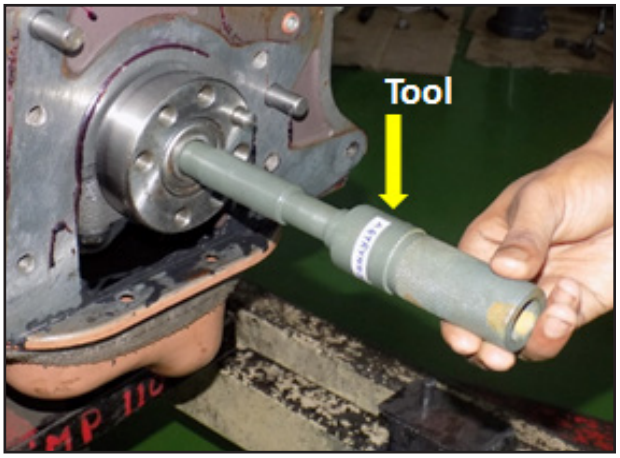
Dolly for oil seal pressing in PTO housing plate

8	AGTNYNH0069

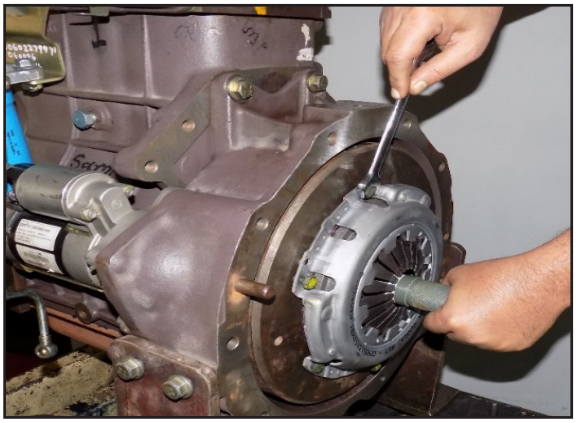


Gauge for checking CCD between bevel pinion and diff. case

9	AGTRYNH0001	PROCEDURE TO USE TOOL



Tool for centralizing the clutch properly



Insert tool in crankshaft & then pass clutch through it and fix it with bolts.

SPECIAL SERVICE TOOL DETAILS

10	AGFAYNH0001

Dolly for pressing slinger and bearing in housing

11	AGFAYNH0053

Dolly for pressing slinger in side housing

1	PROCEDURE TO USE TOOL

Place slinger on dolly & assemble bearing on it

12	AGFAYNH0037

Tool for Spiral Pinion shaft crimping nut

2	PROCEDURE TO USE TOOL

Insert dolly with sub assy inside Swivel Housing

PROCEDURE TO USE TOOL

Use tool to tighten lock nut on Spiral Bevel Shaft with torque wrench. Torque value-: (80-90) Nm

SPECIAL SERVICE TOOL DETAILS

13	AGFAYNH001	PROCEDURE TO USE TOOL

Dolly for pressing oil seal in beam housing

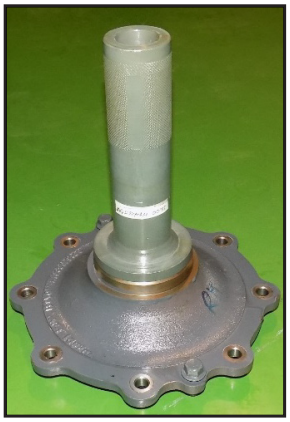
Place oil seal in beam housing and press with tool

14	AGFAYNH0034	PROCEDURE TO USE TOOL

Assemble bearing and oil seal on dolly

Insert Dolly AGFAYNH0034 with sub assembly of oil seal and bearing inside Swivel Housing

15	AGFAYNH0031

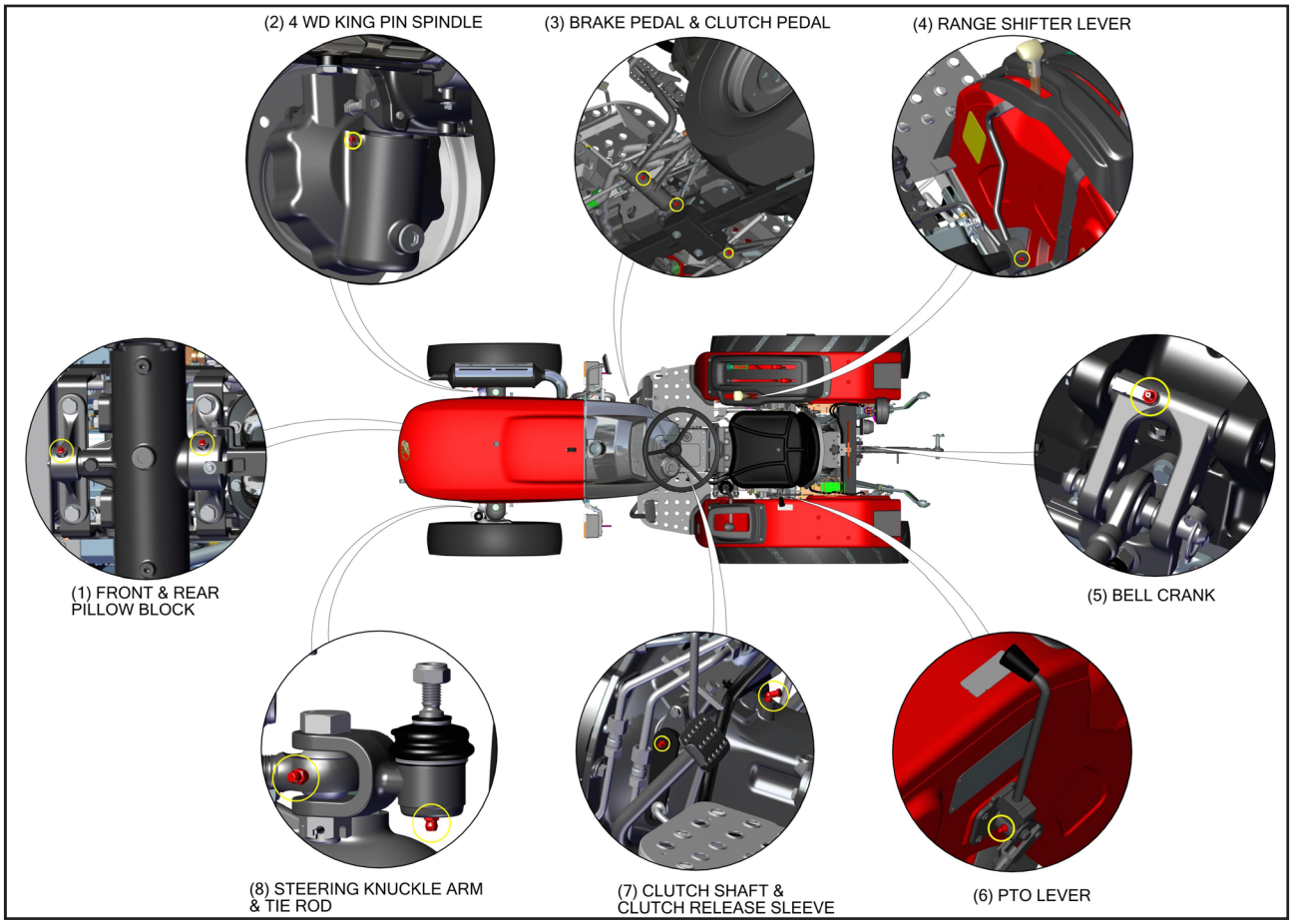


Dolly for hub end oil seal pressing

FAULT TRACING

Probable cause	Possible remedy
Engine not starting	
Stopper knob pulled out	Push the knob in
Water in fuel	Drain system, clean and refill with proper fuel
Fuel system choked	Replace Fuel Filter, Check and Clean dirt in tank
Batteries discharged	Charge or replace
Air cleaner choked	Clean air cleaner
Air trapped in fuel lines	Remove air from fuel lines, injector and fuel filter by loosening of went plug. Do not forget to re-tight it.
Excessive oil consumption	
Oil level in crankcase too high	Maintain correct oil level
Oil leaking	Rectify leakage
Crankcase breather clogged	Wash in breather mesh petrol, blow dry and replace
Engine overheats	
Insufficient water in the cooling system	Check water level in radiator and top up if necessary
Cooling system clogged	Clean out radiator & water jackets of engine
Insufficient oil	Top up and maintain proper oil level
Brakes dragging	Check brake linkages for free movement and adjust free pedal play
Belt Slippage	Check belt tension and correct it
Injector Clogged	Check nozzle opening pressure and Corrected it
Air cleaner choked	Remove check & clean
Improper grade / impurities in Fuel	Use correct grade of fuel
Excessive fuel consumption	
Fuel leaks	Tighten or replace fuel lines / Banjo Washer
Engine overloaded	Select the gear w.r.t load, speed
Engine not operating at proper temperature	Check cooling system and thermostat.
Hydraulics - no lifting or slow lifting	
Less/No oil in system	Check & fill oil to correct level.
Hydraulic lock valve closed	Open valve.
Hydraulic pump has lost its efficiency	Get the pump replaced.
Control valve defective	See Mahindra Tractor Dealer / Authorized Service Centre,
Control linkage defective	See Mahindra Tractor Dealer / Authorized Service Centre,
System overloaded	Reduce load on system.
Brakes	
Do not hold or slips	Adjust brakes or change linings if needed. Lining's oiled up; check bull pinion shaft oil seal.
Drag or uneven	Adjust brakes.
Return spring broken	Replace
Will not release	Release hand-brake. Check brake shaft for seizure.

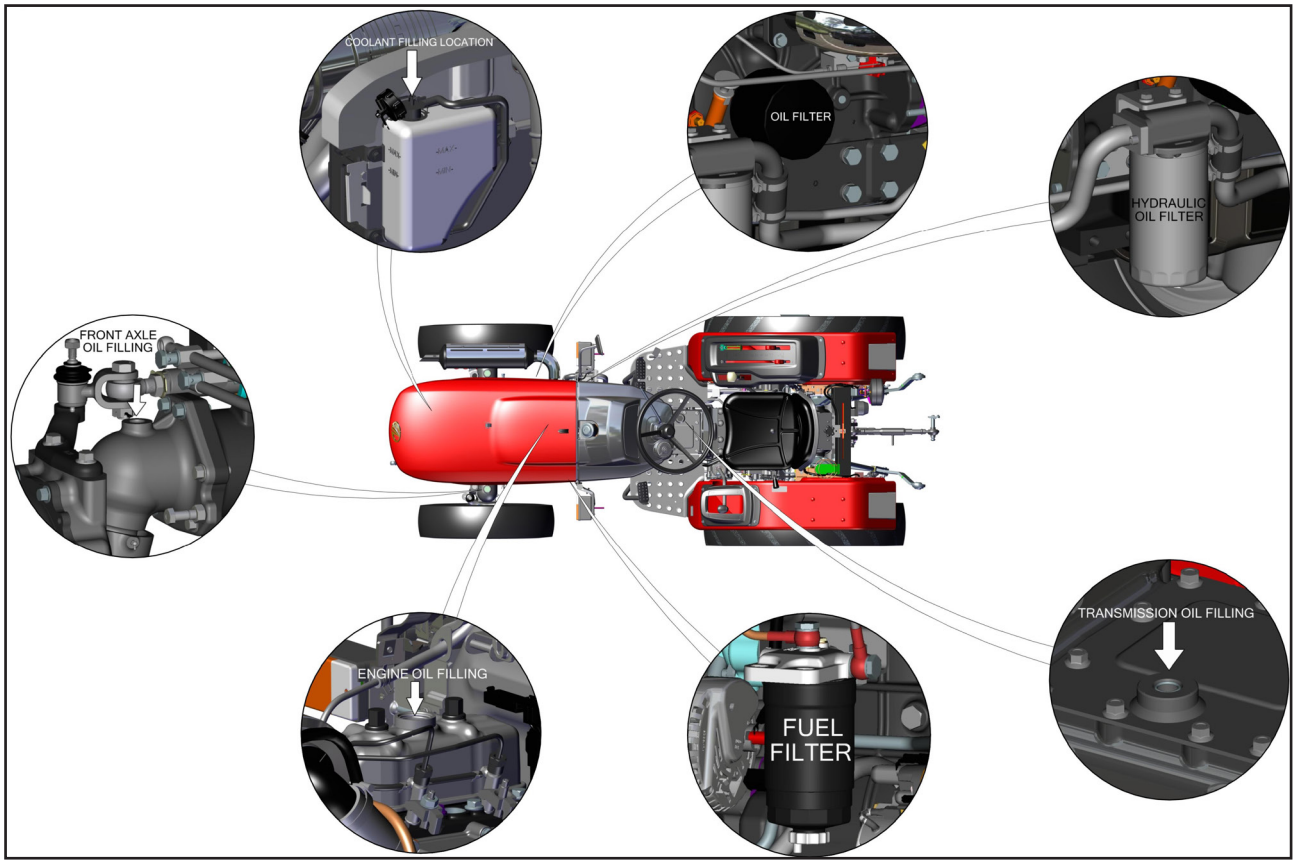
GREASING POINTS LOCATIONS



Sr. No	Location	Greasing Points
1	Front & Rear Pillow Block	2
2	4WD King Pin Spindle	2
3	Clutch Pedal & Brake Pedal	2
		2
4	Range Shifter lever	1
5	Bell Crank Assembly	1
6	PTO Lever	1
7	Clutch Shaft & Clutch Release Bearing Sleeve	1
		1
8	Tie Rod (Mech. + PS Steering) & Steering Knuckle Arm	2
		2

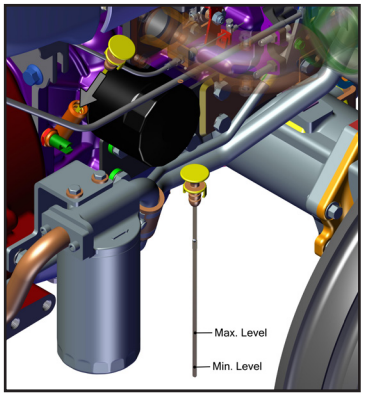
CONSUMABLE DETAILS

Engine Coolant Specs.	Hydraulic Oil Filter Specs.	Engine Oil Filter Specs.
Coolant Grade- Redimix Coolant	**Oil Filter Changed-** 1st at 100 Hrs. & then Every 250 Hrs.	**Oil Filter Changed-** 1st at 100 Hrs. & then Every 250 Hrs.
Coolant Quantity- 5 Ltr(20HP) & 6 Ltr (24HP)		
Coolant Change Period- Every 1000 Hrs.		



4WD Front Axle Oil Specs.	Engine Oil Specs.	Fuel Filter Specs.	Transmission Oil Specs.
Oil Grade- SAE80W90GL5	**Oil Grade-** API CH4 / SAE 15W40 / Mahindra M star Genuine Oil	**Fuel Filter Changed-** 1st at 350 Hrs. & then Every 250 Hrs.	**Oil Grade-** EP-90 (Dry Brakes)/ Mahindra M-Star Oil (OIB)
Oil Quantity- 5.0 Liters	**Oil Quantity**- 4.0 Liters		**Oil Quantity-** 23 Ltr (OIB + PS), 19 Ltr (Dry Brake +Mech. Steering)
Oil Change Period - 1st at 850 Hrs. & thenEvery 1000 Hrs.	**Oil Change Period -** Every Service		**Oil Change Period -** Every 850Hrs.

1

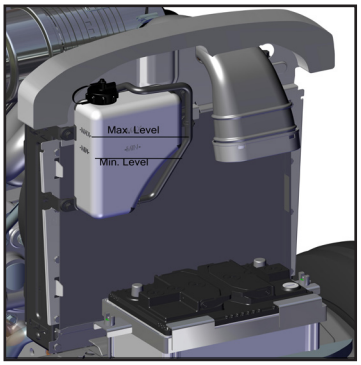


Checking Engine Oil Level

• Check the engine oil before starting the engine or '5' minutes or more after the engine has stopped.
• To check the oil level, draw out the dipstick, wipe it clean, insert it and draw it out again. Check to see that the oil level lies between the two marks.
• Add oil only when the oil level reaches the lowest mark.Recommended oil -"Mahindra M-Star Genuine Engine Oil / API CH-4 SAE 15W40 Oil

⚠ **CAUTION** -:Do not run the engine if the oil level is low than specified.

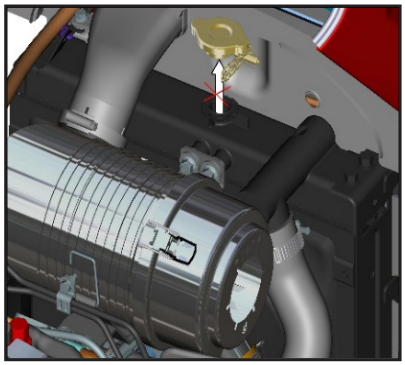
2



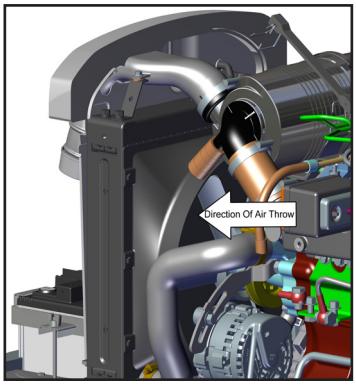
Checking Coolant Level

• Check coolant level in recovery bottle & Top-up if required.
• Use redimix coolant for top up.

⚠ WARNING -: Do not open the coolant cap when the engine is hot. Do not remove the radiator cap when the engine is hot



3



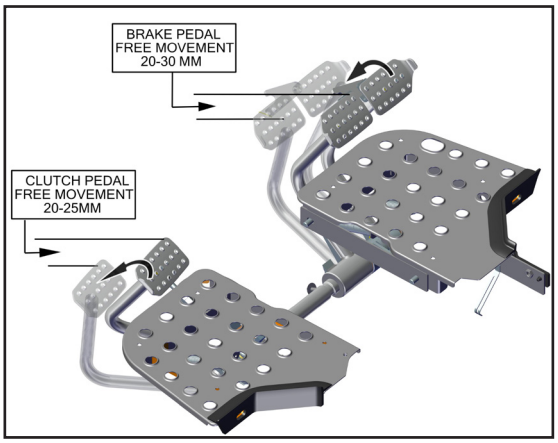
Checking radiator fins

• Clean chaff guard daily or earlier if chocked.
• Blow compressed air through the radiator fins to remove foreign material

⚠ **NOTE -:** Radiator fins must be free of dust or chaff to prevent the engine from overheating.

⚠ **CAUTION -:** To avoid personnel injury, ensure to stop the engine before working on radiator.

4



Check clutch pedal

• With clutch fully engaged pedal should have free movement of 20 – 25 mm

Check brake pedal

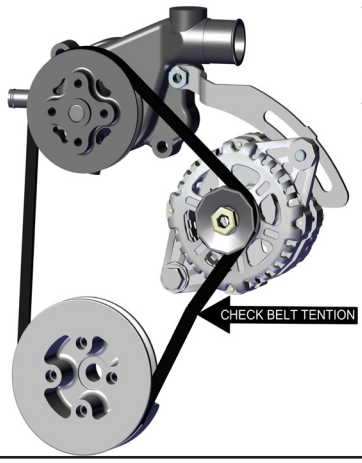
• Pedals should have free movement of 25-30 m.

5

Checking fan belt tension

The tension is correct when the belt can be pressed by thumb to 9 - 12 mm.midway between the two pulleys without much effort.

In case the tension is not correct the adjust the tension by adjusting alternator position on brace plate.



BLEEDING FUEL SYSTEM

Air must be removed :

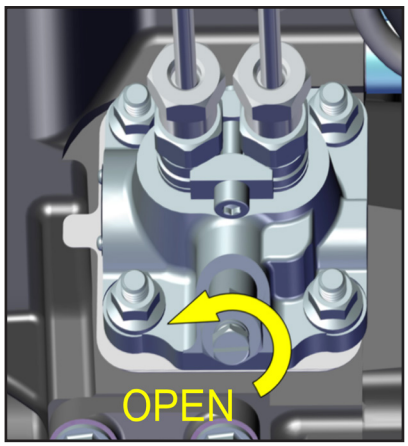
1) When the fuel filter or lines are removed.

2) When water is drained from fuel filter.

3) When tank is completely empty.

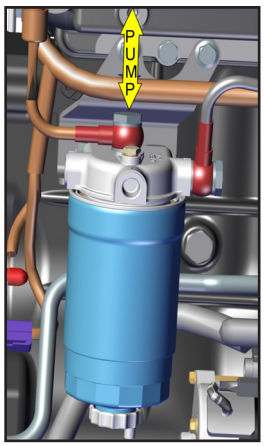
4) When tractor is not used for a long period of time

PROCEDURE OF BLEEDING AIR FROM FUEL SYSTEM

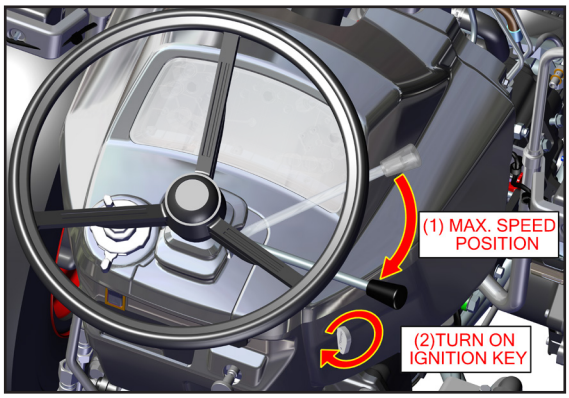


Make sure that fuel Pipe clips are tighten.

Open the air vent on the fuel injection Pump.



Pump the fuel pump knob located on the top of the fuel filter.
The fuel pump knob will pump easily at first and with added resistance as air is purged from the system.
To make sure air is completely purged, pinch the fuel over flow hose with fingers if a pulsation is left when the knob is pumped then, no air remain



(1) Set the hand throttle lever / accelerator at maximum speed position.
(2) Turn on the key switch to start the engine and then reset the throttle at the mid speed position.
If engine doesn't start try it several times with 30 seconds Intervals
Accelerate the engine to remove the small position of air in the fuel system.
If the air still remains and the engine stops, repeat the above steps.
Close the air vent.

⚠ CAUTION :-

Do not hold key at engine start position for more than 10 seconds continuously. If more engine cranking is needed try again after 30 seconds.

Always close the air vent screw except for bleeding fuel lines other wise, engine will run irregularly or stall frequently.

Checking tyre pressure

For normal load and operation of the tractor the following tyre pressure is recommended

	Front tyre 6 x 14"	Rear tyres 8.3 x 24"
For field	1.3 kg/cm²	1.2 kg/cm²
For road	2.0 kg/cm²	1.4 kg/cm²

Note :

1. Keep the tube valve always closed with the dust cap, to protect the valve from mud/dust/slush.
2. To achieve best performance and maximum tyre life, maintain air pressure as per tyre size and load carrying capacity as recommendation.

Addition of Wheel Weights At Rear – To increase drawbar pull of the tractor & reduce wheel slip (Increase tyre life)

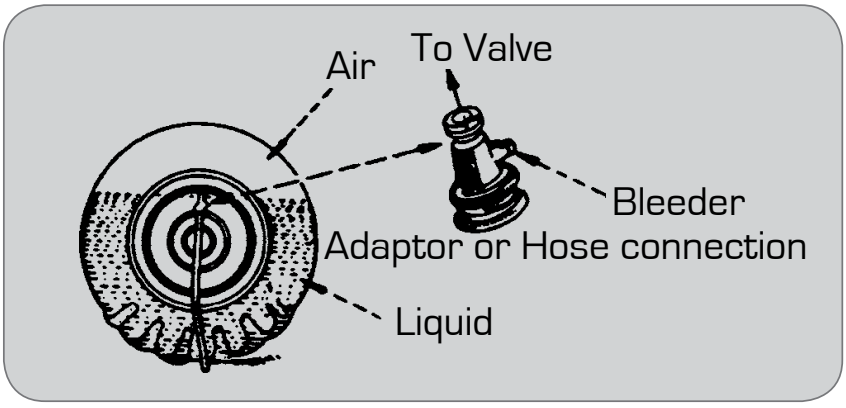
Cast Iron weights can be attached to the rear driving wheels.
In case the slip continues, it may be necessary to liquid ballast the tyre.

Adding Water :

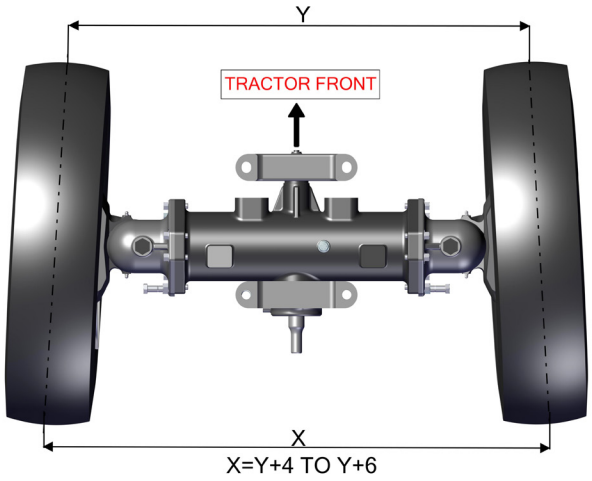
Tractor tyre can be 80% filled with water as follows, Remove excess air from Tyre.

1. Remove all air from tyre.
2. Raise the wheel. Rotate the tyre until the valve, stem is at 1'O Clock position.
3. Remove the valve core housing and screw on the adapter.
4. Force water into the tyre from a tank placed at least five feet higher than the tractor tyre, or by using a compressor and pressure tank filled with water.
5. When the liquid has reached the required level, remove the adapter, screw in the valve core and inflate to the recommended pressure.
6. Maintain air pressure as per recommendation

The instructions and recommendation shown below should be followed in order to secure maximum life and efficient service from pneumatic tyres.



Front Axle - Front Wheel "Toe-in" Check



TOE-IN ADJUSTMENT

Procedure To Adjust Toe In-:

Loosen check nut of wheel cylinder from both sides andadjust Toe in position of front wheel. While adjusting position maintain center of ram inwheel cylinder with exact center of Front axle position.(Refer image MECHANICAL ADJUSTMENT)

After adjusting the front wheel tread and with allconnections secured, the front wheel Toe-in shall be as follows.

FRONT WHEEL TOE-IN

In the event of the tie rod setting being interfered with, then it is necessary to adjust the TOE-IN. Before measuring and adjusting the TOE-IN, ensure the front wheels are in the straight ahead position and the front axle is not tilted.

Calculation of Toe In-:

(Refer image TOE-IN ADJUSTMENT)

Measure distance between centers of both front wheels from front of tractor.

Let that distance be "Y".

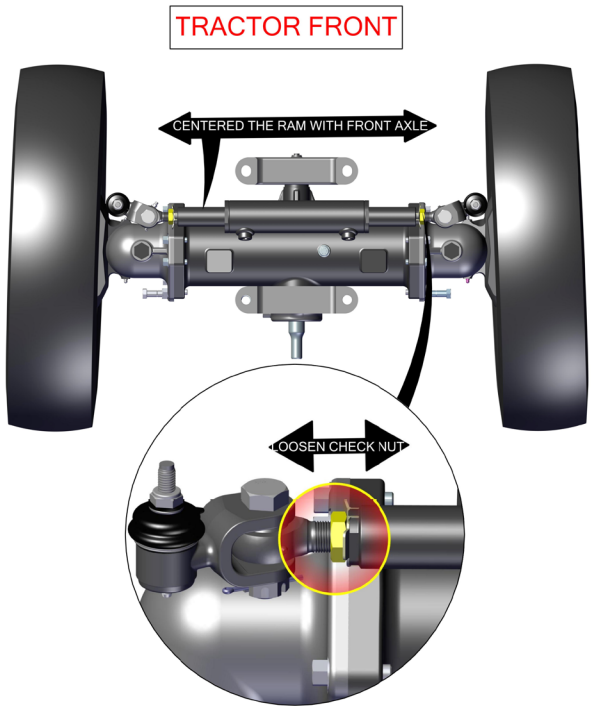
Now adjust track rod ball joints such that distance"Y" will remain same in front side of front wheels and at rear side of front wheel distance will increase in

4 to 6 mm.

let distance in rear of Front wheel be "X".

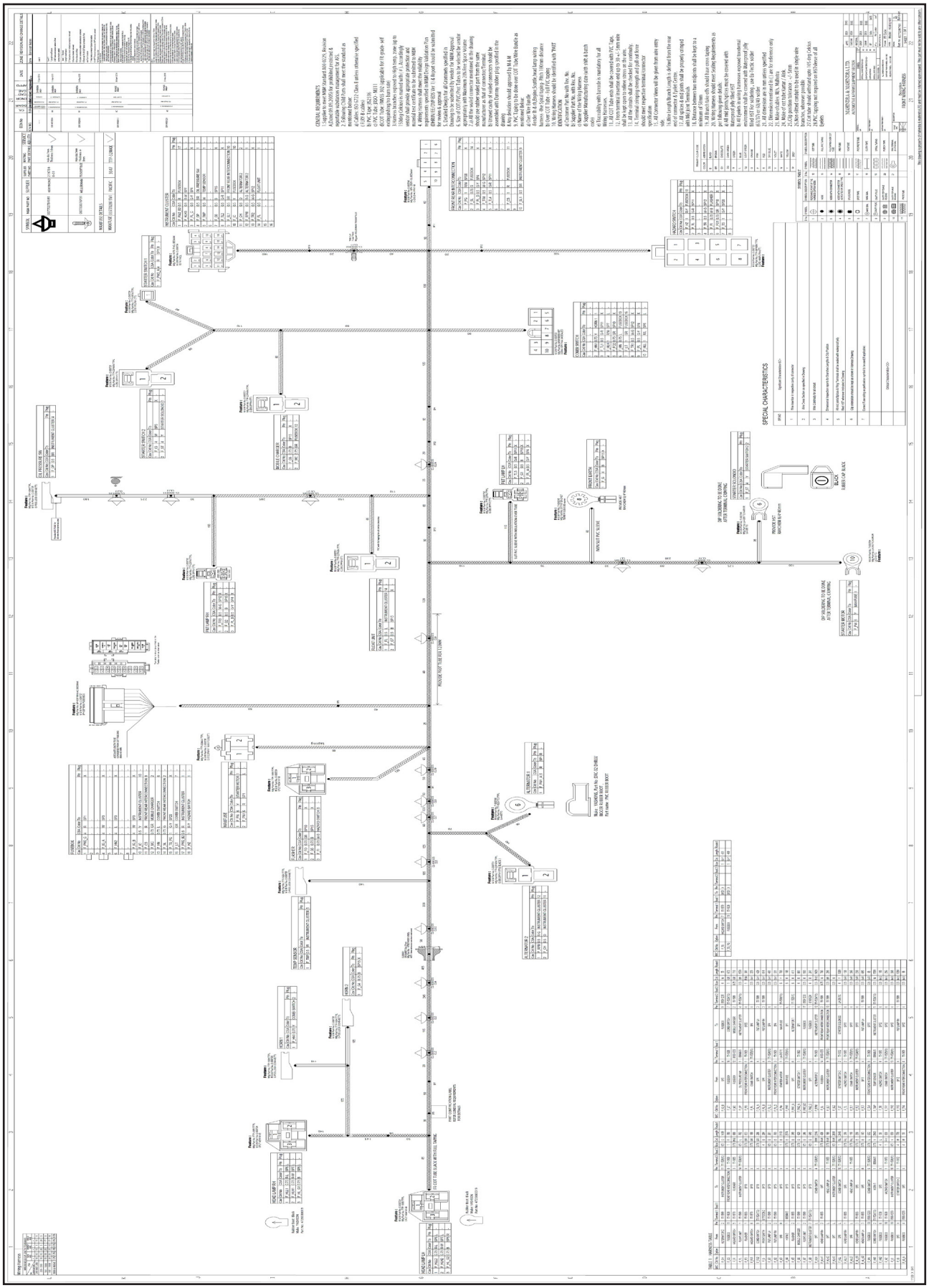
Therefore

X= (Y+4) To (Y+6) in mm

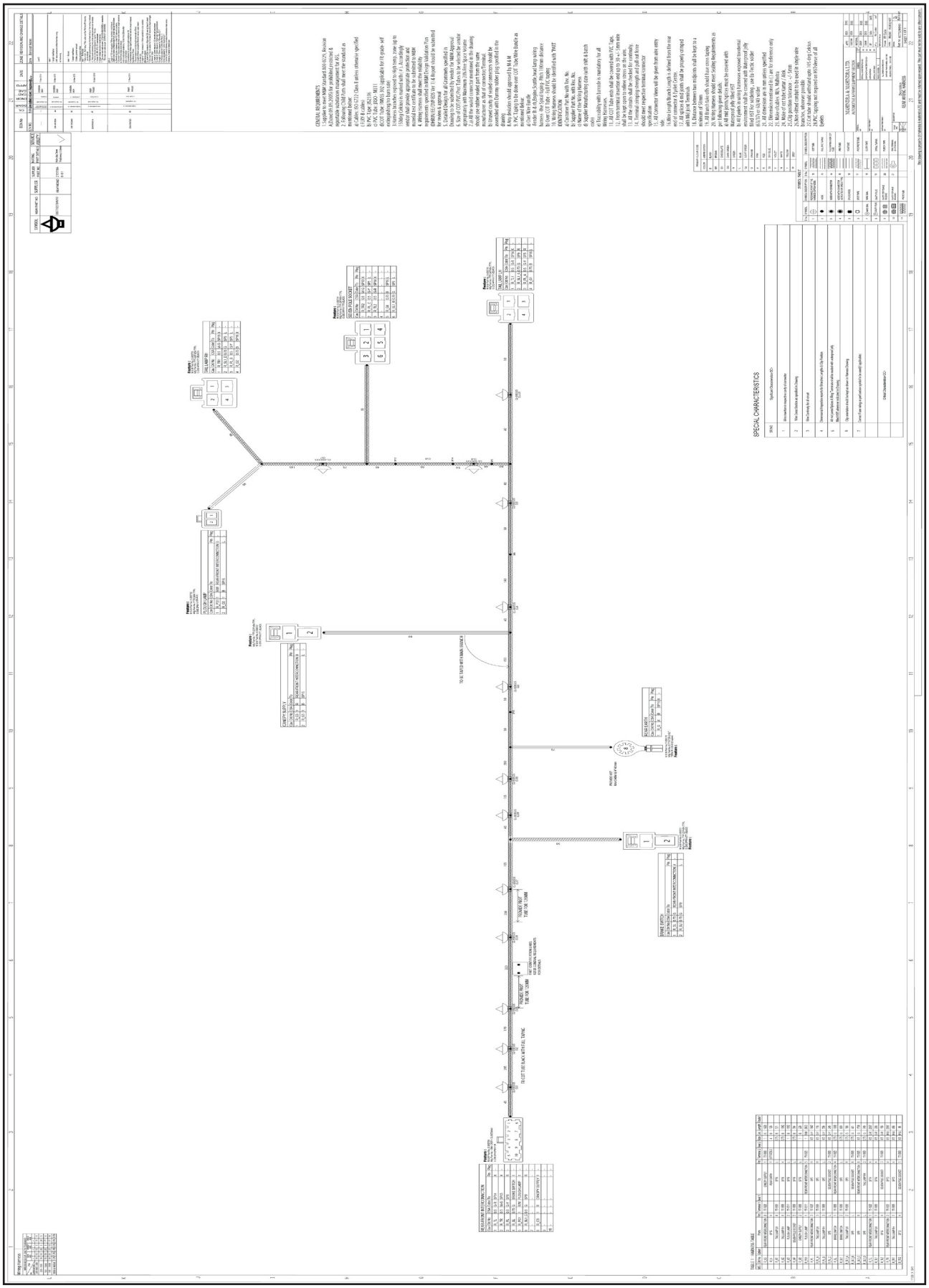


MECHANICAL ADJUSTMENT

FRONT WIRING HARNESS LAYOUT

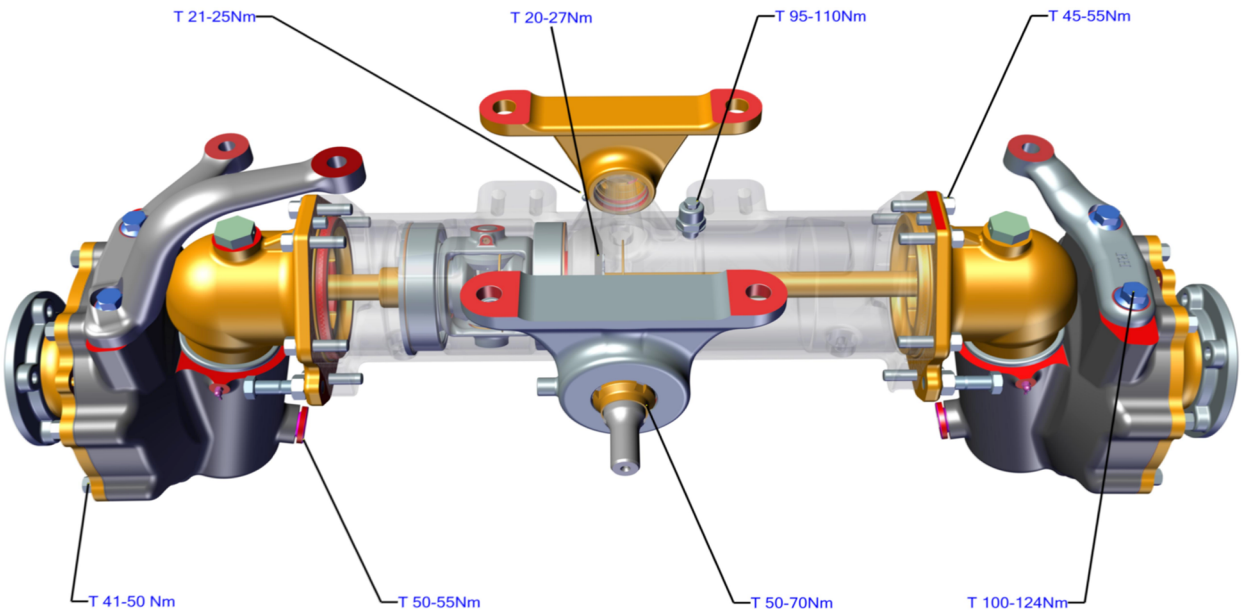


REAR WIRING HARNESS LAYOUT

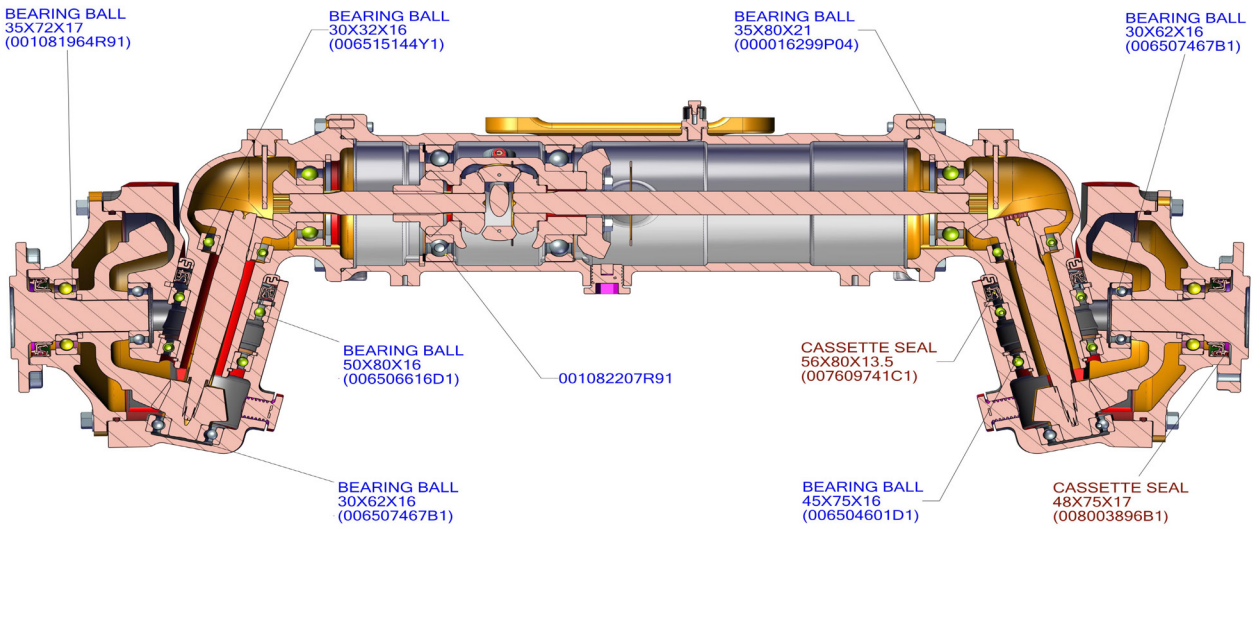


4WD FRONT AXLE ASSEMBLY

4WD FRONT AXLE -TORQUE VALUES



BEARING & OIL SEAL POSITION



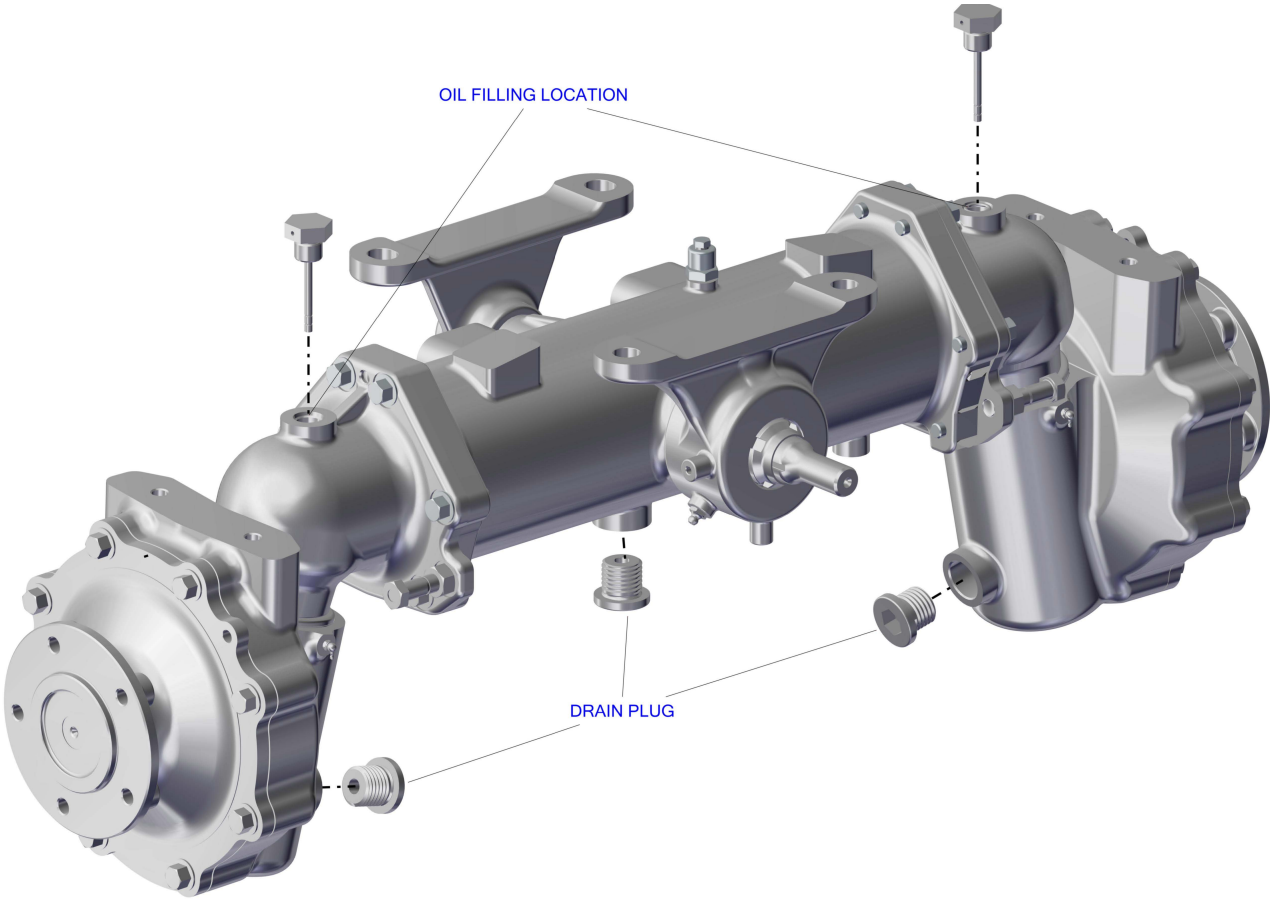
MAINTENANCE SCHEDULE ON 4WD FRONT AXLE

Routine Service Schedule Mahindra 4x4						
CHECK POINTS	**100 Hours**	**350 Hours**	**600 Hours**	**850 Hours**	**1100 Hours**	**1350 Hours**
TRANSMISSION						
Check Oil Level and Top-up if necessary	✓	✓	✓	✓	✓	✓
Change Oil					✓	
First at 1100 hours & thereafter every 1000 hours						

Routine Service Schedule Mahindra 4x4						
CHECK POINTS	**100 Hours**	**350 Hours**	**600 Hours**	**850 Hours**	**1100 Hours**	**1350 Hours**
TRANSMISSION						
Check Tyre Pressure	✓	✓	✓	✓	✓	✓
Torque Wheel Nuts	✓	✓	✓	✓	✓	✓

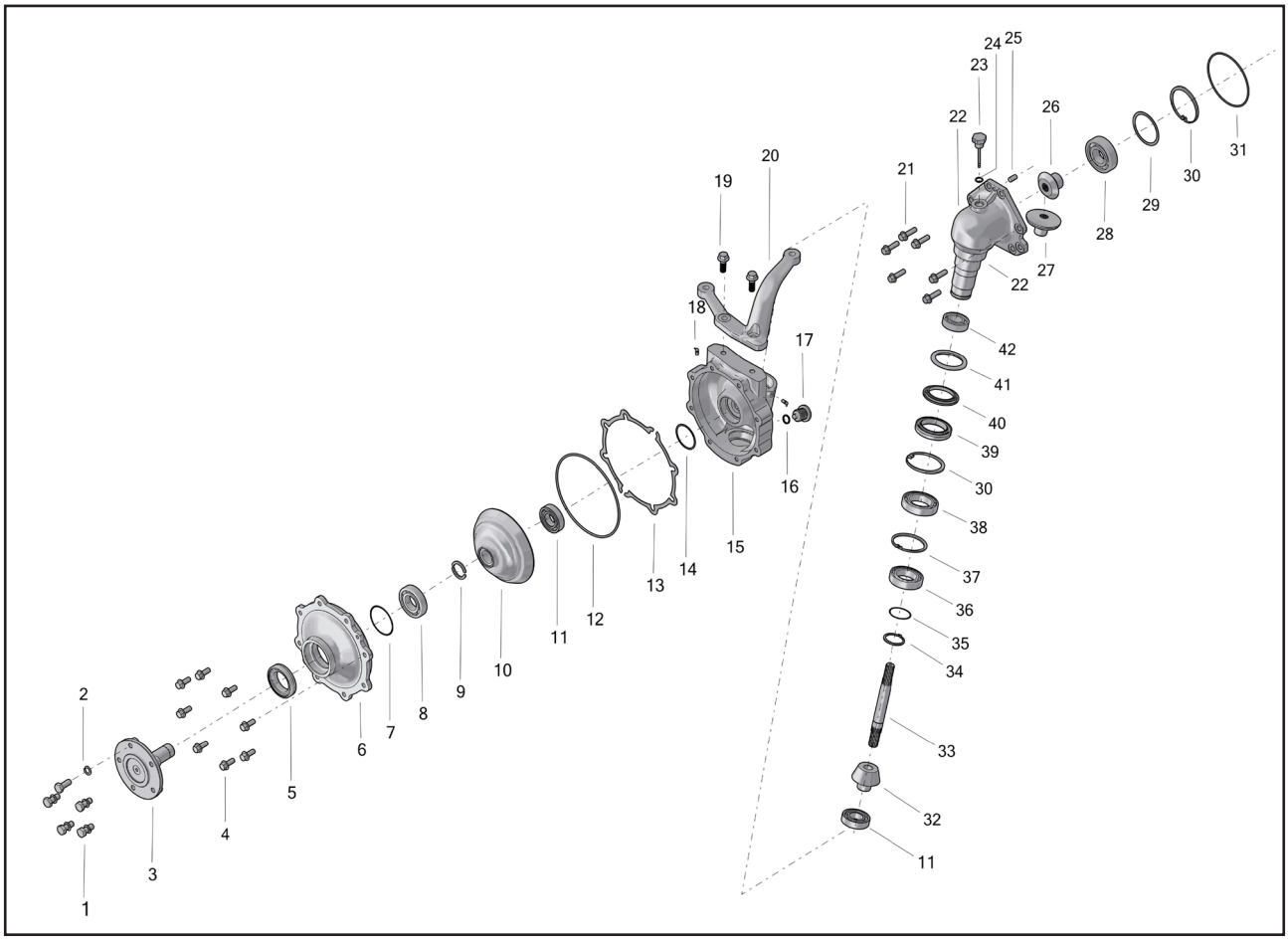
Front Tyre	6.00 x 14 – 6PR	Wheel nut 100 N-m
Rear Tyre	8.30 x 24 – 6PR	Wheel nut 230 N-m

4WD FRONT AXLE –OIL & GREASE SPECIFICATIONS



4x4 Front Axle	
Oil grade	SAE 80 W 90 GL5
Oil Quantity	5.0 liters
Oil change period	first at 1100 hours & then at every 1000 hours
	NO FILTER / STRAINER
Grease nipple in Swivel housing	Normal operation – every 50 hours
	Puddling operation – every 10 hours
To grease, remove one of the grease nipple, grease from other grease nipple till fresh grease comes out of removed grease nipple hole. Do not forget to fit back the removed grease nipple.	

SWIVEL & SIDE HOUSING SUB ASSEMBLY



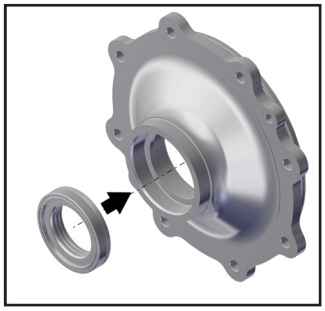
PART NUMBER.	REF.	DESCRIPTION OF PART	QTY.
000012506P04	1	**BOLT** Hex M12X30 10.9GR	5
005550700R1	2	**WASHER** Spring M12	5
006513294Y1	3	**SPINDLE** Front Axle	1
000020313E05	4	**BOLT** HEXFL M10X1.5X25.5X8.8	8
008003896B1	5	**SEAL** Cassete 48X75X17	1
006513300Y1	6	**HOUSING** Hub	1
006517151Y1	7	**SHMS 66X70X0.5**	A/R
006517154Y1	7	**SHIM 46X50X0.1**	A/R
006517153Y1	7	**SHIM 66X70X0.1**	A/R
001081964R91	8	**BEARING** 35X72X17 Asian	1
006513360Y1	9	**COLLAR** Set	1
006513292Y1	10	**GEAR** Bevel Final Reduction	1
006507467B1	11	**BALL BEARING** 6206	2
006513336Y1	12	**O RING** Hub-Swivel Housing 196X4	1
006513355Y1	13	**SHIM** End Reduction	A/R
006513357Y1	13	**SHIM** End Reduction	A/R
006513356Y1	13	**SHIM** End Reduction	A/R
006514365Y1	14	**SHIM 54X60X0.3**	A/R

SWIVEL & SIDE HOUSING SUB ASSEMBLY

PART NUMBER.	REF.	DESCRIPTION OF PART	QTY.
006514364Y1	14	**SHIM 54X60X0.2**	A/R
006514363Y1	14	**SHIM 54X60X0.1**	A/R
006513298Y1	15	**HOUSING** Swivel LH	1
000020286E05	16	**WASHER** Sealing 26X36	1
006516642Y1	17	**PLUG** DRAIN Align Type	1
007602043C1	18	**GREASE** NIPPLE M6	2
000016469P04	19	**BOLT** Flanged Hex. Head M12X1.5X35	2
006515092Y1	20	**ARM** Knuckle LH (MS)	1
000020314E05	21	**BOLT** HEXFL M10X1.5X35.5X8.8	6
006513297Y1	22	**HOUSING** Side LH	1
006517020Y91	23	**DIPSTICK** 4WD	1
007205510C1	24	**O RING** 15.3 X 2.2 M 18	1
000020281E05	25	**PIN** Dowel	1
006513289Y1	26	**PINION** Bevel Intermediate	1
006513290Y1	27	**GEAR** Bevel Intermediate Reduction	1
000016299P04	28	**BALL** BEARING 6307(35X80X21)	1
006513385Y1	29	**SPACER** Intermediate Pinion	A/R
006514284Y1	29	**SHIM 68X80X1.1**	A/R
006513961Y1	29	**SHIM 68X80X1.2**	A/R
006505629D1	30	**CIRCLIP** Internal	2
006513337Y1	31	**O RING** Beam - Side Housing	1
006513291Y1	32	**PINION** Bevel Final Reduction	1
006513293Y1	33	**SHAFT** Side	1
000012165P04	34	**CIRCLIP** Ext - LUG 45 X 2.5	1
006517155Y1	35	**SHIM 46X50X0.5**	A/R
006504601D1	36	**BALL BEARING** Deep Groove 45x75x16	1
006510592U1	37	**CIRCLIP** Internal 75 Dia Heavy Duty	1
006506616D1	38	**BEARING** 50x80x16	1
007609741C1	39	**OIL SEAL** Casette 56X80X13.5 x 1	1
006517048Y1	40	**SLINGER** Swivel End	1
006517047Y1	41	**SLINGER** Side Housing End	1
006515144Y1	42	**BEARING** BALL (28x58x16) NBC	1

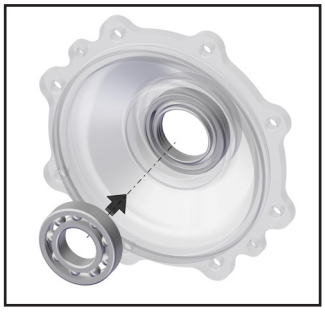
HUB END -ASSEMBLY PROCESS

1



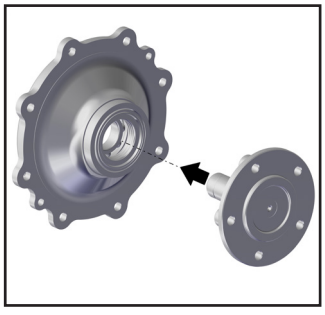
Assemble the Cassette Seal (5) with hub Housing (6) with the help of suitable special purpose dolly.

2



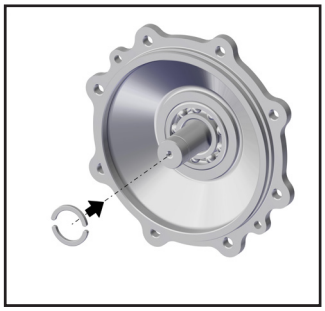
Assemble the Bearing 35X72X17 (8) in Hub Housing (6) after fitment of seal

3



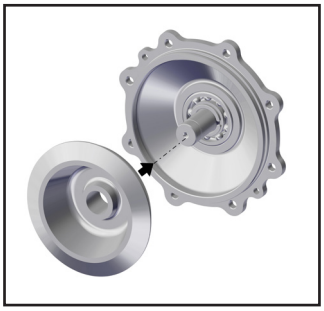
Assemble the Spindle Front Axle (3) in Hub Housing (6)

4



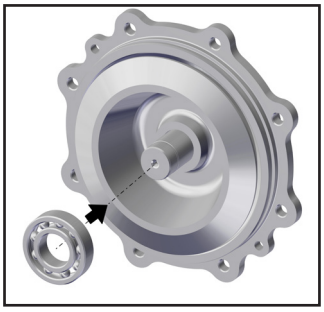
Fitment of collar (14) to Spindle Groove (3)

5



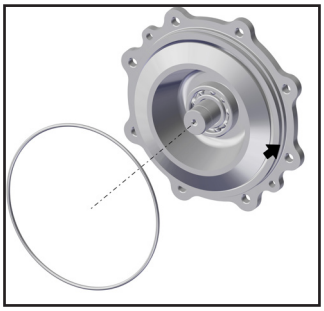
Assemble the final Reduction bevel gear (10) to Spindle Front axle (3)

6



Assemble the Bearing 30X62X16 (11) in Spindle with suitable dolly

7



Fitment of O-Ring (12) to Hub Housing

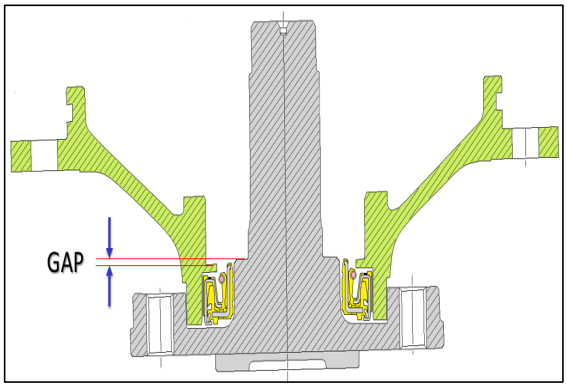
NOTE:- Ensure free rotation of bearing rollers after assembly

Assembly should be free from dust and foreign particles

Apply grease during assembly of oil seal only

HUB END ASSEMBLY CRITICAL SETTINGS

1



For cassette oil seal, maximum internal float recommended is 0.30 mm. Hence SHIM (7) selection is required to control it within 0.20 mm (if more, the lip of the oil seal will invert). Calculation must be done when Spindle or hub housing is replaced. It should also be done when early hour oil seal leakage is observed.

For Example-

reading = 0.32 mm

Recommended maximum float = 0.20 mm

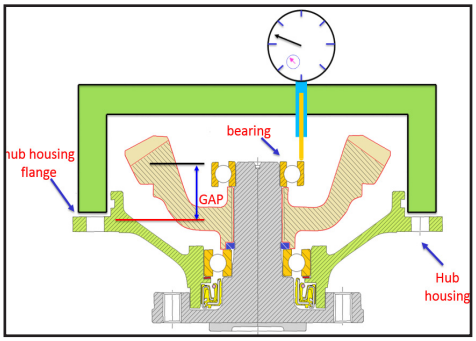
SHIM = 0.32 – 0.20 = 0.12 mm

Spindle Play should be max. 0.20mm

HUB END -ASSEMBLY PROCESS

HUB END ASSEMBLY CRITICAL SETTINGS

2



On hub housing, measure the GAP from bearing top to hub housing flange using tool “AGFAYNMG 004”

For Example-

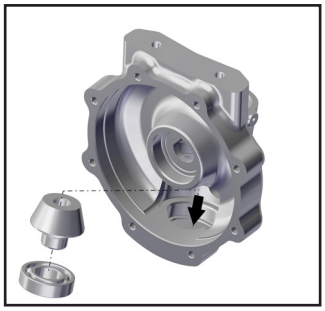
Master height = 35.00 mm

Measured reading = - 0.204 mm

GAP = 35.000 – 0.204 = 34.796 mm

SWIVEL HOUSING SUB ASSEMBLY

1

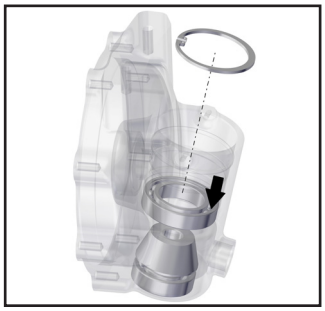


Assemble the Ball Bearing 30x62x16 (11) on Bevel Pinion Final Reduction (32). Fit pair in Swivel Housing.

2

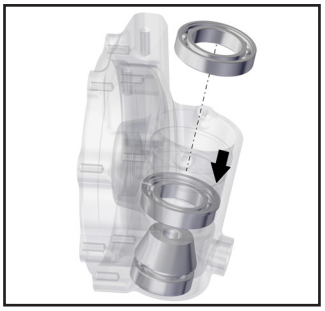
Assemble the Bearing 45X75X16 (36) in Swivel Housing. ⚠**NOTE-** Loctite 638 to be applied on outer race of bearing

3



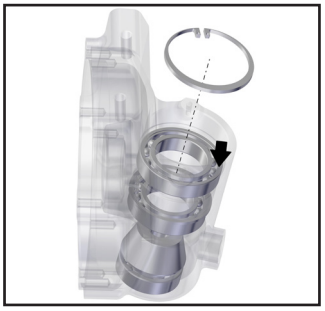
Fix the Circlip Internal 75D (37) to Swivel Housing

4



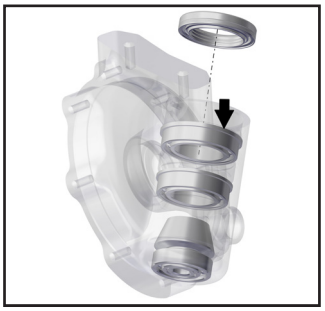
Assemble the Bearing 50X80X16 (38) in Swivel Housing

5



Assemble the circlip (30) after fitment of bearing in Swivel Housing. Ensure free rotation of circlip after fitment in slot.

6

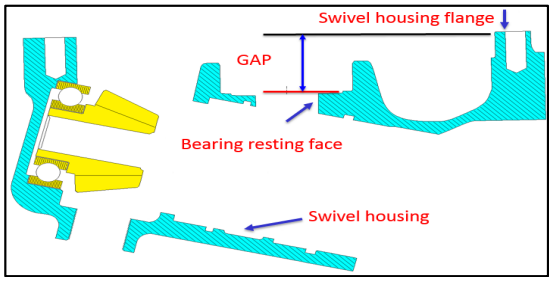


Press the Cassette oil seal 56X80X13.5 (39) in Swivel Housing with the help of suitable dolly

NOTE:- Ensure free rotation of bearing rollers after assembly
Assembly should be free from dust and foreign particles
Apply grease during assembly of oil seal only
Grease to be filled in slingers

SWIVEL HOUSING SUB ASSEMBLY

SWIVEL HOUSING SUB ASSEMBLY CRITICAL SETTINGS



On Swivel housing, measure the GAP from bearing resting face to Swivel housing flange using tool “AGFAYNMG 003”

For Example-

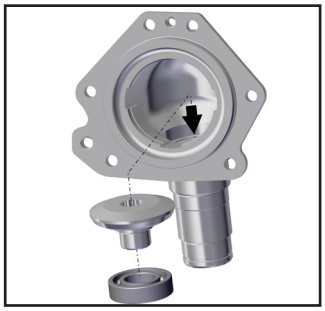
Master height = 35.00 mm

Measured reading = - 0.208 mm

GAP = 35.000 + 0.204 = 35.208 mm

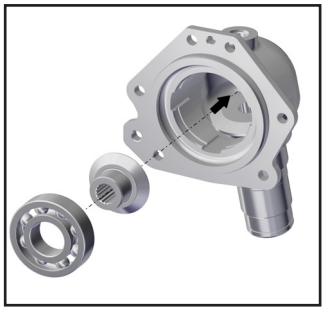
SIDE HOUSING SUB ASSEMBLY LH & RH

1



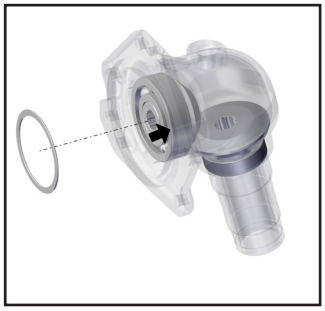
Assemble the Bearing 28X58X16 (006515144Y1) with Bevel Gear Intermediate (006513290Y1) & Assemble it to Side Housing

2



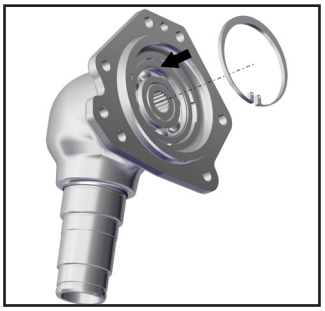
Assemble bearing 35X80X21 (000016299P04) in Bevel Pinion intermediate (006513289Y1). Assemble it to Side Housing

3



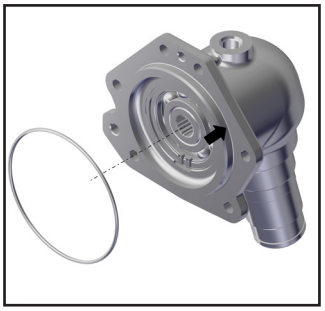
Assemble the Spacer (006513385Y1) to Side Housing

4



Assemble the Circlip (006505629D1) to Side Housing Inner Groove

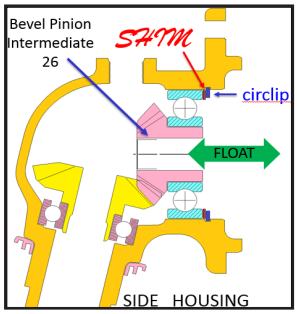
5



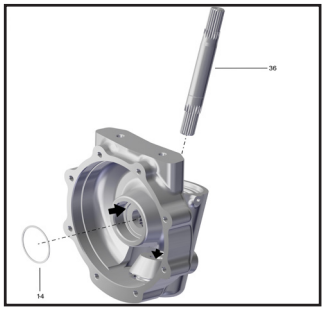
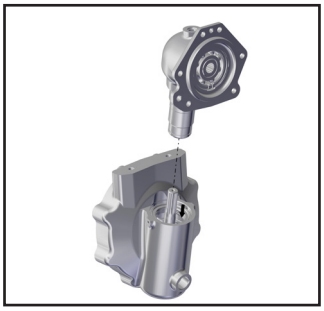
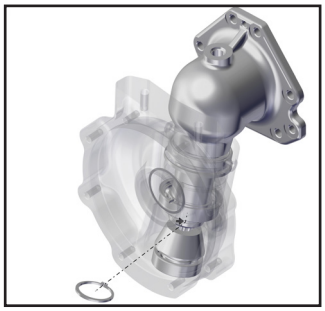
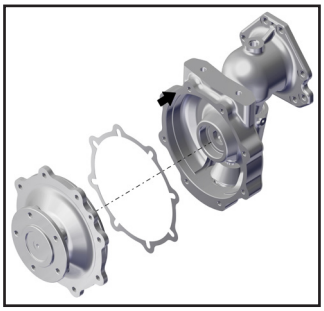
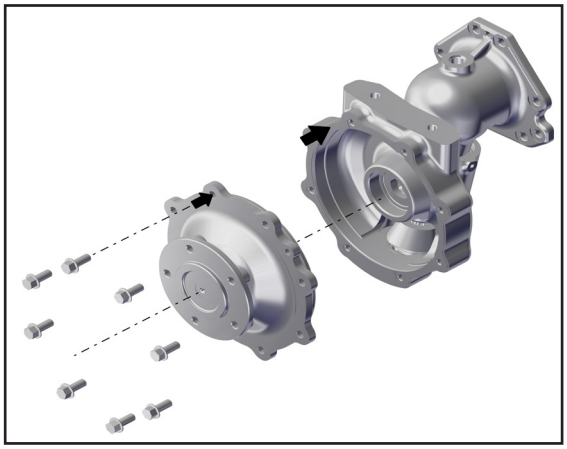
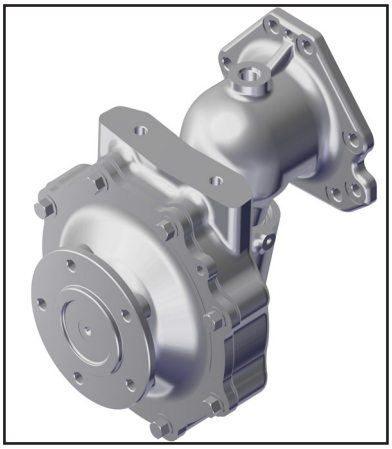
Fit the O-ring (006513337Y1) to Side Housing Outer Groove

CRITICAL SETTING

Measure float of Bevel pinion Intermediate (26) with dial gauge or feeler gauge. Float should be 0.20 mm (maximum). Adjust float with shim



SWIVEL TO SIDE HOUSING ASSEMBLY

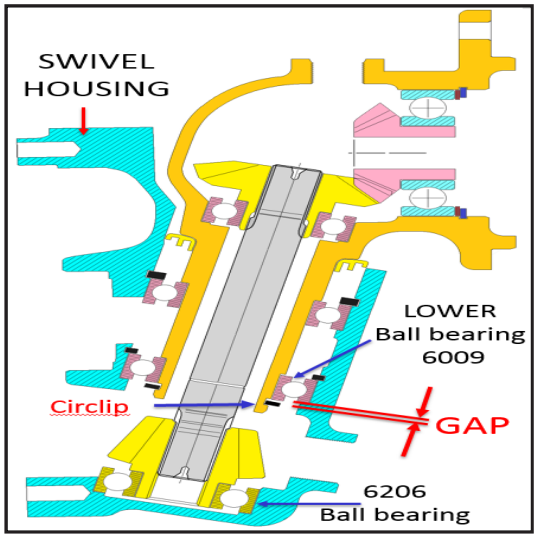
1		Insert the inclined shaft (33) into swivel housing assembly. Insert the Shim (14) in Swivel Housing	2		Assemble the side housing sub assembly in Hub Housing sub assembly
3		Fitment of circlip (34) on side housing end	4		Insert the final reduction shims (13) between Swivel and Hub Housing
5		Assemble the Swivel Housing assembly with Hub Housing assembly Torque the bolt (4) Apply Torque 41-50 Nm Transfer of sub assembly to front axle beam housing			

SWIVEL TO SIDE HOUSING ASSEMBLY CRITICAL SETTINGS

1

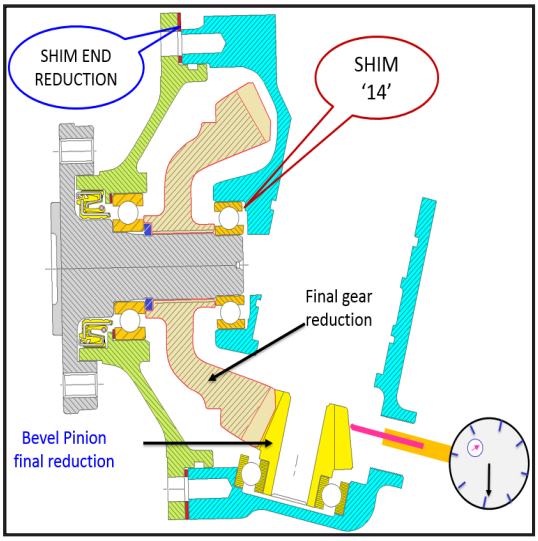
Measure the float (up & down movement) of side housing on swivel housing.
It should be within 0.10 – 0.20 mm.
Adjust the float with SHIM
(0.10 mm / 0.50 mm)

NOTE:- Ensure free movement of bearing rollers after assembly. Assembly should be free from dust and foreign particles. No Grease should be applied during assembly

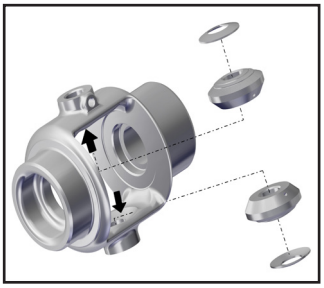
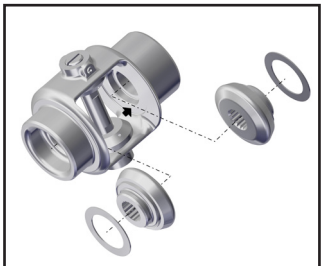
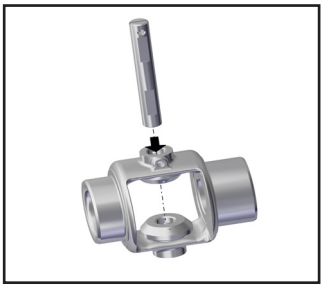
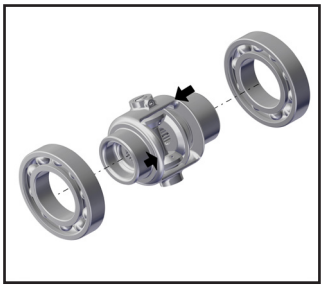
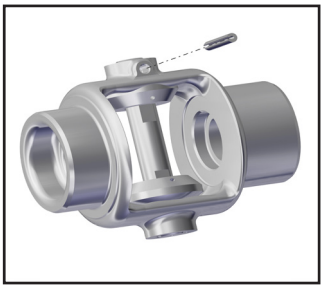
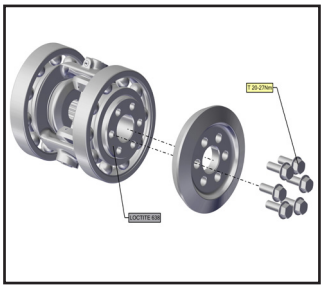


SWIVEL TO SIDE HOUSING ASSEMBLY

SWIVEL TO SIDE HOUSING ASSEMBLY CRITICAL SETTINGS

2	1)When Swivel housing & Hub housing is assembled together there will be a gap. Recommended GAP is 0.200 mm. Hence SHIM '14' will be required. GAP= Measured Gap- Recommended Gap 2) Assemble Hub housing on Swivel housing with some End Reduction Shims. (do not use the shim '14' at present) Measure the backlash between 'Final gear reduction' & 'Bevel Pinion final reduction with a dial gauge. The backlash should be within 0.13 – 0.23 mm. If not, add shim End Reduction (when the backlash is less) or remove that shim (when the backlash is more). 3) Thickness Of Shim "14"=(GAP+Thickness of Shim End Reduction)	

DIFFERENTIAL ASSEMBLY

1		Place the Thrust Washer gear (10) & Pinion Differential (9) in Differential case	4		Place the bevel gear thrust washers (7) & gear Differential (8) in differential case
2		Assemble the shaft Differential (11) between the Pinion Differential (9)	5		Press the Ball Bearing on both side of Differential Housing (1)
3		Fix the Spring Dowel Pin (12) at Differential Shaft hole to Differential Housing Hole	6		Assemble the Ring gear (5) Differential Housing with Bolt Flange HD M8x1.25x25L (6) Torque 20-27Nm (Use Loctite 638)

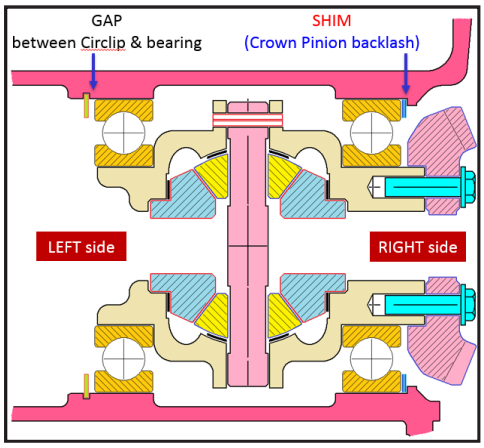
NOTE:- Ensure free rotation of differential gears after assembly.
Ensure free movement of bearing rollers after assembly.
Assembly should be free from dust and foreign particles.
No Grease should be applied during assembly

SWIVEL TO SIDE HOUSING ASSEMBLY

DIFFERENTIAL ASSEMBLY CRITICAL SETTINGS

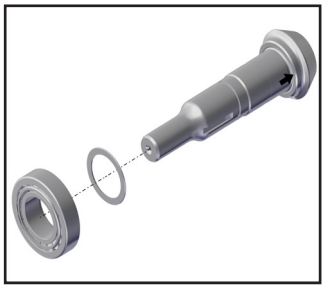
2

1) Measure the gap between circlip & bearing. Gap should be 0.10 mm (maximum). Add SHIM (differential assembly axial float) to adjust the extra gap.
2) Measure the backlash between Crown Wheel & Pinion with a dial gauge. It should be 0.10 - 0.20 mm.
3) If the backlash is not proper (more or less), interchange the position of SHIM (differential assembly axial float) & SHIM (Crown Pinion backlash) to get the desired backlash.



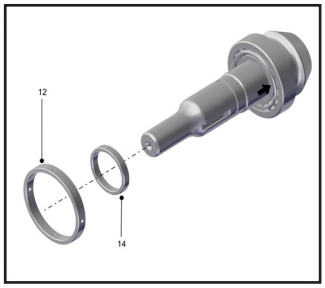
SPLINE SHAFT ASSEMBLY

1



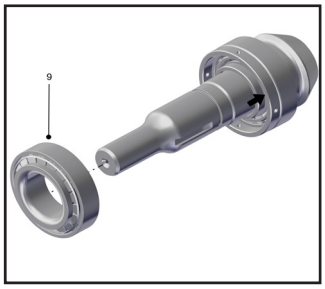
Place the Thrust Washer gear (10) & Pinion Differential (9) in Differential case

2



Assemble the shaft Differential (11) between the Pinion Differential (9)

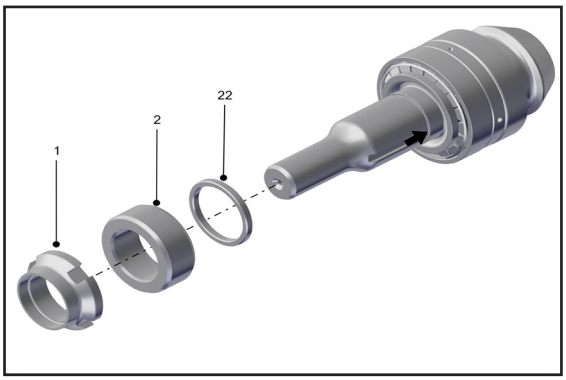
3



Fix the Spring Dowel Pin (12) at Differential Shaft hole to Differential Housing Hole

4

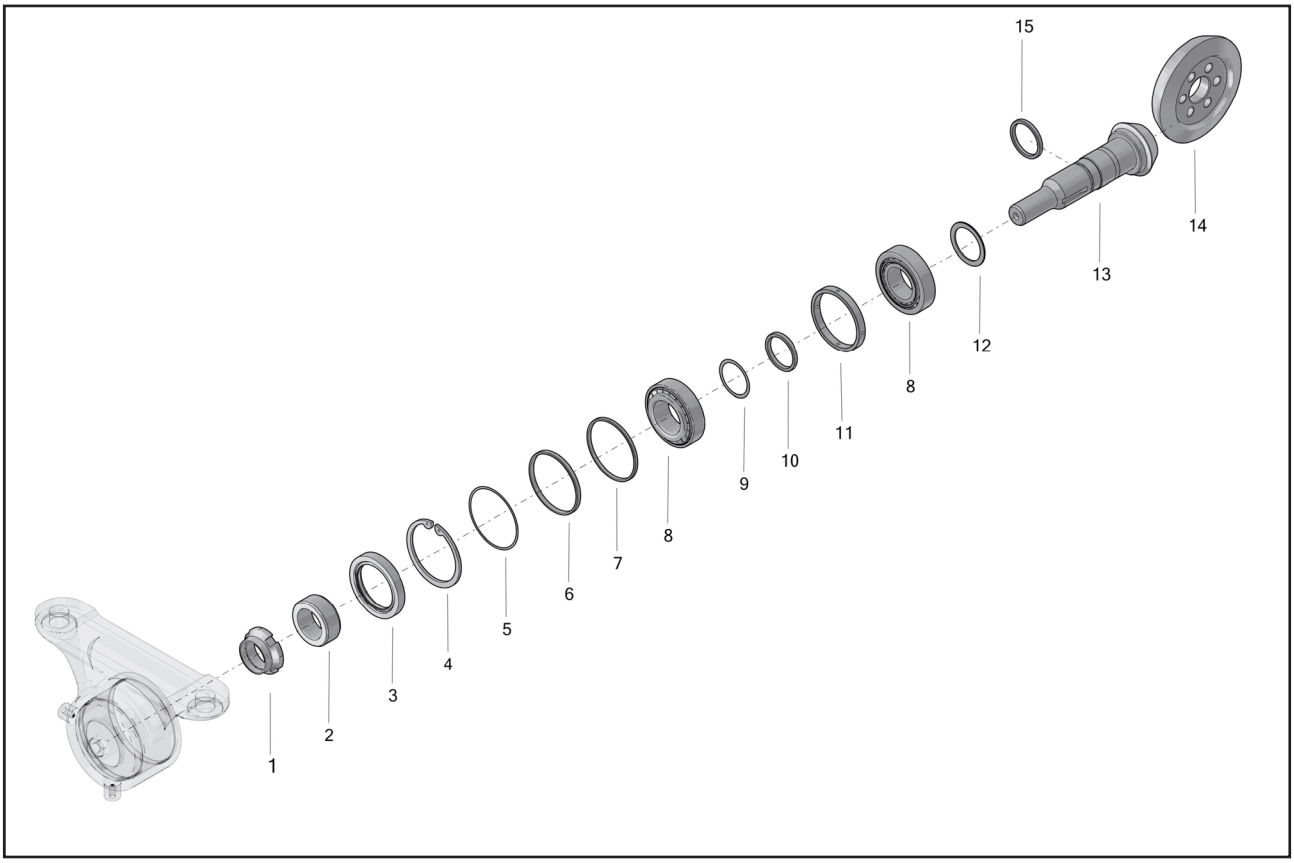
1.After assembly of Spline shaft check the Preload Value Pre Load Spec: 3-4Nm.
2.After setting the preload value remove the spacer oil seal
3.Assemble the O-Ring (22) in Spiral Pinion shaft Groove



1.Assemble the Spacer (2) & oil seal (3) in Spline shaft.
2.Assemble the Lock Nut M30x1.5 (1) in Spline shaft.
3.Ensure Torque value (50-70Nm).
4.Crimp the lock Nut in the spline shaft Slot.

NOTE:- Ensure free movement of bearing rollers after assembly.
Assembly should be free from dust and foreign particles.
No Grease should be applied during assembly

SPLINE SHAFT ASSEMBLY LAYOUT



PART NUMBER.	REF.	DESCRIPTION OF PART	QTY.
006513358Y1	1	NUT Lock M30X1.5	1
006513358Y1	2	**SPACER** Oil Seal Mounting	1
006506912B1	3	**OIL SEAL** Retainer Rear Axle	1
006507407D1	4	**CIRCLIP** INT - LUG 62	1
006514373Y1	5	SHIM 58X62X0.1	A/R
006514295Y1	6	SPACER 58X62X4.5	A/R
006514294Y1	6	SPACER 58X62X4.0	A/R
006513391Y1	7	**SPACER** End	1
006513342Y1	8	**BEARING** Taper Roller SKF	2
006514372Y1	9	SPACER 31.75X38X0.1	A/R
006514290Y1	10	SPACER 31.75X38X6.0	A/R
006514289Y1	10	SPACER 31.75X38X5.5	A/R
006513990Y1	10	**SPACER** Inside	1
006513389Y1	11	**SPACER** Outside	1
006514288Y1	12	SHIM 33X43X1.4	A/R
006514005Y1	12	SHIM 33X43X1.3	A/R
006514004Y1	12	SHIM 33X43X1.2	A/R
006514003Y1	12	SHIM 33X43X1.1	A/R
006513770Y1	12	**SHIM** For Backlash Spiral Pinion Shaft	A/R
006513942Y91	*	**SET Of two**	1
‡	13	**SHAFT** Spiral Pinion (13T)	1
‡	14	**GEAR** Ring (30T)	1
006507816D1	15	**O** RING 27X30X2	1

SPLINE SHAFT ASSEMBLY LAYOUT

SPLINE SHAFT ASSEMBLY CRITICAL SETTINGS

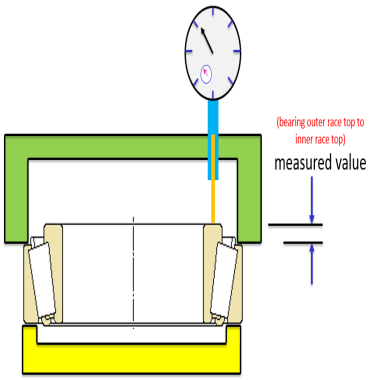
1

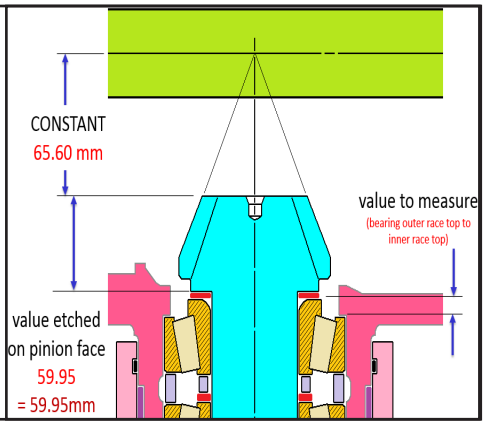
CONE CENTER DISTANCE

As per the value etched on Pinion & bearing height

SHIM = CONSTANT –
(value etched on pinion face
+ value to measure)

Use special tool for measuring bearing height (bearing outer race top to inner race top)



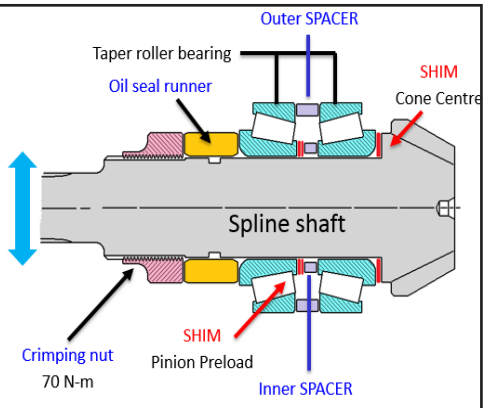


2

PINION BEARING PRELOAD

1) Place the CCD shim as per selection.
2) Slide the inner race of the inner taper roller bearing with suitable dolly. Ensuring that the inner race firmly & squarely
3) Place 'outer race" of the inner bearing, 'Outer spacer", Inner spacer few shims, 'Outer TRB along with outer race,
'Oil seal runner' & 'Crimping nut'.
Use suitable pressing dolly.
4) Fix the Spline shaft on FIXTURE.
Torque the Crimping nut 70 N-m with a special wrench.
5) Wind the rope on the end of the Spline shaft as shown.
Fix the Spring balance on the other end of the rope & measure the pinion bearing preload.
6) Pinion preload should be within 3.0 – 8.0 kg.
* If the Preload is more – add some more shims.
* If the Preload is less – remove some shims.

Wind the rope on the end of the Spline shaft

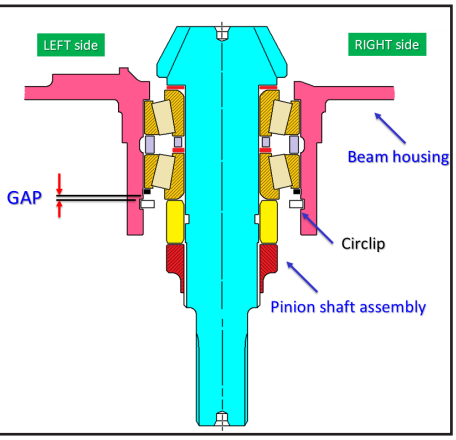


3

CONE CENTER DISTANCE

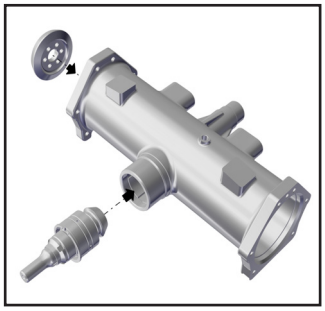
1) Measure the gap between 'Circlip' & 'Spacer' with a FEELER gauge.
2) The gap should be 0.10 mm. Add SHIM to fill the excess gap.

NOTE:- Ensure free movement of bearing rollers after assembly. Assembly should be free from dust and foreign particles. No Grease should be applied during assembly



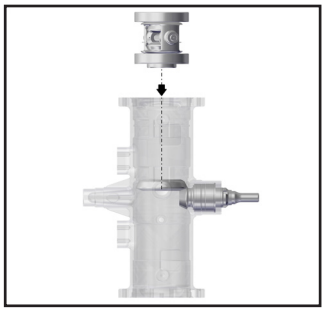
BEAM HOUSING ASSEMBLY

1



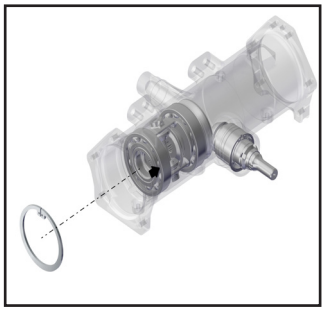
Take diff case (17) & insert bevel gear RH (B) & LH (A) with thrust washers (C).

2



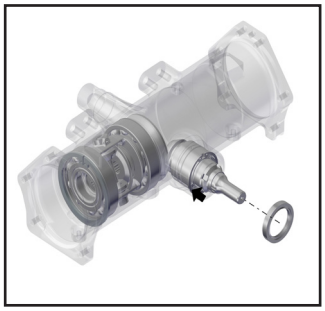
Insert 2 bevel pinion (12) with Pinion Thrust Washers (13) in differential case

3



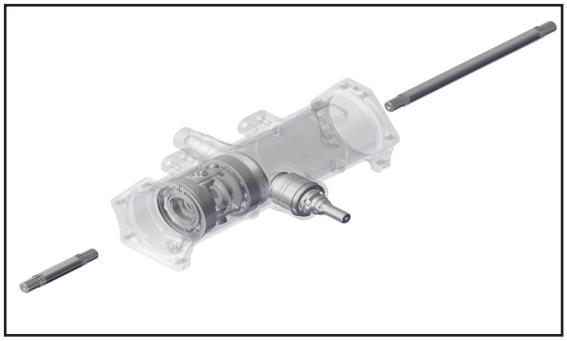
Insert bevel pinion shaft (16) through both pinion. Press roll pin (11) after aligning Diff Case and shaft holes by Dolly for roll pin pressing

4



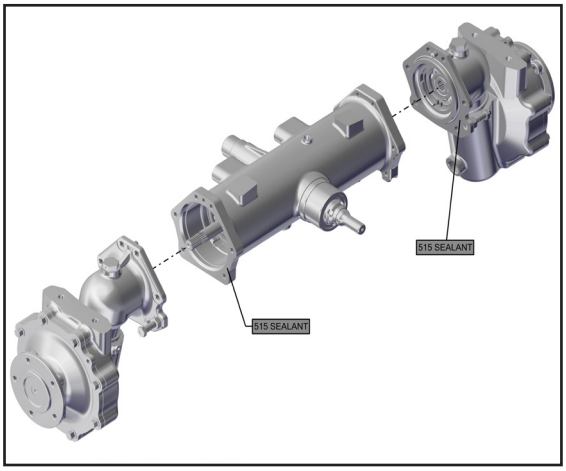
Apply sealant 638 on ring gear and Insert ring gear (9)on Differential Case
Mount the bolt (8) & apply torque 118-125 Nm

5



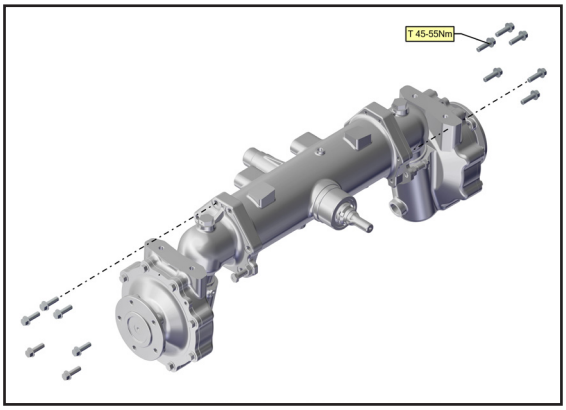
Insert LH & RH connecting shaft in beam housing

6



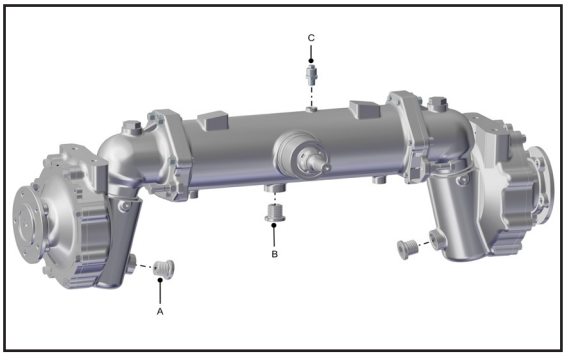
Apply 515 sealant on side housing & dock complete sub assembly to the beam housing (For LH & RH)

7



1.Mount Bolt & apply Torque.
2.Apply Torque 45-55 NM

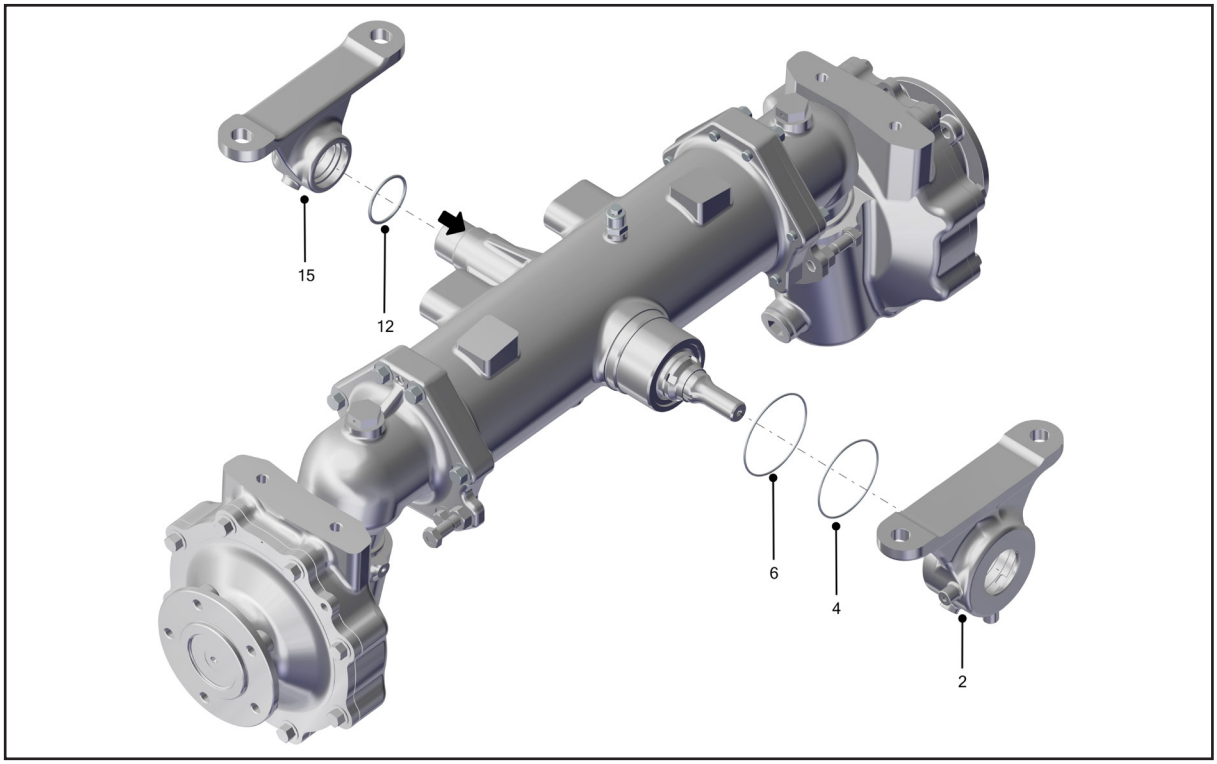
8



1.Mount breather on beam Housing.
2.Apply Torque 95-110 NM.
3.Mount Drain plug in beam housing with Torque 50-55 NM.
4.Mount Drain plug of Swivel Housing LH & RH Apply Torque 50-55 NM.

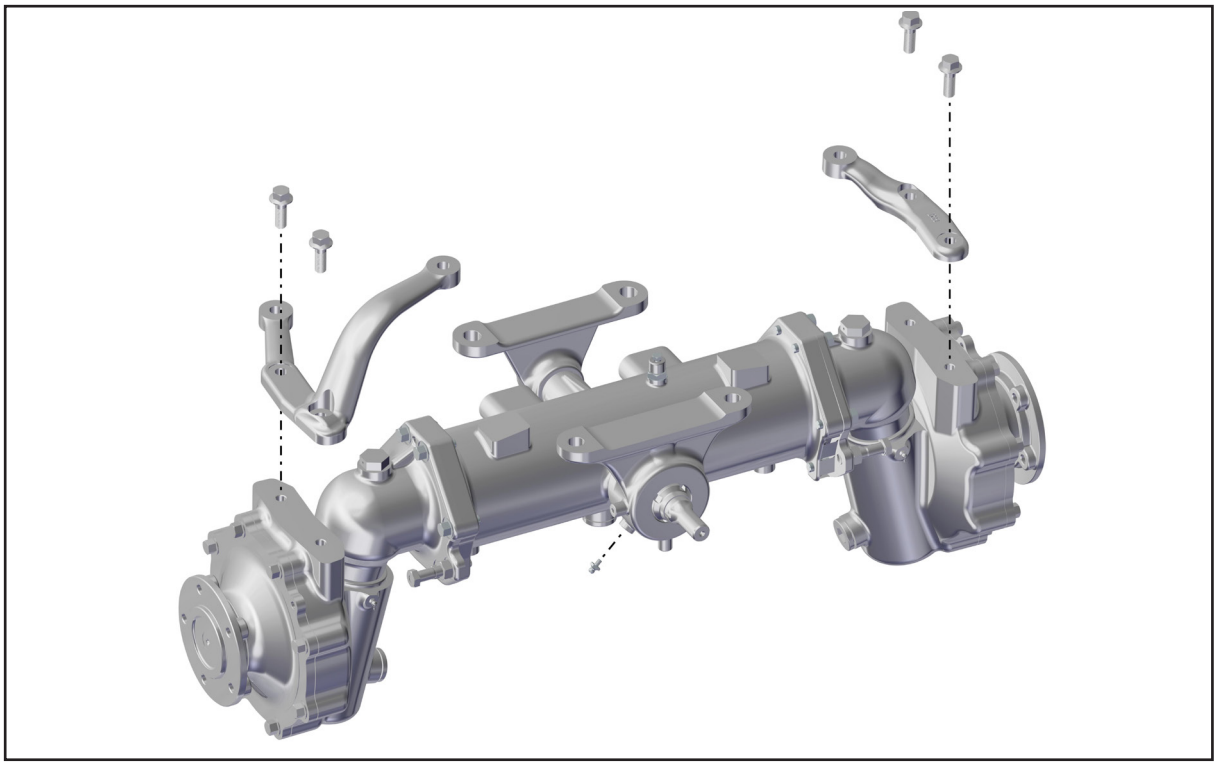
BEAM HOUSING ASSEMBLY

9



Mount Front pillow Block after mounting the 1 no of O Ring	Mount Rear pillow Block after mounting the 2 no of O Ring

10

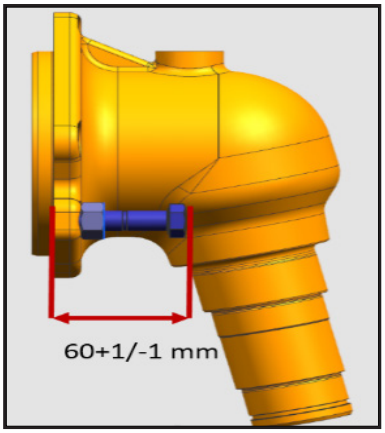


Mount Grease nipple of Front & Rear pillow Apply Torque 21-25 NM	Mount Knuckle arm sub LH & RH on swivel Housing Apply Torque 100-124 NM

CRITICAL SETTING ON 4WD FRONT AXLE CHART

CRITICAL SETTING

Stopper bolt adjustment LH & RH side housing should be (60+1/-1) mm

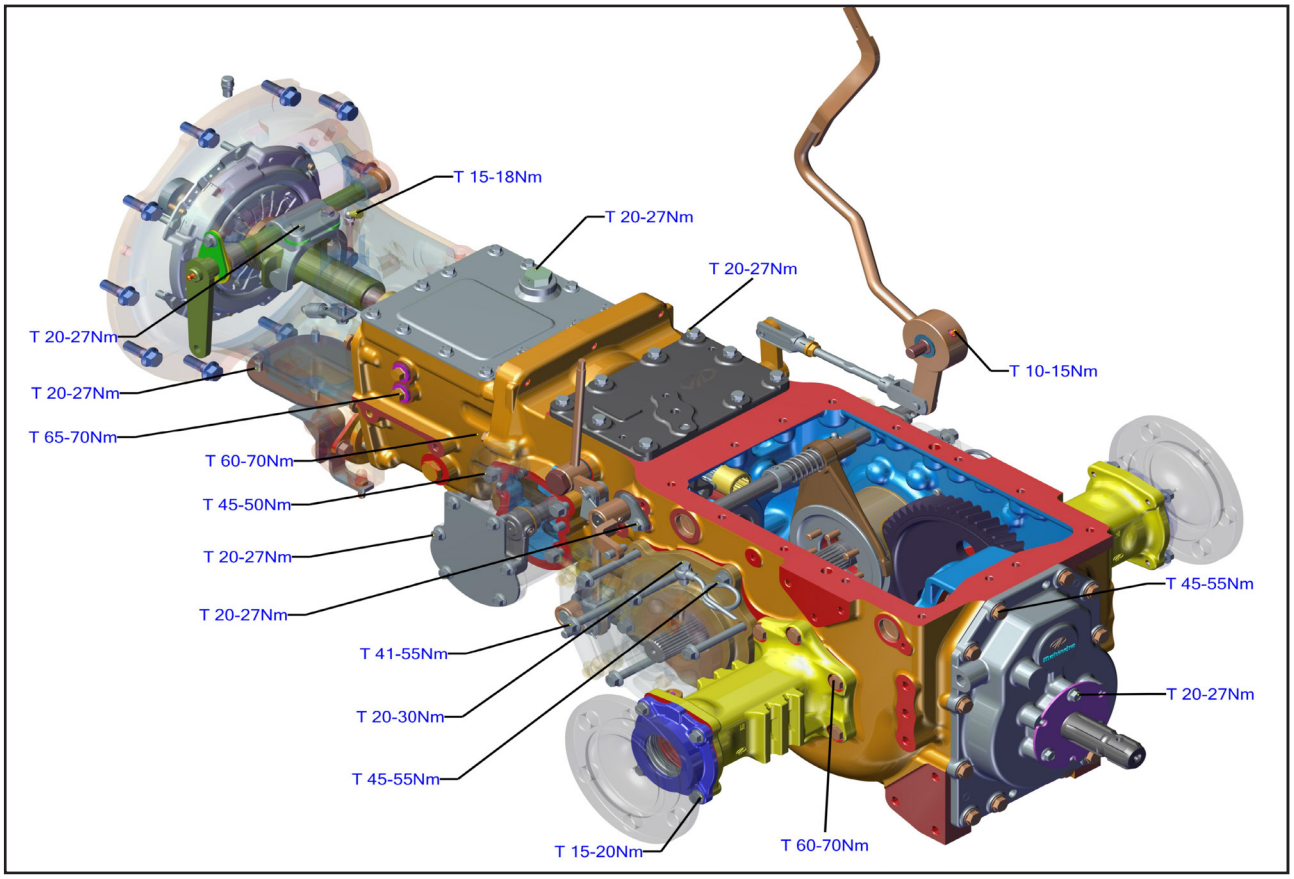


LIST OF CRITICAL SETTINGS FOR 4WD FRONT AXLE

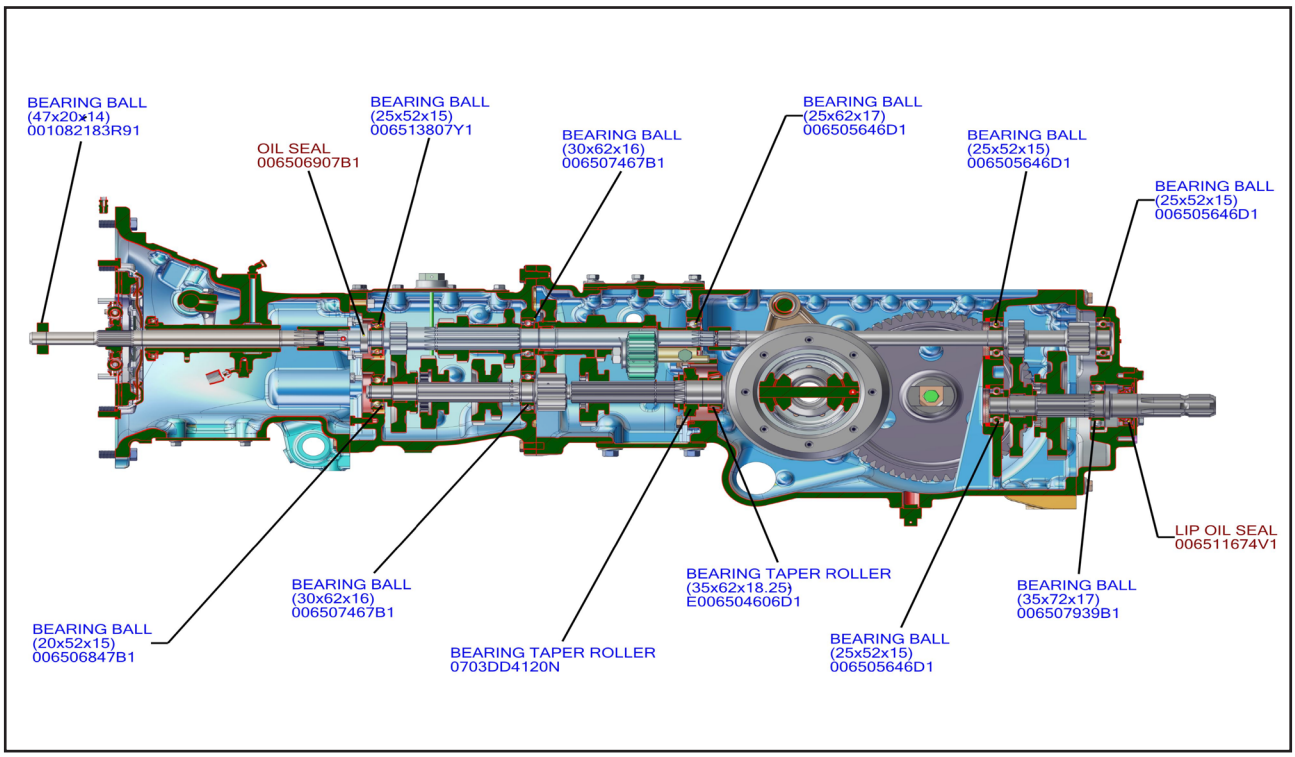
1	Cone Centre Distance	As per the number etched on Pinion
2	Pinion Preload	3.0 – 8.0 kg
3	Pinion shaft assembly axial play	0.10 mm
4	Differential Assembly axial float	0.10 mm (maximum)
5	Crown Pinion backlash	0.10 – 0.20 mm
6	Bevel Pinion Intermediate FLOAT	0.20 mm (maximum)
7	Swivel housing float on side housing	0.10 – 0.20 mm
8	Spindle play	0.20 mm (maximum)
9	Final gear backlash	0.13 – 0.23 mm
10	Final gear reduction float	0.10 mm
11	Steering Stopper bolt adjustment - LH & RH	60 mm
12	Toe – in adjustment	0 – 5 mm

TRANSMISSION

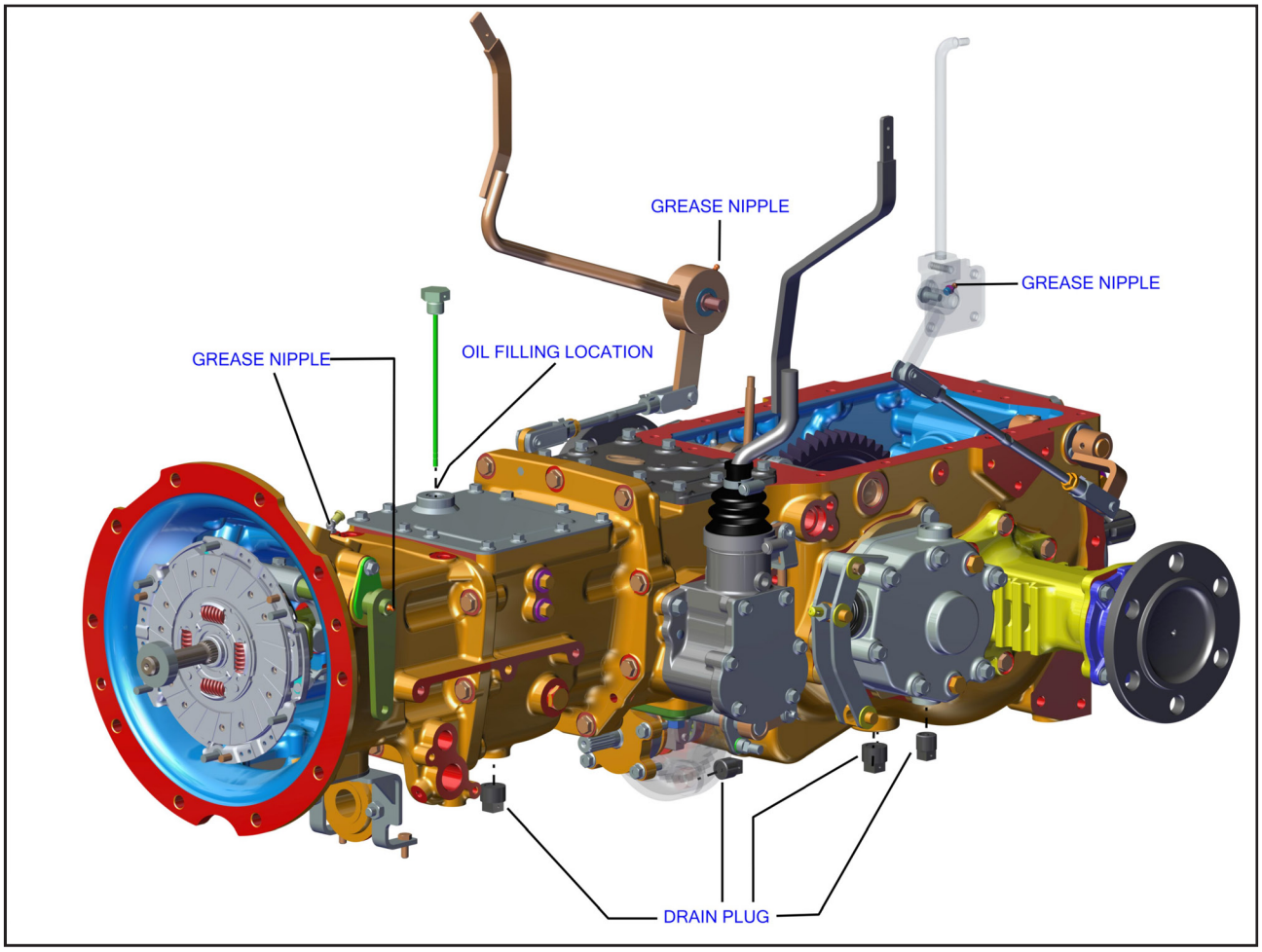
TRANSMISSION - TORQUE VALUES



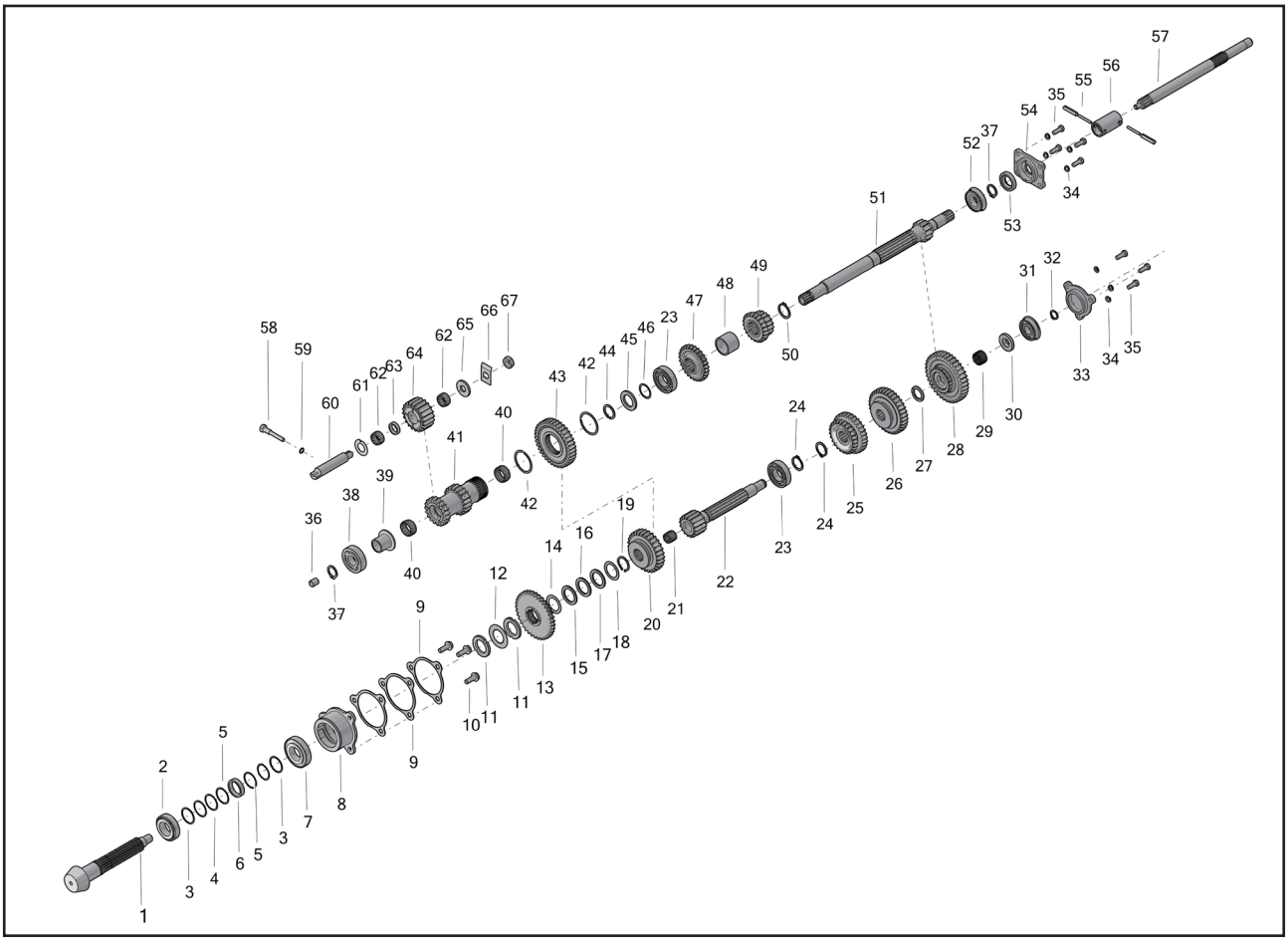
BEARING & OIL SEAL POSITIONS



TRANSMISSION OIL AND GREASE SPECIFICATIONS



TRANSMISSION SLIDINGMESH GEARS AND SHAFTS LAYOUT



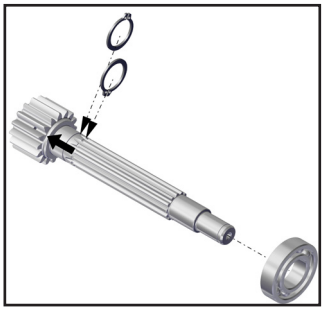
PART NUMBER.	REF.	DESCRIPTION OF PART	QTY.
‡	1	**SHAFT** Spiral Bevel 10T	1
E006504606D1	2	**BEARING** Tapper Roller Bevel Pinion Shaft (35x62x18.25)	1
006505768D1	3	**SHIM** Laysyhaft 0.5mM	A/R
006505770D1	4	**SHIM** Laysyhaft 0.05mm	A/R
006505769D1	5	**SHIM** Laysyhaft 0.2mm	A/R
006513093Y1	6	**SPACER** Bevel Pinion Shaft TRB	1
0703DD4120N	7	**BEARING TRB MD GEAR 30207 J2 Q**	1
006512422Y1	8	**RETAINER** Bevel Pinion Shaft TRB	1
006513090Y1	9	**SHIM** Bevel Pinion Shaft 0.2(CCD)	A/R
006513089Y1	9	**SHIM** Bevel Pinion Shaft 0.1(CCD)	A/R
006513091Y1	9	Shim Bevel Pinion Shaft 0.1(CCD)	A/R
006514316Y1	9	**SHIM** Bevel Pinion Shaft 0.075(CCD)	A/R
007206788C1	10	**BOLT** Flange Headed Hex M10X1.5X28	3
006513087Y1	11	**NUT** Lock Bevel Pinion Shaft	2
006513088Y1	12	**WASHER** Lock Bevel Pinion Shaft	1
006513307Y1	13	**GEAR** Input Dropbox	1
006514256Y1	14	**SPACER** Graded Input Gear 0.5mm	1
006514043Y1	15	**SPACER** Graded Input Gear 3.2mm	1
006513810Y1	16	**SPACER** Graded Input Gear 3.0mm	2
006514044Y1	17	**SPACER** Graded Input Gear 3.4mm	1
006514046Y1	18	**SPACER** Graded Input Gear 1.0mm	1
006500870C1	19	**CIRCLIP** Rev Idler Shaft(REV CRPTO)	1
006512421Y1	20	**GEAR** Low Driven (29T)	1

TRANSMISSION SLIDINGMESH GEARS AND SHAFTS LAYOUT

PART NUMBER.	REF.	DESCRIPTION OF PART	QTY.
006505619D1	21	**NRB** Spline SHAFT Pilot	1
006512417Y1	22	**SHAFT** Counter With Cm Gear Driver (16T)	1
006507467B1	23	**BALL BEARING** 6206	2
000012230P04	24	**CIRCLIP** EXT - LUG 30 X 2	2
006512420Y1	25	**GEAR** Cluster 3RD (31T) And 4TH(25T) Driven	1
006512419Y1	26	**GEAR** 2ND Driven	1
006505861B1	27	**SPACER** Rear Spline Shaft	1
006512418Y1	28	**GEAR** 1st Driven	1
006505616D1	29	**NRB** Gear First Driven (25 X 30 X 17)	1
006513008Y1	30	**SPACER** Front Spline Shaft With Cm Gear Driving	1
006506847B1	31	**BALL BEARING** Spline Shaft Front End	1
006502942C1	32	**CIRCLIP** On Spline Shaft	1
006514147Y1	33	**RETAINER** Counter Shaft	1
000934309R1	34	**WASHERS** Spring Lock	7
000022271RD	35	**BOLT** M8 X 1.25 X 22-H3	7
006510937V1	36	**BUSH** pto Driving	1
000032097B12	37	**CIRCLIP** Idler Shaft Rear End	2
006505646D1	38	**BEARING**-25X62X17	1
006513017Y1	39	**SPACER** Rear Lay Shaft 1st Gear Driving	1
006506852B1	40	**NRB** Low Cm Rev(30X37X16)	2
006514125Y1	41	**GEAR** Cluster Low(19T) & Reverse (19T)	1
SF0604038	42	**RING** Snap 52X1.4	2
006514094Y1	43	**GEAR** Driven CM 37T	1
006508991U1	44	V-RING Speed Driving	1
006513016Y1	45	**SPACER** Front Gear Cluster Cm Low And Reverse	1
006515354U1	46	**SHIM DIA 37 PTO MPST 0.2mm**	A/R
006515355U1	46	**SHIM DIA 37 PTO MPST 0.4mm**	A/R
006515353U1	46	**SHIM DIA 37 PTO MPST 0.1mm**	A/R
006512415Y1	47	**GEAR**-4th Driving (27T)	1
006513019Y1	48	**SPACER** 3RD AND 4TH Driving Gears	1
006512413Y1	49	**GEAR** Driving 2nd(18T) and 3rd(22T)	1
000012353P04	50	**CIRCLIP** EXT - LUG 35 X 2.5	1
006512412Y1	51	**LAY SHAFT** With 1st Gear Driving (13T)	1
006513807Y1	52	**BEARING** BALL 6205-1Z	1
006506907B1	53	**OIL SEAL** Drive Shaft	1
006512411Y1	54	**RETAINER** Lay Shaft With First Gear Driving	1
006513546V91	55	**PIN** Compound Roll For Pto	2
006513007Y1	56	**COUPLING** Input Drive Shaft	1
006512445Y1	57	**SHAFT** Input Drive	1
006506636B1	58	**SCREW** Grub Reverse	1
000020723E05	59	**WASHER Relief Valve Cu**	1
006512455Y1	60	**SHAFT** Reverse Idler	1
006514275Y1	61	**WASHER** Thrust Reverse Idler	1
006506868B1	62	**NRB** Revrse Idler Gear(22X30X15)	2
006513111Y1	63	**SPACER** Plastic	1
006512437Y1	64	**GEAR** Reverse Idler	1
006514274Y1	65	**SPACER** Reverse Idler	1
006514276Y1	66	**LOCK** PLATE Reverse Idler	1
E007605528D1	67	**NUT** M16X1.5 RH	1

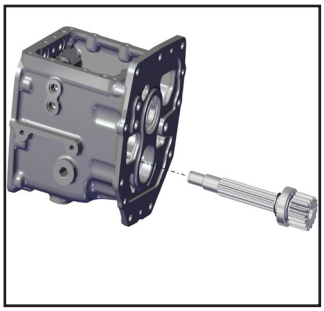
SPEED BOTTOM SHAFT MOUNTING

1



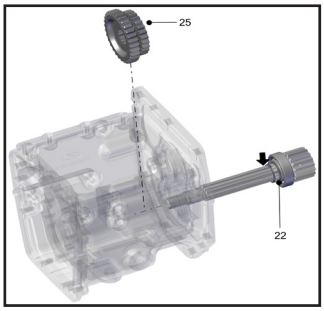
Press Ball bearing on counter shaft (22) And mount 1st & 2nd circlip on shaft after bearing with 90 Deg. Bend Plier

2



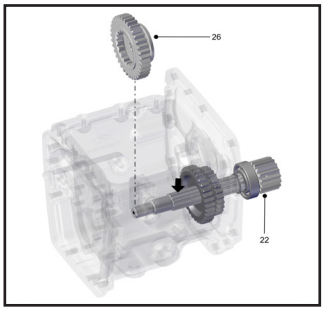
Insert Bottom shaft sub assy from RH side in speed Housing

3



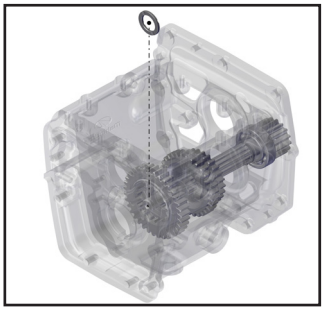
Fitment of 3rd and 4th driven gear on bottom shaft

4



Fitment of 2nd driven gear on bottom shaft sub assy in speed housing

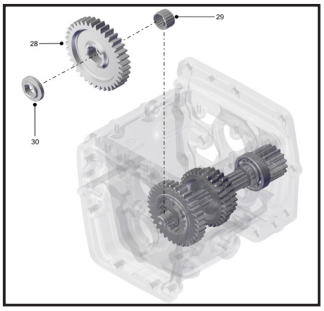
5



Fitment of spacer on driven shaft

⚠ NOTE :- Ensure free rotation of ball bearing after assembly
Ensure oil application on NRB

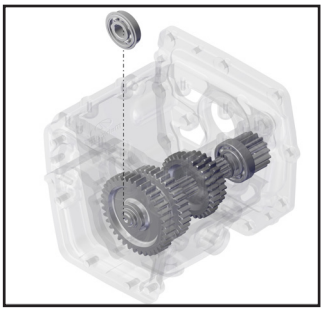
6



Fit 1st driven gear with NRB with application of oil & place front spacer on counter shaft

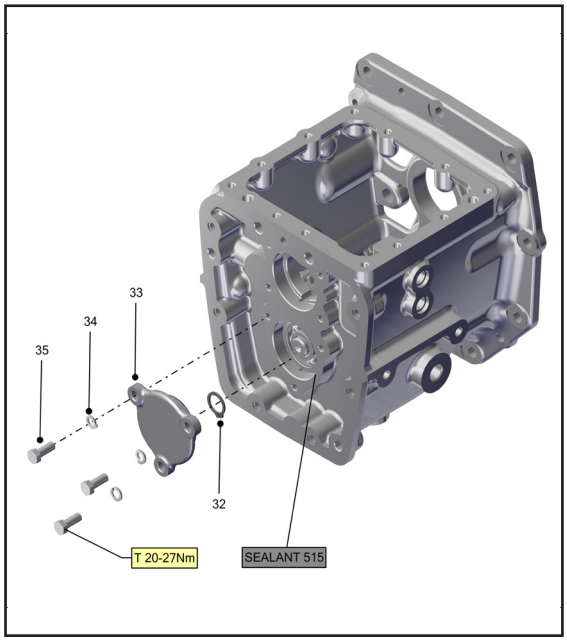
⚠ NOTE- Ensure free rotation of NRB With gear(28)

7



Fitment of ball bearing 6304N on bottom shaft using pressing dolly

8

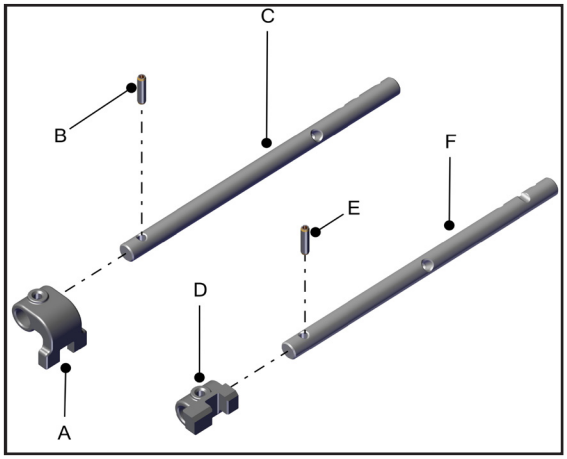


Fitment of circlip using 90o Bend plier.
Fit counter shaft retainer applying sealant 515 and tighten it with bolt & washer. Apply torque 20-27 Nm to the bolts with torque wrench

⚠ NOTE :- Assembly should be free from dust and foreign particles

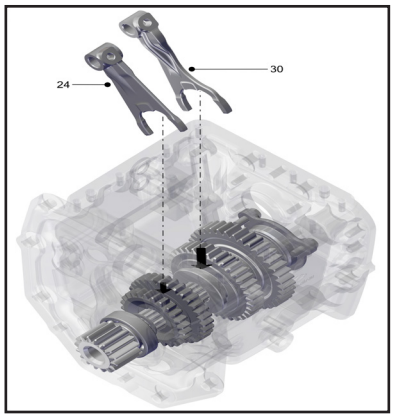
SPEED HOUSING FORK & RAIL MOUNTING

1



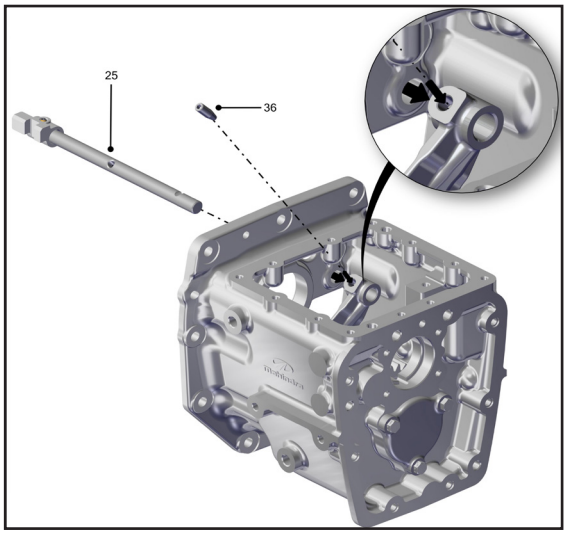
Locate the shifter block (A) on 1st & 2nd rail (C) & press the roll pin (B) on it. Similarly locate the shifter block (D) on 3rd and 4th rail (F) & press the roll pin (E) on it .

2



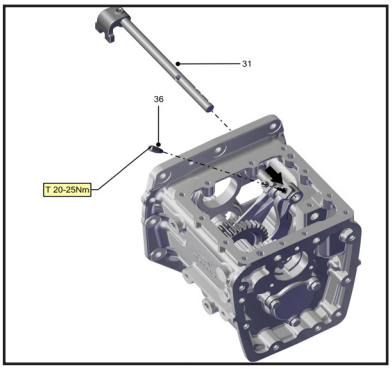
Assemble the 3rd and 4th fork and 1st and 2nd fork on its gears.

3



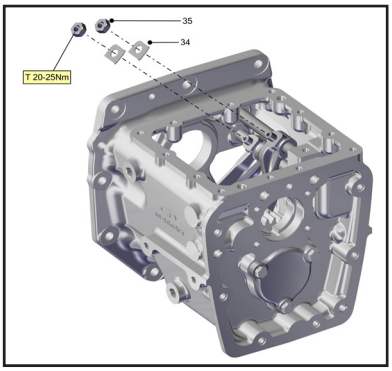
Fitment of 2nd driven gear on bottom shaft sub assy in speed housing

4



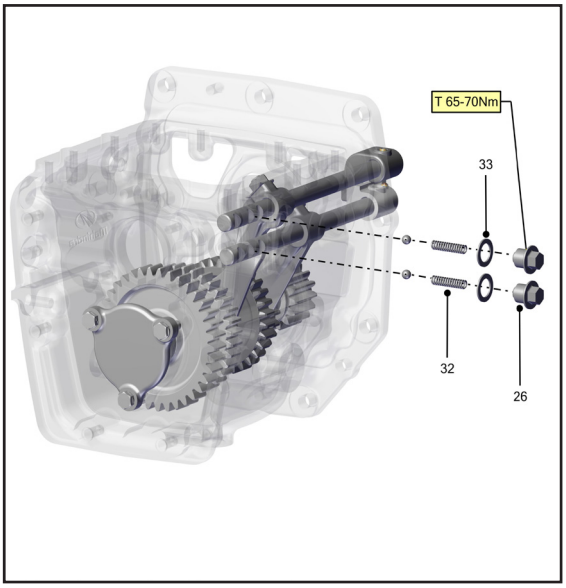
Insert the 1st and 2nd rail on fork and assemble the grub screw. Apply Torque 20-25Nm

5



Assemble the lock plate and nut on grub screw on both rails. Apply Torque 20-25Nm

6

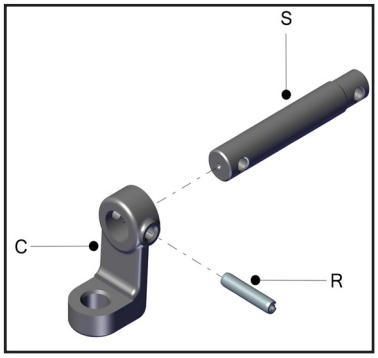


Assemble detent ball, spring & detent bolt with washer.
Apply Torque 65-75

NOTE :- Use thread lock sealant for bolts
Apply grease between outer cam link and lever's ball end.
Check free movement of gear lever in all gear positions.

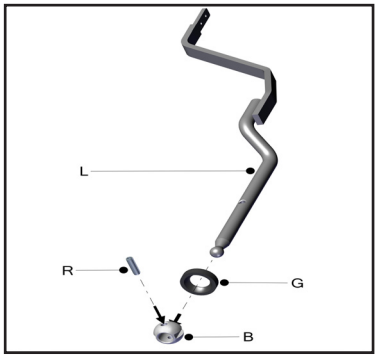
SPEED SHIFTER ASSEMBLY & MOUNTING

1



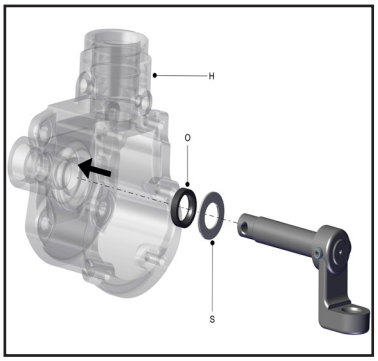
Assemble outer cam Link (C) and shaft speed shifting (S) locking it with roll pin (R)
⚠ **NOTE-** Ensure free rotation of shaft

2



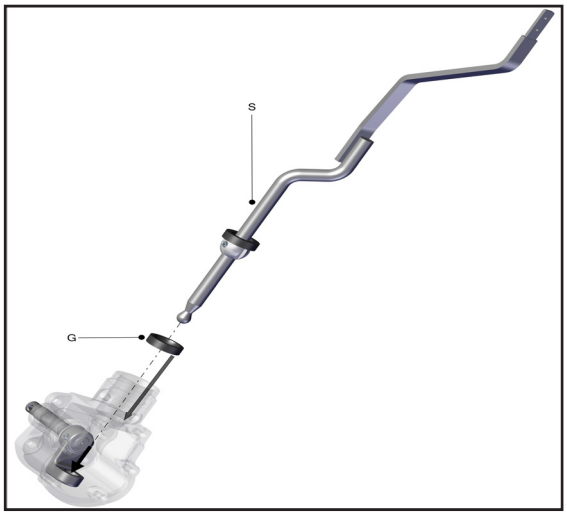
Take upper Gear shifter on lever and then assemble the ball pivot (B) on lever (L) and lock both with roll pin (R).

3



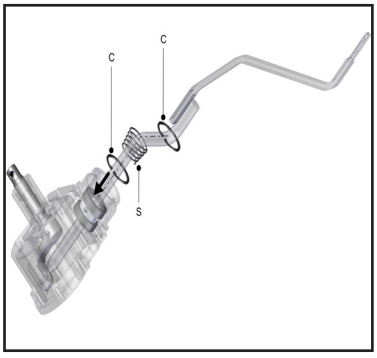
Take speed shifter housing (H) and (S) in housing (Hpress oil seal (O) in it.Insert the shaft gate shifter with spacer stopper).

4



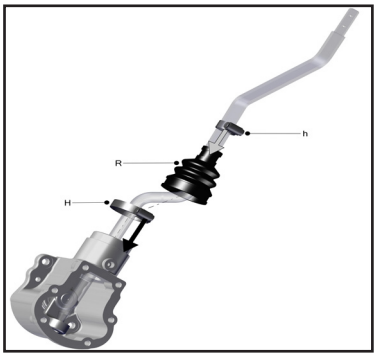
Insert the gear shifter (G) followed by assembly (S) of speed shifter lever and ball pivot gear shifter in speed shifter housing

5



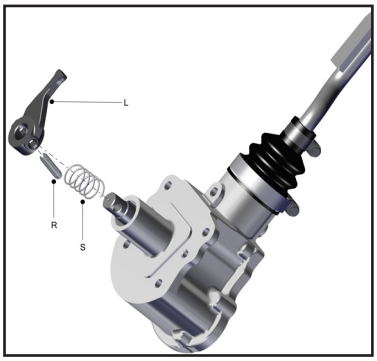
Insert Circlip internal (C) with straight circlip plier. Insert Conical spring (S). Insert the Circlip Internal (C) in dropbox

6



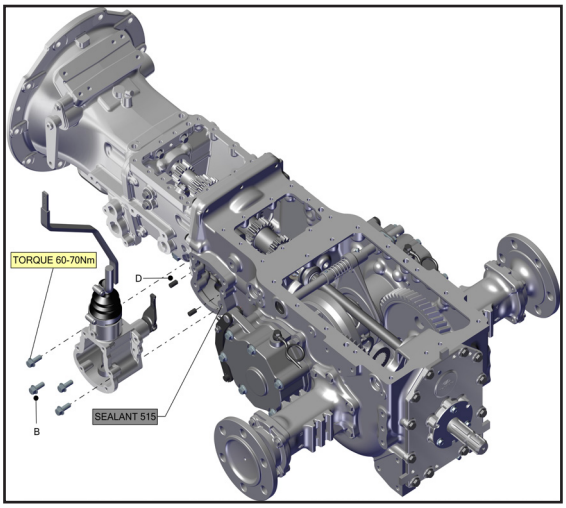
Cover dropbox upper open end & shifter lever with rubber boot (R). Fix it with hose clip (h) on lever & on dropbox with hose clip (H).

7



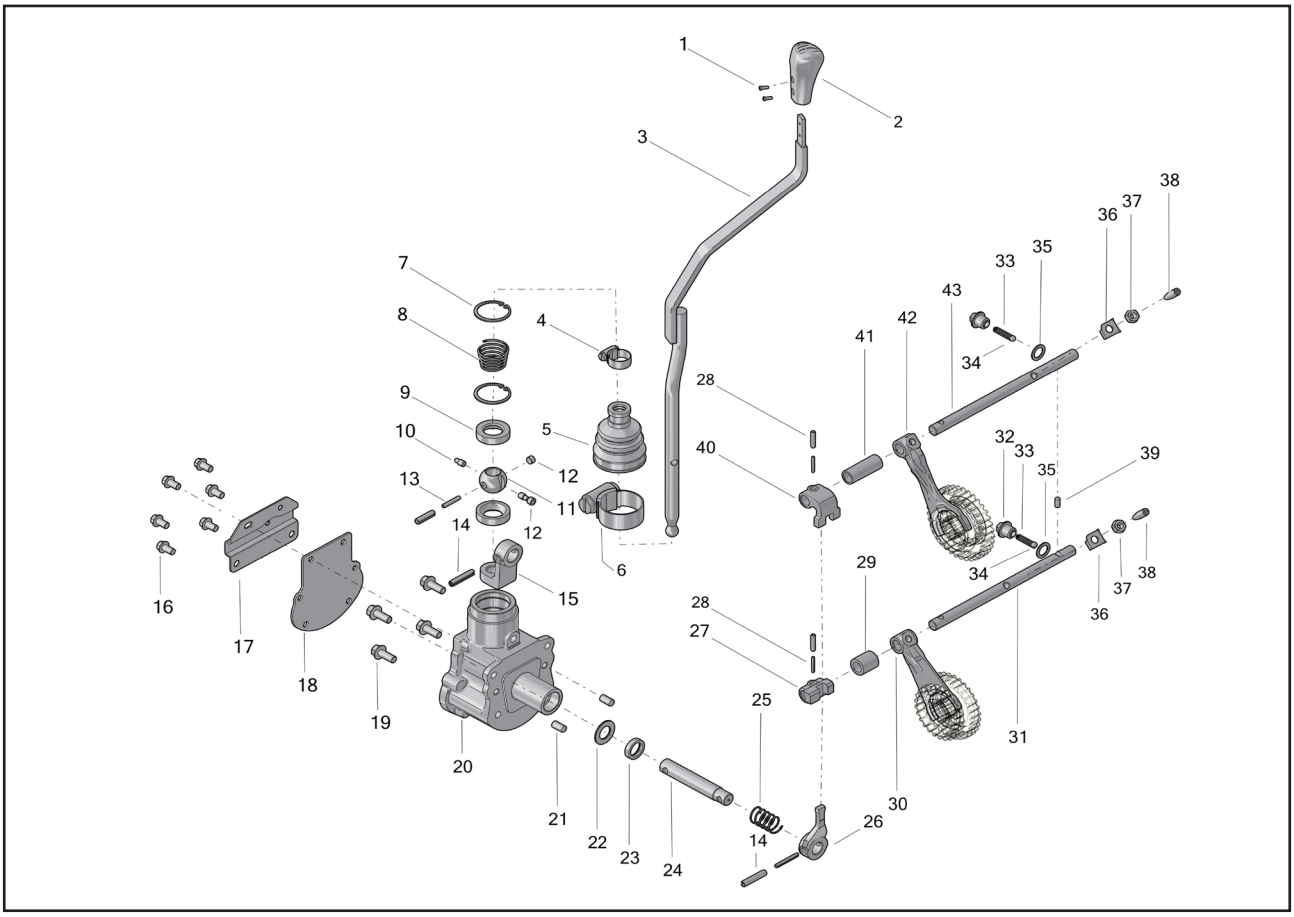
Insert the spring bias (S) on shaft and Fit cam link inner (L) with roll pin (R)

8



Insert the shifter mounting dowel (D) on housing. Mount shifter sub assy with 515 sealant & tight it with 4 bolts (B). torque (60-70Nm)

SPEED SHIFTER ASSEMBLY & MOUNTING

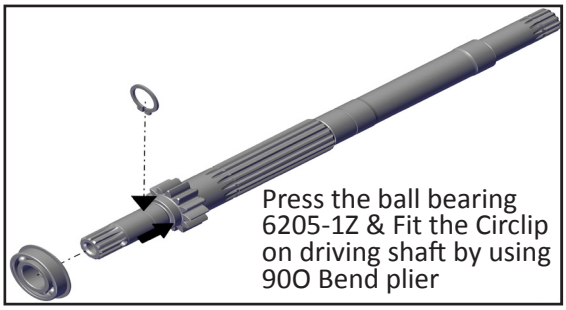


PART NUMBER.	REF.	DESCRIPTION OF PART	QTY.
000012904P04	1	**SCREW** Pan Head m4x10	2
007544530Y1	2	**KNOB** Speed Lever	1
006513780Y1	3	**LEVER** Speed Shifting	1
005552915R91	4	**CLIP**-Hose Warm Drive	1
006509780U1	5	**RUBBER** BOOT Range Lever Exter-nal-Mstar	1
005555585R91	6	**CLIP** Hose	1
000012188P04	7	**CIRCLIP** Internal	2
006511051U1	8	**SPRING** Conical Gear Shifter Lever	1
000012010P04	9	**SPHERICAL** half Gear Shifter Lever	2
006511258C1	10	**PIN** Pivot GS Lever Mpt	2
006516290Y1	11	**BALL** Spherical Gear Shifter Lever	1
000444687	12	**PLUG** 1 8 NPT	2
006513814V1	13	**PIN** Compound Roll (8X30 AND 5X30)	1
006511060C91	14	**PIN** Compound Roll	2
006513147Y1	15	**CAM** Link Outer Speed Shifting	1
000020308E05	16	**BOLT** For Oil Pan M8X1.0X16	6
007532466Y91	17	**ASSEMBLY** Fender Front Mounting Bracket	1
006513149Y1	18	**COVER** Plate Shifter Housing	1
000020313E05	19	**BOLT** HEXFL M10X1.5X25.5X8.8	4
006513148Y1	20	**HOUSING** Speed Shifter	1
000020281E05	21	**PIN** Dowel	2

PART NUMBER.	REF.	DESCRIPTION OF PART	QTY.
006512276V1	22	**SPACER** Stopper-Spring	1
006511675V1	23	**LIP SEAL** Rotary Shaft	1
006512465Y1	24	**SHAFT** Cross Gate Speed Shifting	1
006512275V1	25	**SPRING** Biasing Speed Range	1
006513146Y1	26	**CAM** Link Inner Speed Shifting	1
006513145Y1	27	**SHIFTER** Block 3rd And 4th Speed	1
006513178Y91	28	**PIN** Roll	2
006516648Y1	29	**SPACER** Nylon 3rd Gear Stopper	1
006513142Y1	30	**FORK** 3rd And 4th Speed	1
006513140Y1	31	**RAIL** 3rd And 4th Speed	1
006513820V1	32	**BOLT** Spring Retention M16x1.5x15	2
006516459Y1	33	**SPRING** Speed Detent	2
006503662C1	34	**BALL** Steel 8mm	2
000012488P04	35	**WASHER** Copper	2
006511058V1	36	**LOCKPLATE**	2
000031251B12	37	**NUT** Hex M8X1.25X8X8	2
000031249B12	38	**SCREW** Grub Sk M10X1.5X30XST	2
000030902B11	39	**PIN** Interlock	1
006513143Y1	40	**SHIFTER** Block 1st And 2nd Speed	1
006516647Y1	41	**SPACER** Nylon 2nd Gear	1
006513141Y1	42	**FORK** 1st And 2nd Speed	1
006513139Y1	43	**RAIL** 1st And 2nd Speed	1

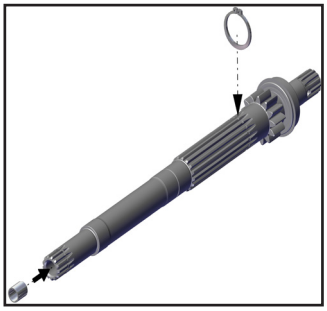
SPEED DRIVING SHAFT MOUNTING

1



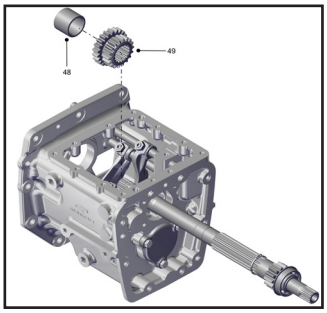
Press the ball bearing 6205-1Z & Fit the Circlip on driving shaft by using 90O Bend plier

2



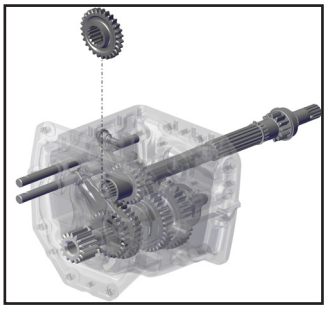
Fit the Circlip on driving shaft by using 90O Bend plier & Press the bush In shaft at rear end

3



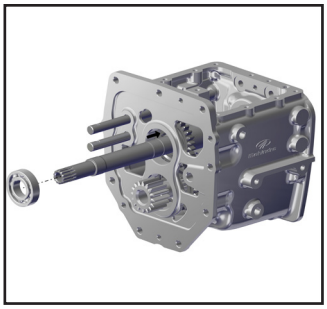
Insert driving shaft sub assy in speed housing top bore & fit 2nd &3rd driving gear on shaft & spacer

4



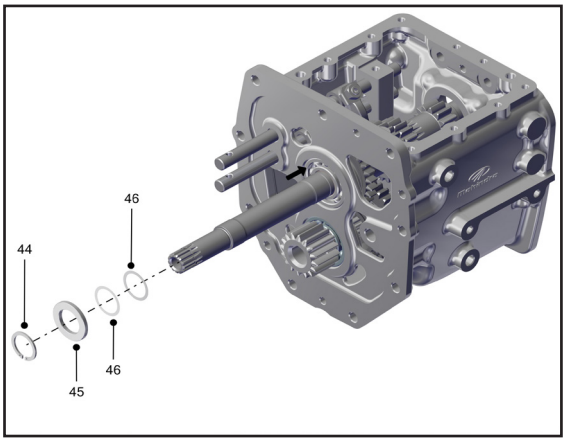
Fitment of 4th driving gear on driving shaft

5



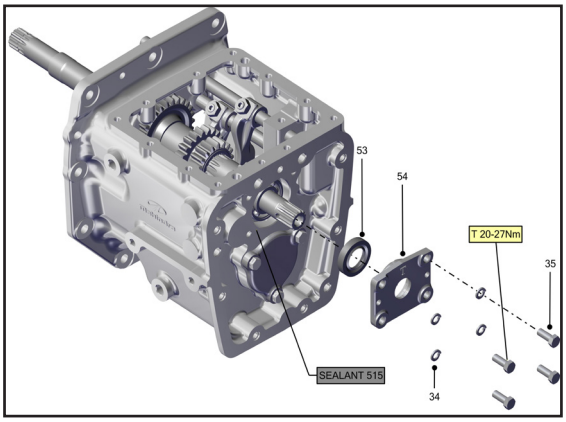
Fitment of ball bearing 6206 on driving shaft inserted in speed housing

6



Insert shims as per measured value Shim = Gap Between 4th Gear and bearing 6206. Then fit spacer ahead of it. V-ring speed driving on driving shaft

7



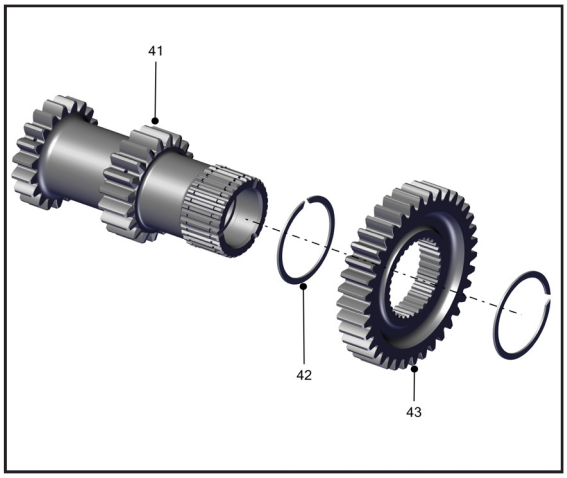
Fit oil seal on the driving shaft .(Lip Side of the oil seal should be up side). Press in Retainer applying sealant 515 on speed housing with bolt and washer. Apply Torque 20-27 NM on bolts

NOTE :- Ensure free rotation of ball bearing after assembly Ensure oil application on NRB Ensure proper fitment of circlips by rotation Assembly should be free from dust and foreign particles No grease application.

NOTE :- DO NOT REPLACE Inverted external Circlips with Basic external Circlip
Do not try to reduce the thickness of the thicker Graded spacer with Emery paper, bench grinder or files. They will not be uniform & lead to failure. Have all Graded Spacer before you carry out repairs.

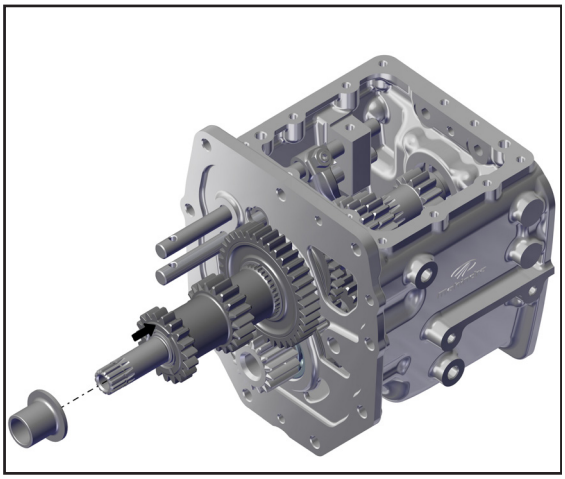
CLUSTER GEAR MOUNTING

1



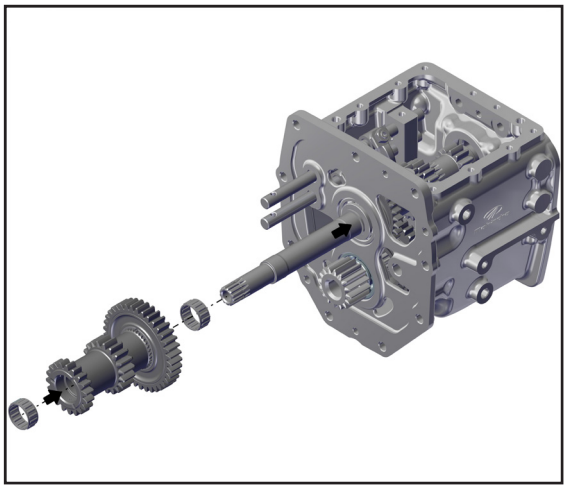
Fitment of CM driven gear on cluster shaft with snap rings one before and after of the gear

3



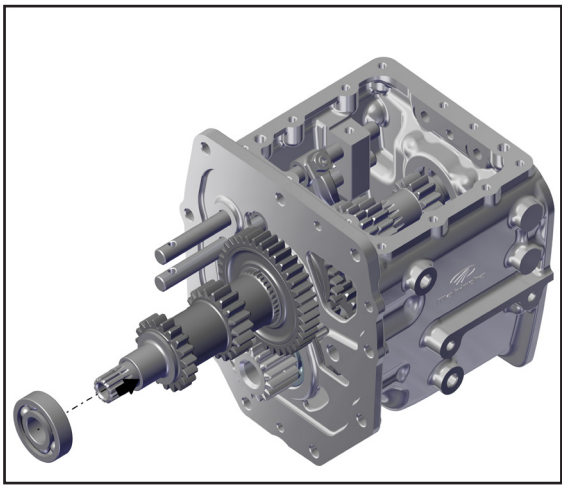
Insert spacer on driving shaft.
⚠ **NOTE-** Ensure orientation of spacer as shown only

2



Insert NRB in range cluster gear & fit this cluster gear assy on driving shaft
⚠ **NOTE-** Ensure free rotation of NRB With cluster gear assembly

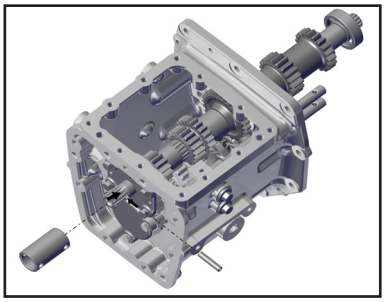
4



Press bearing 6305 on the speed driving shaft

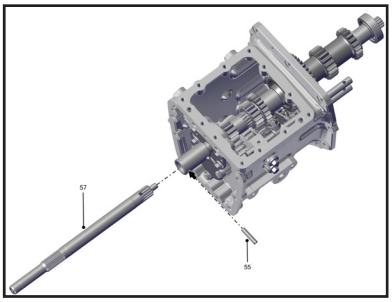
INPUT SHAFT MOUNTING

1



Assemble the coupler on top shaft with roll pin.

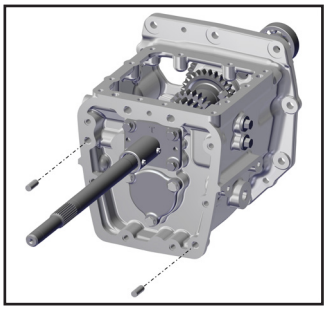
2



Insert input drive shaft on coupler and assemble the roll pin on it.

SPEED HOUSING AND CLUTCH HOUSING ASSEMBLY

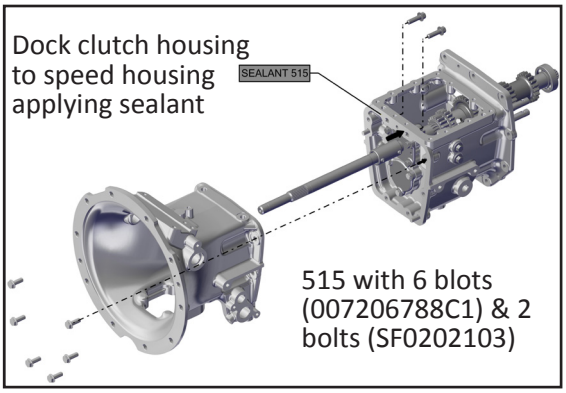
1



Press Ball bearing on counter shaft (22) And mount 1st & 2nd circlip on shaft after bearing with 90 Deg. Bend Plier

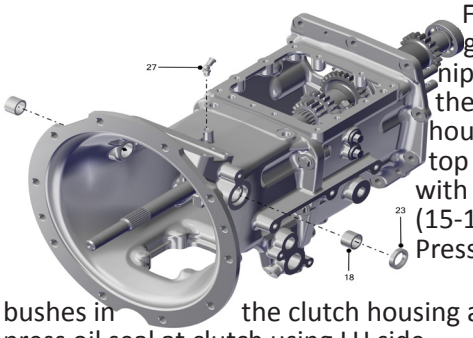
2

Dock clutch housing to speed housing applying sealant



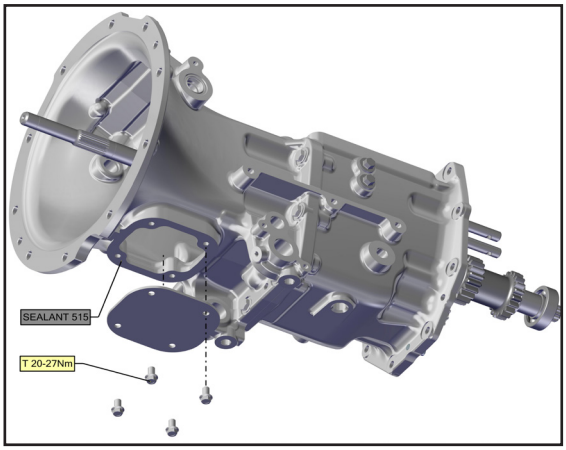
515 with 6 blots (007206788C1) & 2 bolts (SF0202103)

3



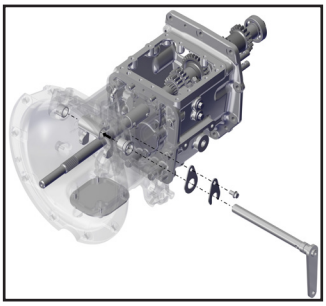
Fit the grease nipple in the clutch housing at top side with torque (15-18)N. Press 2 bushes in the clutch housing and press oil seal at clutch using LH side.

4



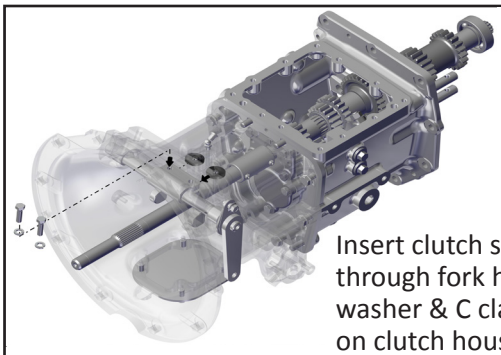
Fit Inspection hole cover plate on the clutch Housing using sealant 515 with 4 bolts. Apply Torque (20 -27)Nm.

5



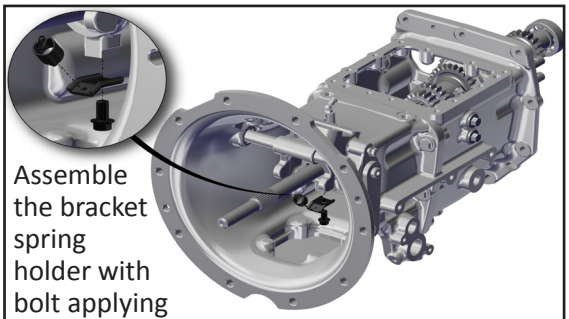
Insert clutch shaft through fork hole, washer & C clamp on clutch housing

6



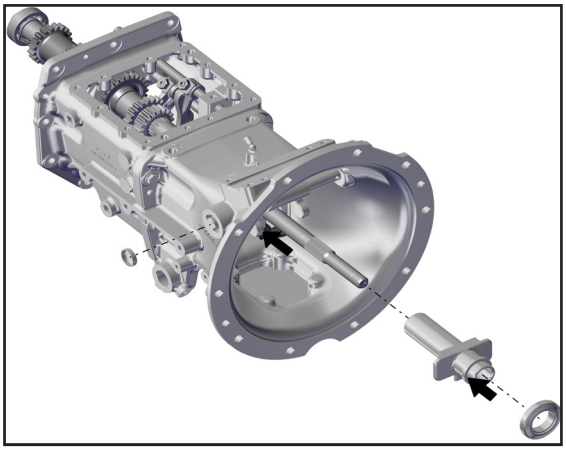
Insert clutch shaft through fork hole, washer & C clamp on clutch housing

7



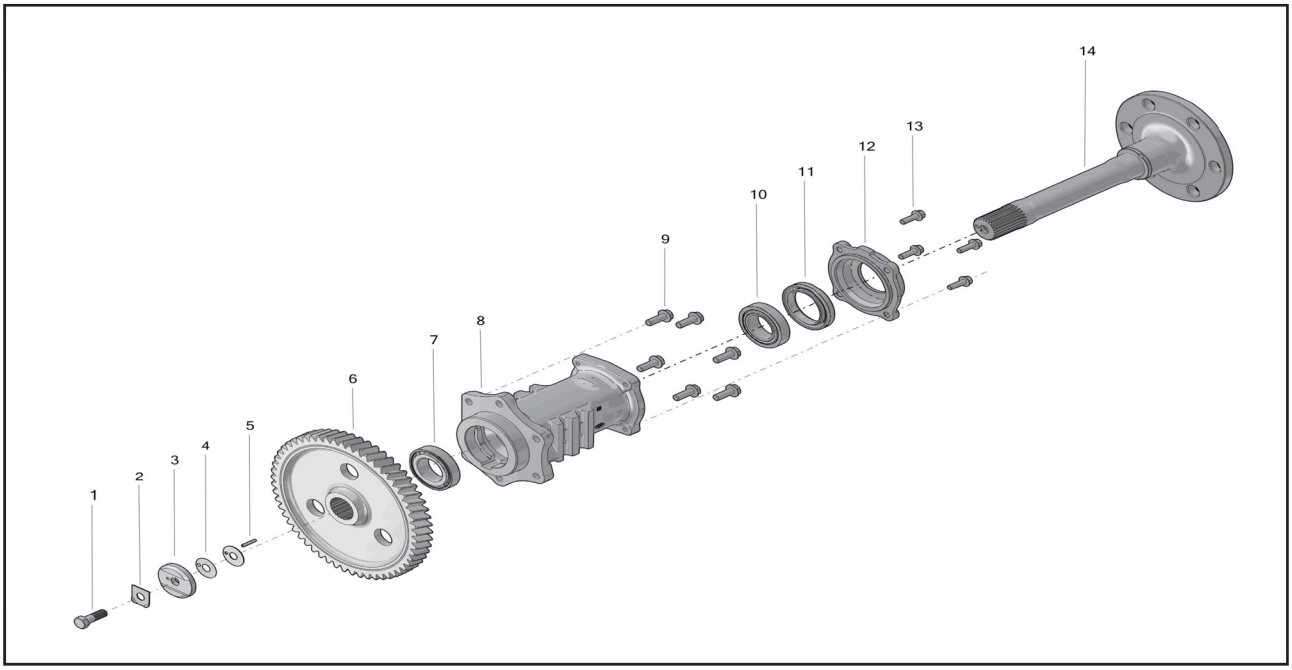
Assemble the bracket spring holder with bolt applying torque (20-27)Nm & Return spring on clutch housing

8



Apply Glubber grease & Assemble the C-Cup on clutch at RH side. Apply the glubber grease in clutch release sleeve Insert the Clutch release bearing in the housing

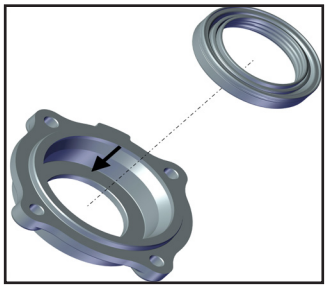
REAR AXLE CARRIER ASSEMBLY & MOUNTING PROCESS



PART NUMBER.	REF.	DESCRIPTION OF PART	QTY.
006508412U1	1	**BOLT** Ring Gear Differential Case	2
006512987Y1	2	**LOCK PLATE** Bull Gear	2
006512985Y1	3	**LOCK NUT** Bull Gear	2
006514306Y1	4	**SHIM** Rear Axle 0.4	A/R
006514307Y1	4	**SIM** 0.125	A/R
006514308Y1	4	**SHIM** Rear Axle 0.1	A/R
006514305Y1	4	**SHIM** Rear Axle	A/R
006517036Y1	4	**SHIM** Rear Axle 0.05	A/R
000017047R1	5	**PIN** Spring Dowel 4.064 X 0.8128 X 22.352	2
006513402Y1	6	**GEAR** Bull RH	1

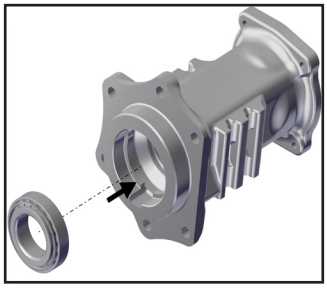
PART NUMBER.	REF.	DESCRIPTION OF PART	QTY.
006513400Y1	6	**GEAR** Bull LH	1
	7	**BEARING** Rear Axle Inner	2
006513004Y1	8	**CARRIER** Rear Axle RH	1
006512974Y1	8	**CARRIER** Rear Axle LH	1
007206788C1	9	**BOLT** Flange Headed Hex M10X1.5X28	12
	10	**BEARING** Rear Axle Outer	2
007609741C1	11	**OIL SEAL** Casett 56X80X13.5	2
006514185Y1	12	**RETAINER** Rear Axle	2
000020309E05	13	**BOLT** Hexfl M8X1.25 X 25.5 X 8.8	8
006512975Y1	14	**AXLE** Rear	2

1



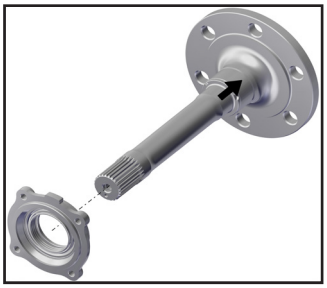
Press the oil seal (11) in Retainer (12)

2



Press needle bearing cone (7) in rear axle carrier (8) LH & RH from rear housing side attachment.

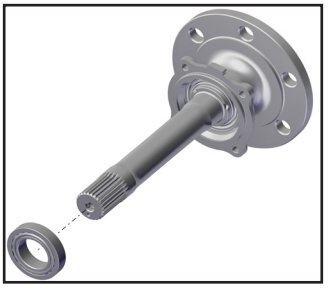
3



Press RAC oil seal retainer sub assembly in rear axle (14)

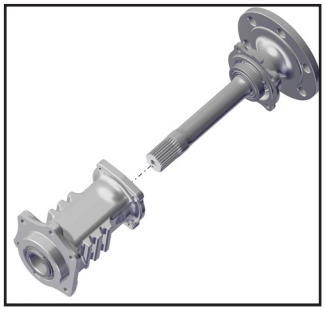
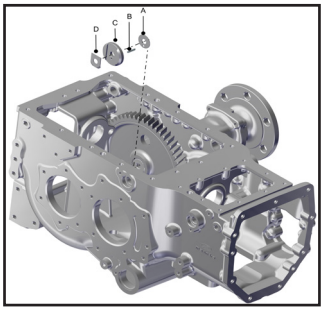
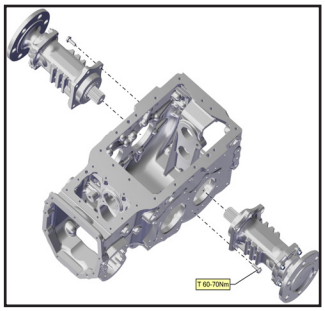
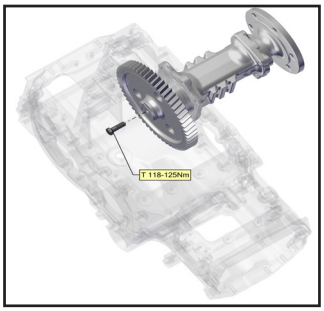
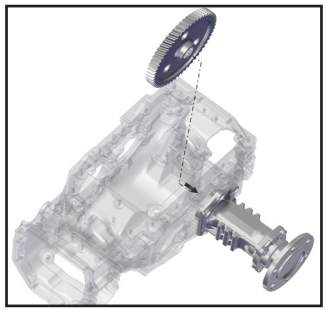
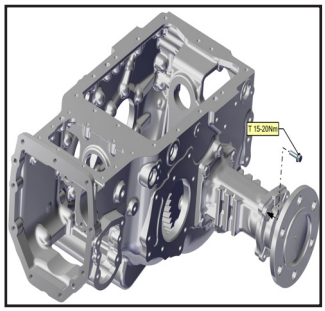
⚠ **NOTE-** Ensure lip safety of oil seal (11) while inserting rear axle

4

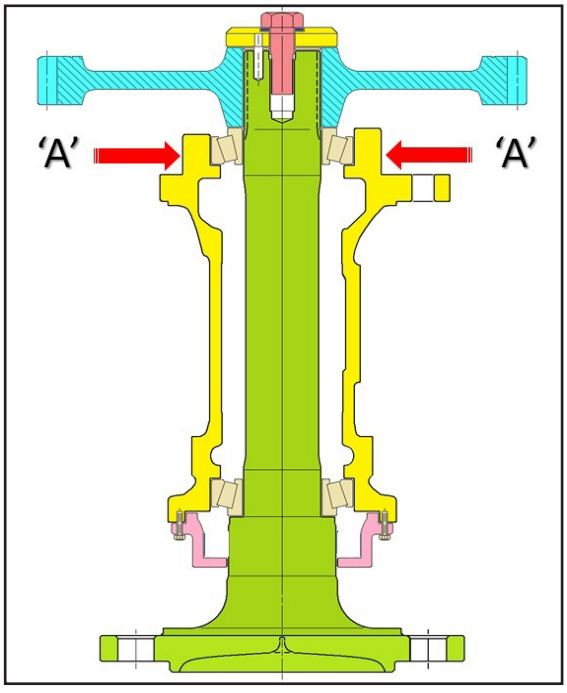


Insert & press inner TRB (10) on rear axle

REAR AXLE CARRIER ASSEMBLY & MOUNTING PROCESS

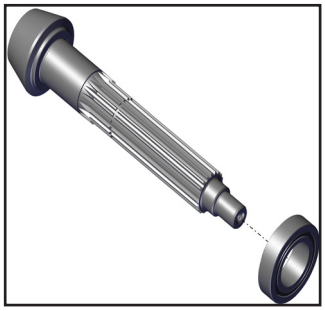
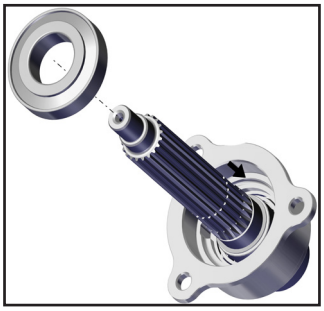
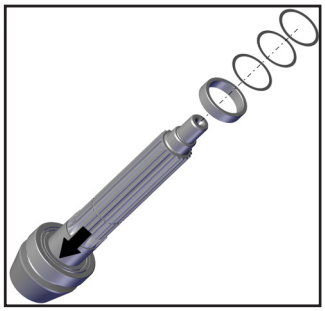
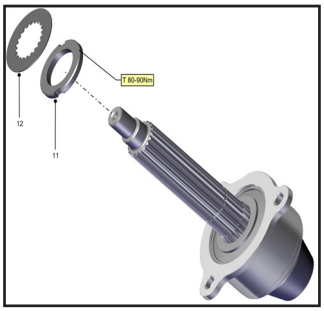
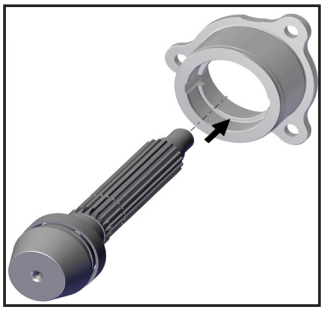
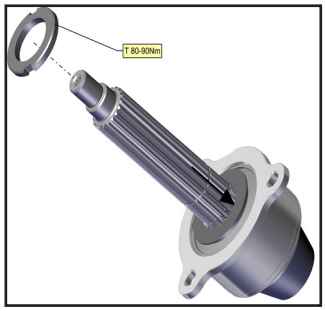
5		Insert Rear Axle assembly in Rear axle casing sub assembly	8		Insert shims (A) and fix lock washer (C) along with roll pin (B) & lock plate (D) in bull gear
6		Dock (LH + RH) RAC to Rear housing with 6 bolts (9) on each side with torque (60-70) Nm & sealant 515.	9		Mount axle mounting bolt (1) on bull gear with torque of 118-125 Nm. With torque wrench
7		Insert bull gear (6) LH & RH in rear housing and mount it on respective rear axle	10		Fix RAC retainer with 4 bolts (13) to RAC & Apply Torque 15-20 NM to bolt.

REAR AXLE CARRIER ASSEMBLY CRITICAL SETTINGS

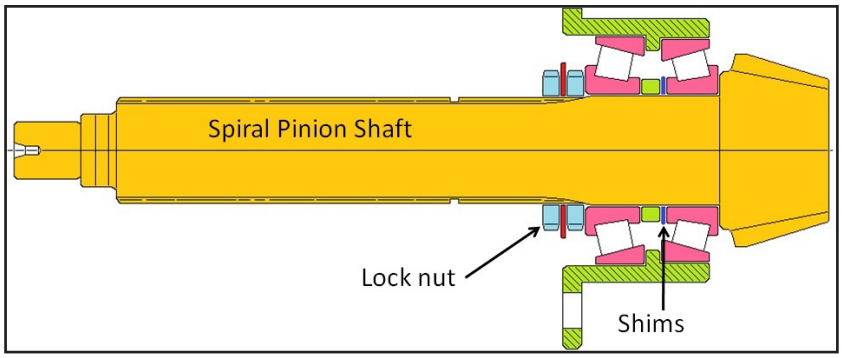


For 'Rear axle preload', tie the rope in the shown area 'A' 'A'.
Preload should be measured without oil seal (11) in Retainer(12)
Rear Axle bearing Preload should be within range of 1.5 to 3.2 Kg
If the bearing preload is not within the desired value adjust shims accordingly.
If preload is more add the shims and if preload is less remove the shims.

BEVEL PINION SHAFT SUB ASSEMBLY

1		Press inner TRB on spiral bevel pinion shaft	4		Press outer taper roller bearing in retainer passing it through bevel pinion shaft
2		Insert spacer and press shims of required thickness as per calculations for preload on bearing and spiral bevel pinion shaft.	5		Lock the spline shaft bearing cage set up by using 1st lock nut (11) & apply Torque 80-90 NM. Insert lock washer (12) on spline shaft
3		Insert spiral bevel pinion shaft sub assembly in retainer of spline shaft	6		Lock the spline shaft bearing cage set up by using 2nd lock nut applying torque 80-90 Nm. Again check preload of spline shaft on retainer OD

BEVEL PINION SHAFT SUB ASSEMBLY CRITICAL SETTINGS



Spiral Pinion shaft – bearing preload

Using spring balance & tying the rope around bearing retainer outer periphery, check the Spiral Pinion shaft bearing preload. It should be within 2 to 4.5 Kg.

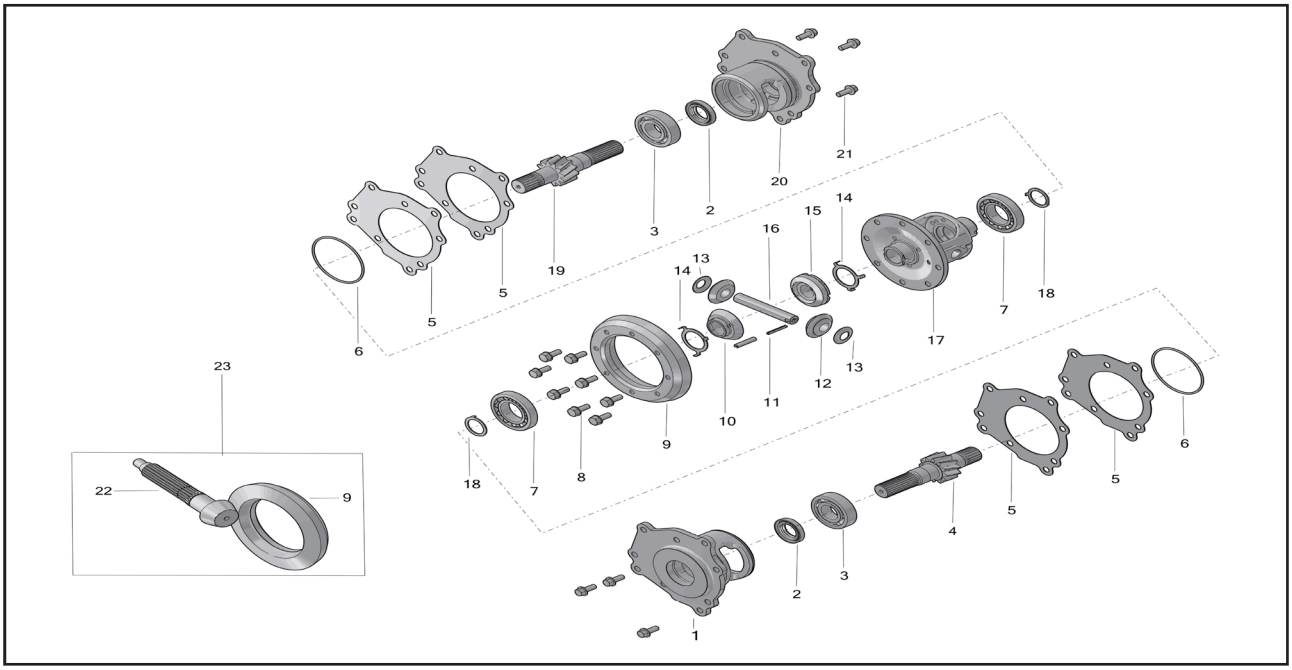
If the bearing preload is not within the desired value adjust shims accordingly.

If preload is more add the shims and if preload is less remove the shims.

Available thickness of shims for bevel pinion shaft are 0.5; 0.05; 0.2mm.

NOTE:- Ensure free rotation of taper roller bearings. TRB cone to be heated to 120 degree C and pressed using pressing dolly. No Grease should be applied during assembly. Assembly should be free from dust and foreign particles.

BULLCAGE & DIFFERENTIAL ASSEMBLY

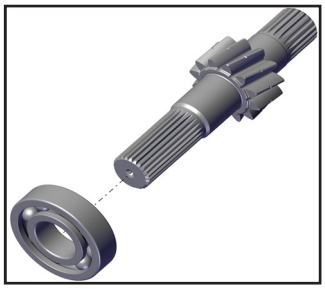


PART NUMBER.	REF.	DESCRIPTION OF PART	QTY.
006512981Y1	1	**CAGE** Bull Dry LH	1
006514438Y1	1	**CAGE** Bull OIB LH	**1**
005558067R91	2	**OIL SEAL** Drive Shaft Pto	2
000016299P04	3	**BEARING** BALL 6307(35X80X21)	2
006513399Y1	4	**SHAFT** Bull LH	1
006513099Y1	5	**SHIMS** Bull Cage 0.1 MM	A/R
006513098Y1	5	**SHIMS** Bull Cage 0.2 MM	A/R
006513097Y1	5	**SHIMS** Bull Cage 0.5 MM	A/R
006514321Y1	5	**SHIMS** Bull Cage 0.075	A/R
006513994Y1	6	**O-RING** Bullcage	2
005557130R91	7	**BEARING** Trans Spline Shaft FRT	2
006508939U1	8	**BOLT** M10x1.25x25 Length Oilseal	8
006512433Y1	10	**GEAR** Side Bevel LH	1
006513546V91	11	**PIN** Compound Roll For PTO	1

PART NUMBER.	REF.	DESCRIPTION OF PART	QTY.
006512432Y1	12	**PINION** Differential	2
006512477Y1	13	**WASHER** Thrust Differential Pinion	2
006512478Y1	14	**WASHER** Thrust Bevel Gear Side	2
006514241Y1	15	**GEAR** Side Bevel RH	1
006512453Y1	16	**SHAFT** Differential Pinion	1
006514184Y1	17	**HOUSING** Differential	1
006513607Y1	18	**WASHER** Thrust Bull Shaft	2
006513401Y1	19	**SHAFT** Bull RH	1
006513020Y1	20	**CAGE** Bull RH	1
006514439Y1	20	**CAGE** Bull OIB RH	**1**
000020313E05	21	**BOLT** HEXFL M10X1.5X25.5X8.8	6
006513869Y91	23	**SET** Of Two 10T/41T	1
‡	9	**GEAR** Spiral Bevel(41T)	1
‡	22	**SHAFT** Spiral Bevel 10T	1

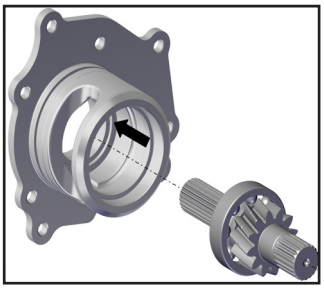
BULLCAGE ASSEMBLY

1



Take bull shaft LH (4) & RH (19) and press bearing (3) on both shafts

2

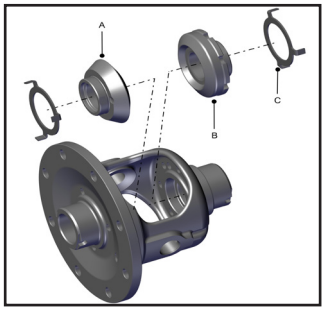


Take bull cage LH (1) & RH (20) insert bull shaft sub assy. in bull cage. Ensure that shaft is easily inserted in bull cage

NOTE:- Ensure free rotation of ball bearings of bull cage assembly Use protective sleeve during mounting of O ring on bull cage.
Assembly should be free from dust and foreign particles.

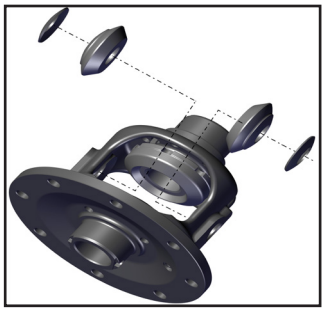
DIFFERENTIAL CASE ASSEMBLY & DIFFERENTIAL LOCK MOUNTING

1



Take diff case (17) & insert bevel gear RH (B) & LH (A) with thrust washers (C).

2

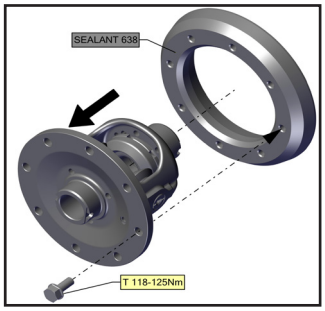


Insert 2 bevel pinion (12) with Pinion Thrust Washers (13) in differential case

3

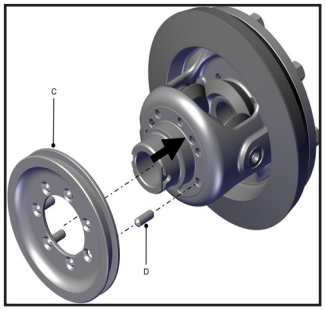
Insert bevel pinion shaft (16) through both pinion. Press roll pin (11) after aligning Diff Case and shaft holes by Dolly for roll pin pressing

4



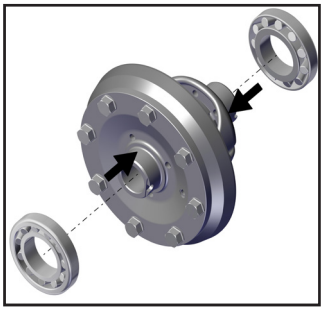
Apply sealant 638 on ring gear and Insert ring gear (9)on Differential Case
Mount the bolt (8) & apply torque 118-125 Nm

5



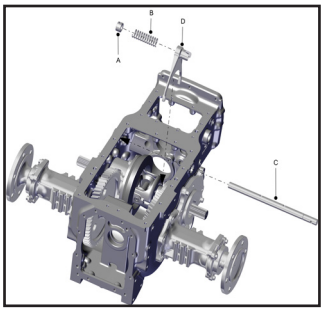
Put the diff lock coupling "C" in the LH diff case through 7 dowel pins "D".

6



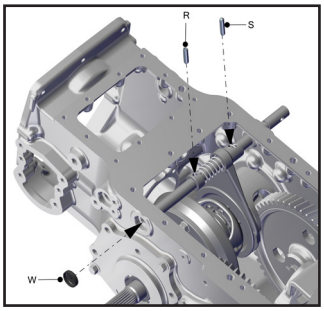
Press the TRB bearing (7) on LH & RH side of diff case with pressing dolly

7



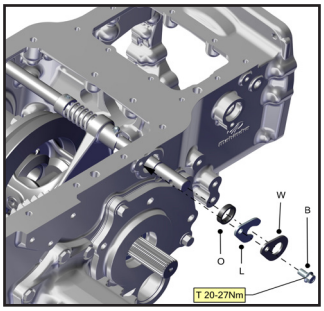
Insert the Diff lock shaft (C) through the fork (D), Stopper (A) & spring (B).

8



Fitment of solid pin (S) & roll pin (R) in the diff lock shaft.
Insert welch plug (W) in the rear housing

9



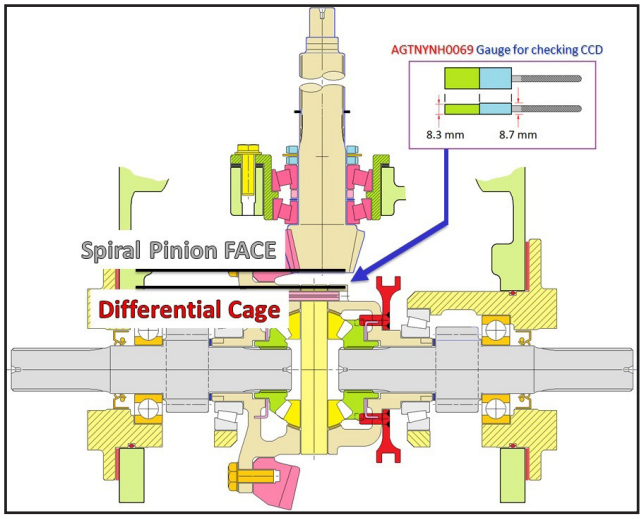
Press the oil seal (O) on the diff lock shaft.
Lock the diff lock shaft with Washer (W), lock plate (L) & bolt (B) with Torque (20-27)Nm

NOTE:- Ensure free rotation of differential gears after assembly
Both differential cones to be heated to 120 degree C and pressed using pressing dolly.
Ensure free bearing of bearing rollers after assembly.

NOTE:- No Grease should be applied during assembly of differential lock on differential case
Check for easy engagement and disengagement of coupling
Assembly should be free from dust and foreign particles.

DIFFERENTIAL CASE ASSEMBLY & DIFFERENTIAL LOCK MOUNTING

BEVEL PINION SHAFT AND DIFFERENCIAL CASE CRITICAL SETTINGS



CCD- CONE CENTER DISTANCE

Once the 'Spiral Pinion Bearing preload' & 'Crown Bearing preload' is done, assemble the 'Spiral Pinion shaft' sub-assembly in the rear housing with some shim

Torque the 'Spiral Pinion shaft' sub-assembly mounting bolts.

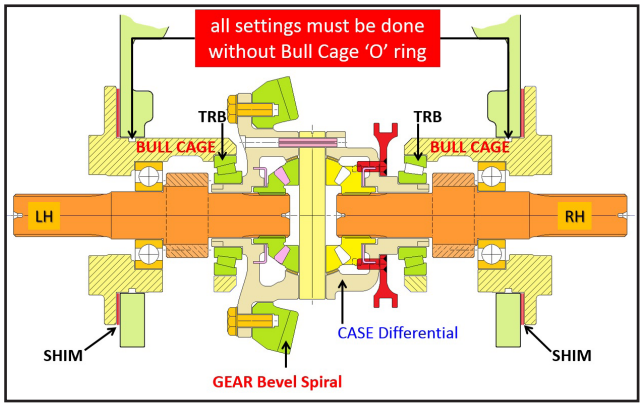
With the help of special tool 'AGTNYNH0069 - Gauge for checking CCD', measure the gap between 'Differential cage' & 'Spiral Pinion shaft face'.

GO should go easily & NO GO should not go.

Available thickness of shims for bevel pinion shaft CCD are 0.075; 0.1; 0.2mm.

If GO is not going	Add some more CCD shims & check.	NO GO is also going	Remove some CCD shims & check.

BULL CAGE SUB ASSEMBLY AND DIFFERENCIAL CASE CRITICAL SETTINGS



Check the Differential Cage Tapper Roller bearing preload. It should be within 1 to 2 Kg.

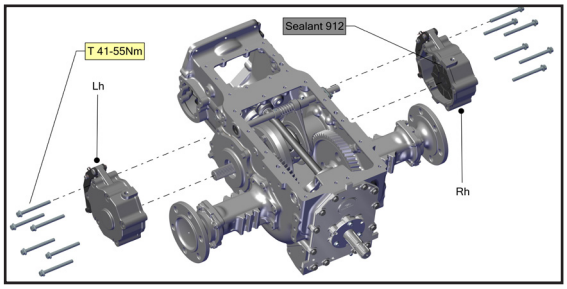
All settings must be done without Bull Cage "O" ring. Adjust preload without inserting thrust washers in differential cage.

If the bearing preload is not within the desired value adjust shims accordingly.

If preload is more add the shims and if preload is less remove the shims.

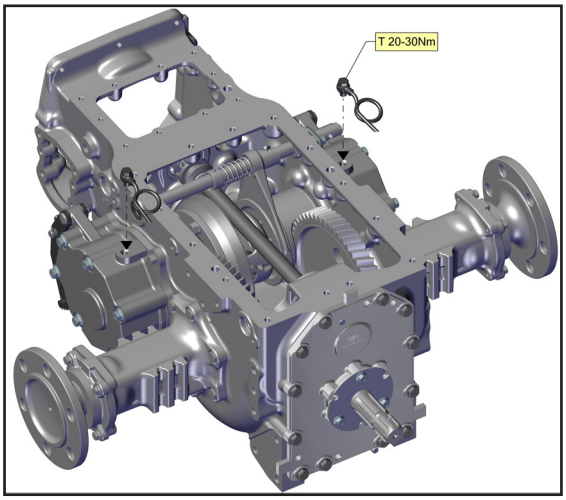
BRAKE ASSEMBLY MOUNTING

1



Assemble the brake assembly(Rh) & (Lh) on RH side and Lh side resp. with 6 no. of bolts on each side applying sealant 912. Apply Torque (41-55) NM on bolts with torque wrench to fix brake assembly on rear housing

2

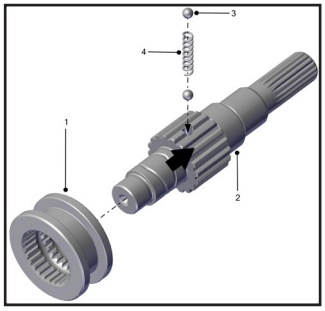


Assemble the breathers on brakes in proper direction & Torque (20-30) Nm.

NOTE:- Ensure free rotation of ball bearings after assembly.
No Grease or oil trace should be present in **DRY BRAKE** assembly.
Assembly should be free from dust and foreign particles.
Make sure liners to be presoaked before assembly of **OIB BRAKES.**
Remove all protective caps before installing.

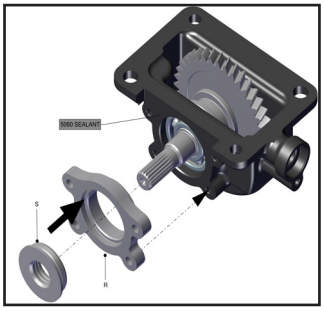
DROPBOX ASSEMBLY & MOUNTING ON REAR HOUSING

1



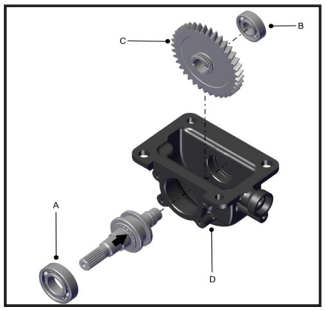
Fitment of Coupling (1) with 2 ball (3) & 1 spring (4) in the output shaft (2)

3



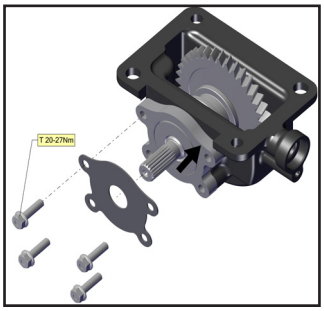
Fitment of retainer (R) on dropbox with sealant 5060 and press output shaft oil seal (S) in retainer.

2



Press Front bearing (A) in output shaft sub assembly. Insert this sub assy through Dropbox (D), o/p gear (C), & inner bearing(B)

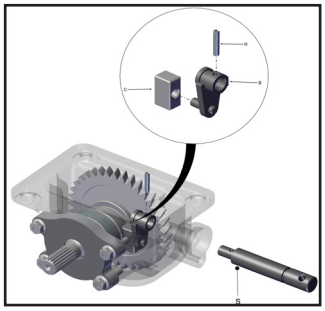
4



Fix dropbox cover plate on dropbox sub assembly using 4 no. of bolts applying torque of 20-27Nm on it.

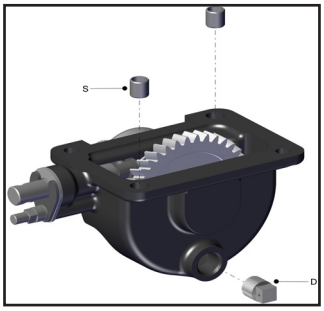
DROPBOX ASSEMBLY & MOUNTING ON REAR HOUSING

5



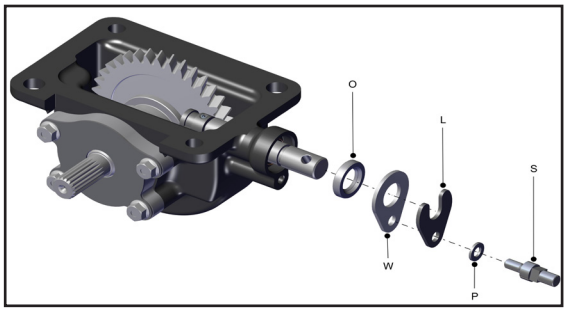
Insert shifting arm (S) in dropbox lock it with sub assembly of chock block (C) and shifting bracket (B) by roll pin (R).

7



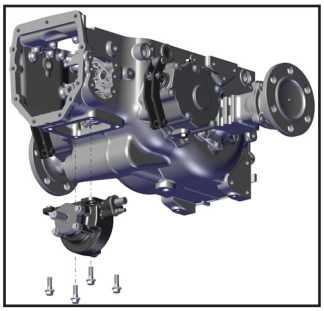
Press location sleeve (S)in opposite holes of dropbox as shown in image. Fit drain plug (D) in drop box with applying torque of 60-70Nm.

6



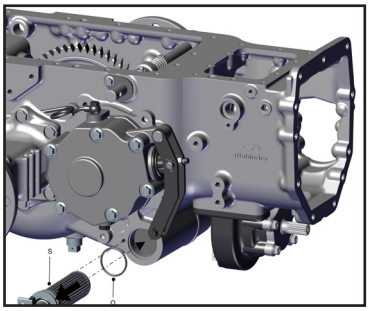
Press oil seal (O) in dropbox on the shifting arm.
Lock the shaft with differential lock washer (W) and lock plate (L) with plain washer (P) and stopper bolt (S).

8



Fit dropbox sub assembly below rear housing using 4 no. of bolts

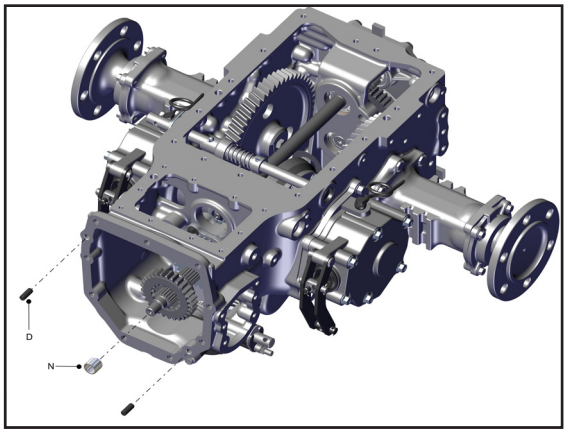
9



Assemble the strainer (S) with O-ring (O) and lock it with bolt (B) on rear housing.

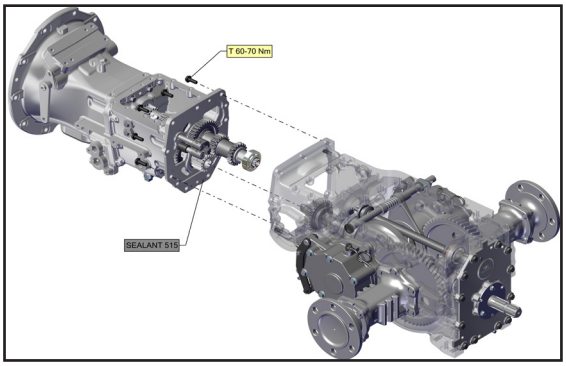
SPEED HOUSING AND CLUTCH HOUSING MOUNTING WITH REAR HOUSING

1



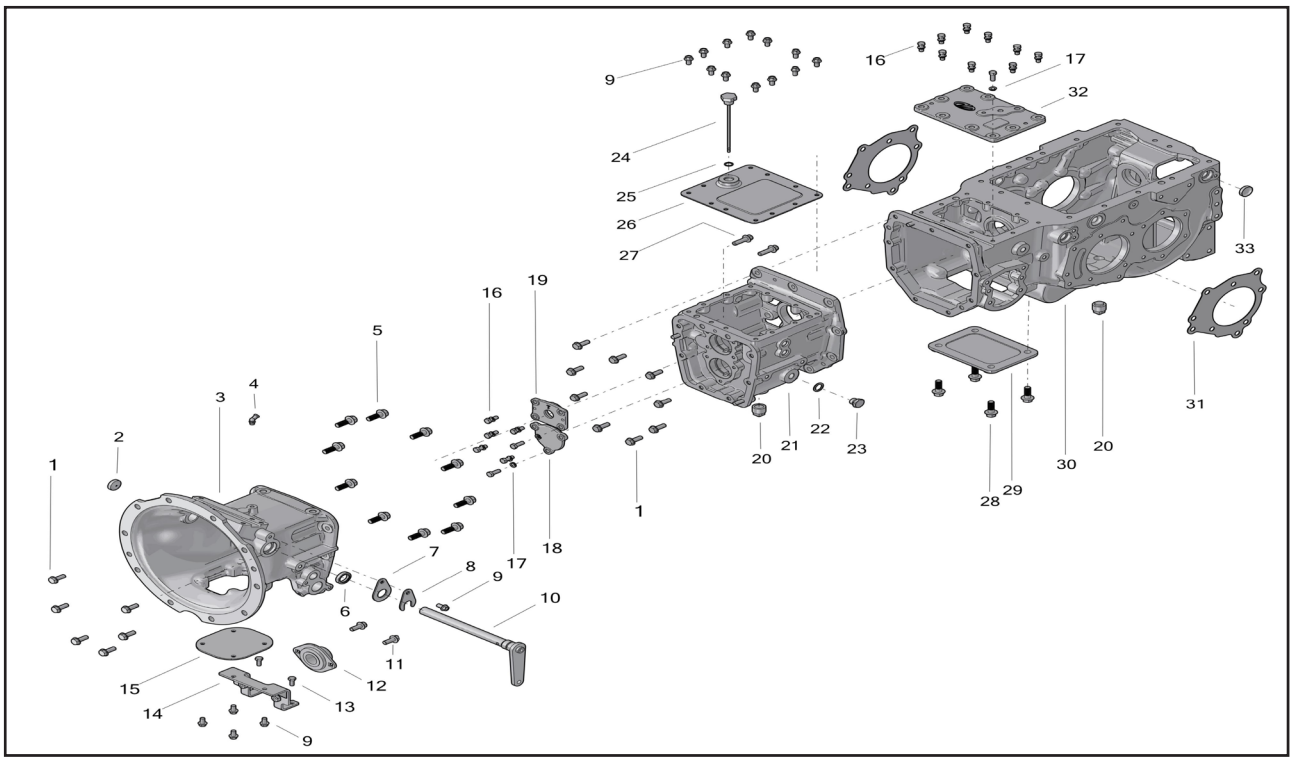
Fitment of two dowels (D) on rear housing
Place the NRB (N) in bottom shaft at Spline shaft end mating area

2



Docking of Speed housing to Rear housing with bolts & sealant 515.
Apply Torque (60-70)Nm

SPEED HOUSING AND CLUTCH HOUSING MOUNTING WITH REAR HOUSING

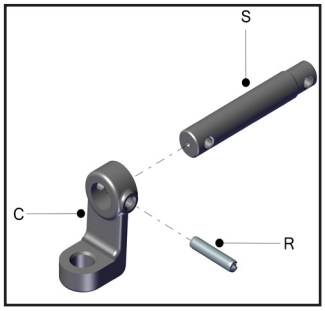


PART NUMBER.	REF.	DESCRIPTION OF PART	QTY.
007206788C1	1	**BOLT** Flange Headed Hex M10X1.5X28	15
006017521V1	2	**PLUG** Welch Dia 30.0	1
006513106Y1	3	**HOUSING** Clutch	1
006515065V91	4	**NIPPLE** GREASE With Cap	1
000016469P04	5	**BOLT** Flanged Hex. Head M12X1.5X35	10
000016211P04	6	**OIL SEAL** I 35x25x7 SGD	1
006513515V1	7	**WASHER** Clutch Housing LH	1
006513551Y1	8	**C CLAMP** Clutch Release Shaft	1
000020308E05	9	**BOLT** For Oil Pan M8X-1.0X16	17
006514025Y91	10	**SHAFT** Clutch Release Assembly	1
000020313E05	11	**BOLT** HEXFL M10X-1.5X25.5X8.8	2
006500998C1	12	**BEARING** Intermediate	1
006008883B1	13	**BOLT** Hexagonal	2
006513317Y1	14	**BRACKET** Support Frame	1
006512454Y1	15	**COVER** Inspection Hand Hole	1
000022271RD	16	**BOLT** M8 X 1.25 X 22-H3 x 2	17
000934309R1	17	**WASHERS** Spring Lock	17
006514147Y1	18	**RETAINER** Counter Shaft	1

PART NUMBER.	REF.	DESCRIPTION OF PART	QTY.
006512411Y1	19	**RETAINER** Lay Shaft With First Gear Driving	1
005556606R1	20	**PLUG** Drain Magnetic Met-lok Precoate	2
006513104Y1	21	**HOUSING** Speed	1
007206997C1	22	SEAL Bonded **M18**	1
007205033C1	23	**PLUG** M18x1.5	1
006513122Y91	24	**ASSY** Dipstick	1
007205510C1	25	**O RING** 15.3 X 2.2 M 18 Stud End	1
006514406Y1	26	**COVER** Top Speed Housing	1
SF0202103	27	**SCREW** HEX FL M10X-1.5X35X10.9	2
000016469P04	28	**BOLT** Flanged Hex. Head M12X1.5X35	4
006513119Y1	29	**PLATE** Bottom Cover Tran-scase	1
006513105Y1	30	**HOUSING** Rear	1
006513098Y1	31	**SHIMS** Bull Cage 0.2 MM	A/R
006513097Y1	31	**SHIMS** Bull Cage 0.5 MM	A/R
006514321Y1	31	**SHIMS** Bull Cage 0.075	A/R
006513099Y1	31	**SHIMS** Bull Cage	A/R
006514407Y1	32	**COVER** Top Rear Housing	1
006514440Y1	32	**COVER** Top Rear Housing Oib	1
006017521V1	33	**PLUG** Welch Dia 30.0 (Pres-ent Only For Single PTO)	1

SPEED SHIFTER ASSEMBLY & MOUNTING

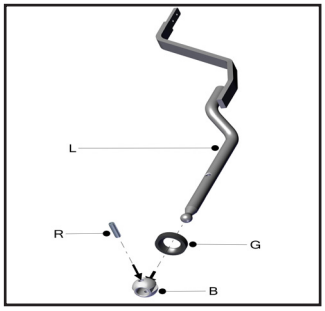
1



Assemble outer cam Link (C) and shaft speed shifting (S) locking it with roll pin (R)

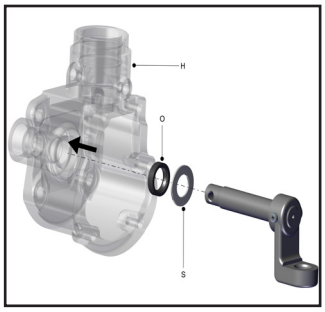
⚠ **NOTE-** Ensure free rotation of shaft

2



Take upper Gear shifter on lever and then assemble the ball pivot (B) on lever (L) and lock both with roll pin (R).

3

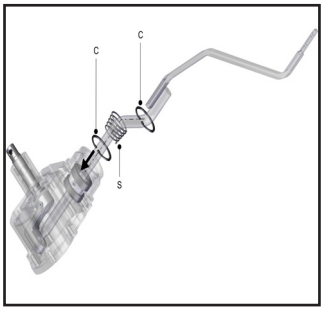


Take speed shifter housing (H) and press oil seal (O) in it. Insert the shaft gate shifter with spacer stopper (S) in housing (H).

4

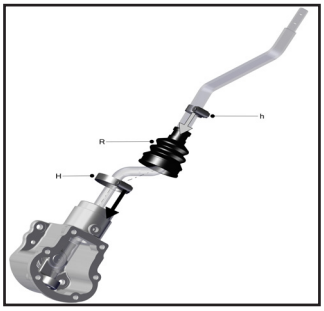
Insert the gear shifter (G) followed by assembly (S) of speed shifter lever and ball pivot gear shifter in speed shifter housing

5



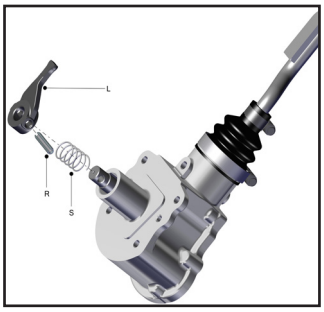
Insert Circlip internal (C) with straight circlip plier. Insert Conical spring (S). Insert the Circlip Internal (C) in dropbox

6



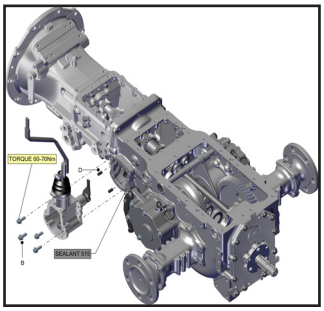
Cover dropbox upper open end & shifter lever with rubber boot(R). Fix it with hose clip (h) on lever & on dropbox with hose clip (H).

7



Insert the spring bias (S) on shaft and Fit cam link inner (L) with roll pin (R)

8

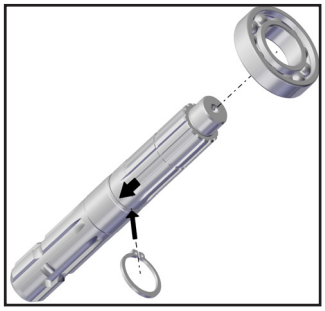


Insert the shifter mounting dowel (D) on housing. Mount shifter sub assy with 515 sealant & tight it with 4 bolts (B). torque (60-70Nm)

⚠ **NOTE:-** Use thread lock sealant for bolts.
Apply grease between outer cam link and lever's ball end.
Check free movement of gear lever in all gear positions.

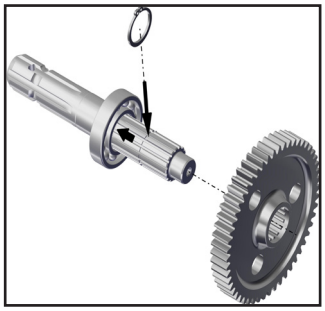
1 SPEED PTO SHAFT AND GEARS ASSEMBLY AND MOUNTING

1



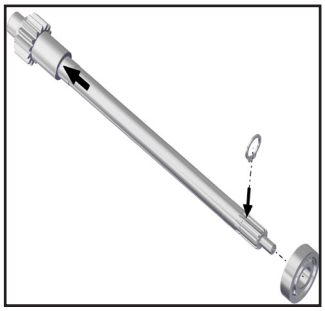
Take diff case (17) & insert bevel gear RH (B) & LH (A) with thrust washers (C).

2



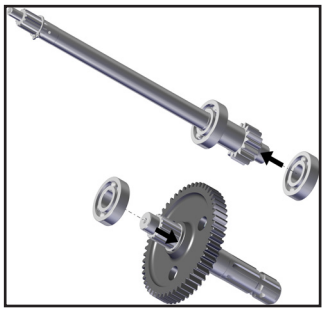
Insert 2 bevel pinion (12) with Pinion Thrust Washers (13) in differential case

3



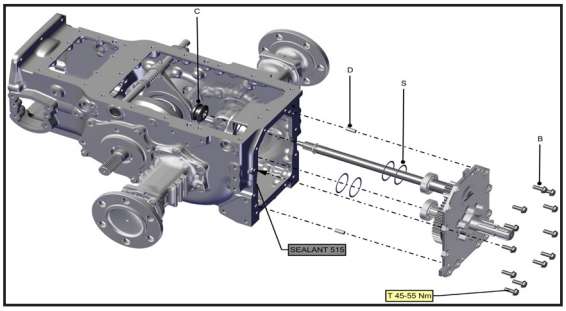
Insert bevel pinion shaft (16) through both pinion. Press roll pin (11) after aligning Diff Case and shaft holes by Dolly for roll pin pressing

4



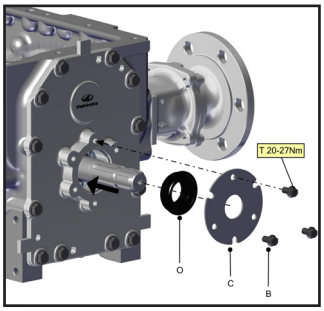
Apply sealant 638 on ring gear and Insert ring gear (9)on Differential Case
Mount the bolt (8) & apply torque 118-125 Nm

5



Insert PTO shifting coupling (C) to driving shaft end. Insert the PTO output Shims (S) in rear housing to adjust gap between driven & driving shaft bearing with rear housing Fit two dowels (D) on rear housing. Dock PTO housing to Rear housing with bolts (B) & sealant 515. Apply Torque

6

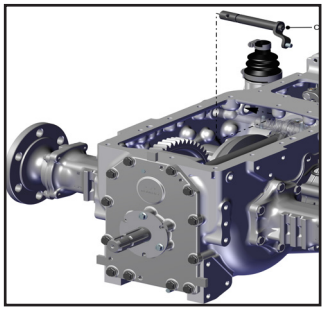


Press PTO output oil seal (O) in housing
Fitment of PTO cover plate (C) with 3 bolts (B). Apply Torque (20-27Nm)

NOTE:- Ensure free rotation of ball bearings after assembly.
No Grease should be applied during assembly.
Assembly should be free from dust and foreign particles.
Shimming to be done as required
Keep float of 0.1mm

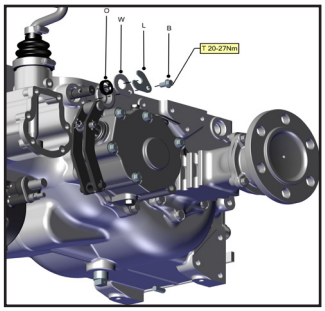
1 SPEED PTO OPERATING LINKAGE MOUNTING

1



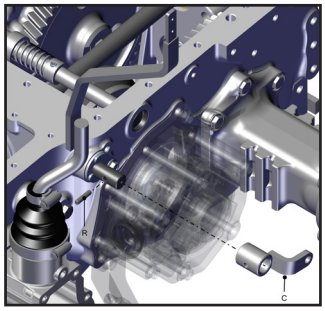
Insert the PTO cam assembly (C) from inner side of the transmission case. Adjust position as pin pto cam is in contact with coupling

2



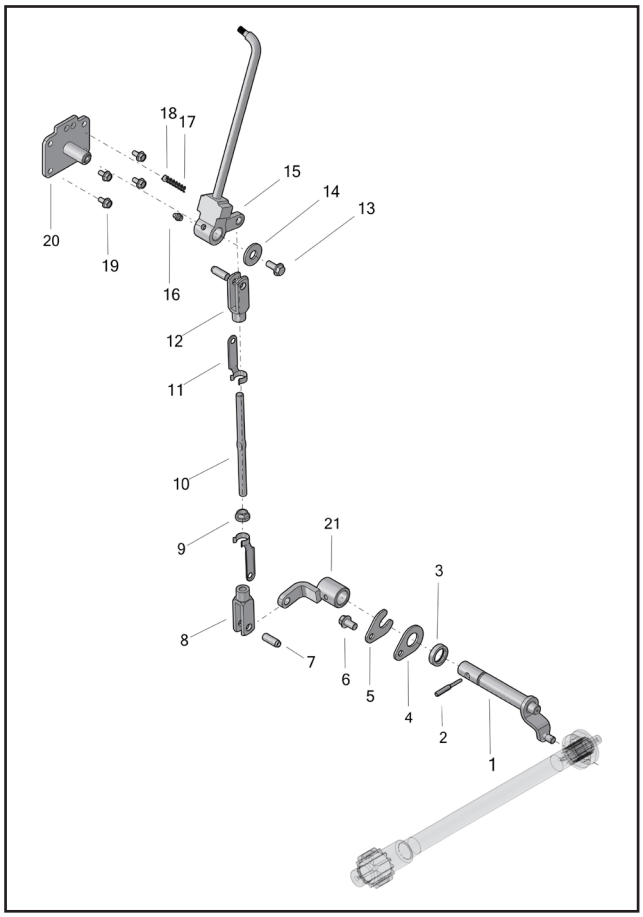
Press the oil seal (O) on the PTO cam shaft.
Lock the shaft with Washer (W), lock plate (L) & bolt (B) with Torque (20-27) Nm

3



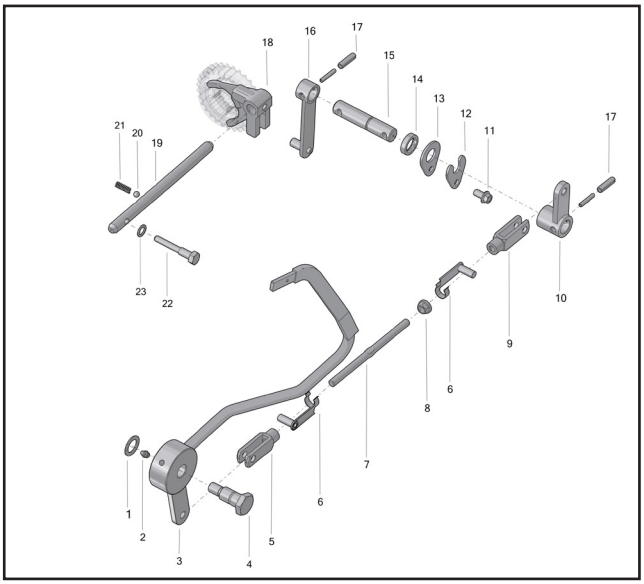
Lock PTO outer cam(C) with PTO shifter cam by means of roll pin (R)

1 SPEED PTO SHIFTER ASSEMBLY



PART NUMBER.	REF.	DESCRIPTION OF PART	QTY.
006513923Y11	1	**CAM** PTO Shifter	1
006513178Y91	2	**PIN** Roll	1
006511675V1	3	**LIP** SEAL Rotary Shaft	1
006510797V1	4	**WASHER** Diff Lock	1
000016322P04	5	**LOCKPLATE**	1
000020308E05	6	**BOLT** For Oil Pan M8x1.0x16	1
‡	7	**PIN**	2
007600229D1	8	**YOKE** Standard Rh M10x1.25	1
000012645P04	9	**NUT** HEX FL M10X1.25X9.8X8	1
006516656Y1	10	**LINK** Connecting M10	1
000012935P04	11	**LOCK** Pin Yoke	2
007600776D1	12	**YOKE** Std M10X1.25 LH	1
000020307E05	13	**BOLT** M8x1.25x20	1
006509245B1	14	**WASHER** Aux Lever	1
006513992Y11	15	**LEVER** Single Speed Pto Shifter	1
000012871P04	16	**NIPPLE** Grease M8X1	1
006509853U1	17	**SPRING** Retention Shifting System	1
006503662C1	18	**BALL** Steel 8MM	1
000020797E05	19	**BOLT** Flange Hex M6X12	4
006516699Y91	20	**BRACKET** Pto Assembly	1
006516848Y91	21	**CAM Outer PTO - 1S PTO**	1

RANGE SHIFTER ASSEMBLY

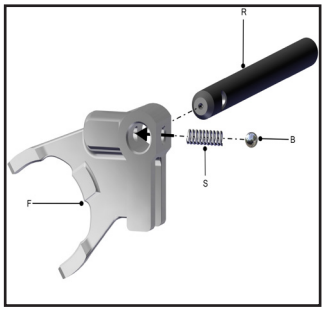


PART NUMBER.	REF.	DESCRIPTION OF PART	QTY.
000615167R1	1	**WASHER** Plain	1
000012871P04	2	**GREASE** NIPPLE M8X1	1
006512449Y1	3	**LEVER** Range Shifting	1
000704757R3	4	**BOLT** Differential Lock Pivot	1
007600776D1	5	**YOKE** Std M10X1.25 LH	1

PART NUMBER.	REF.	DESCRIPTION OF PART	QTY.
000012935P04	6	**YOKE** Lock Pin	2
006516656Y1	7	**LINK** Connecting M10	1
000012645P04	8	**NUT** HEX FL M10X1.25X9.8X8	1
007600229D1	9	**YOKE** Standard RH M10x1.25	1
006513137Y91	10	**PIVOT** Range Cross Shaft	1
000020308E05	11	**BOLT** For Oil Pan M8X1.0X16	1
000016322P04	12	**LOCK PLATE**	1
006510797V1	13	**WASHER** Diff Lock	1
006511675V1	14	**LIP SEAL** Rotary Shaft	1
006513136Y1	15	**CROSS-SHAFT** Range Shifter	1
006513135Y1	16	**CAM** Range Shifter	1
006513814V1	17	**PIN** Compound Roll (8X30 AND 5X30)	2
006512446Y1	18	**FORK** Range Shifter	1
006512456Y1	19	**RAIL** Range Shifter	1
006503662C1	20	**BALL** Steel 8mm	1
006516655Y1	21	**SPRING** Range	1
006506636B1	22	**SCREW** Grub Reverse	1
000020723E05	23	WASHER Seal CU M10X-13.40X1	1

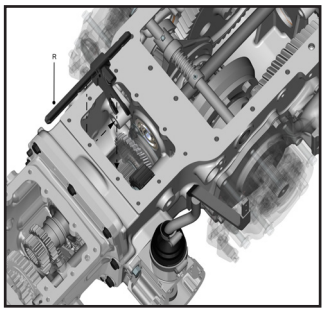
RANGE SHIFTER ASSEMBLY

1



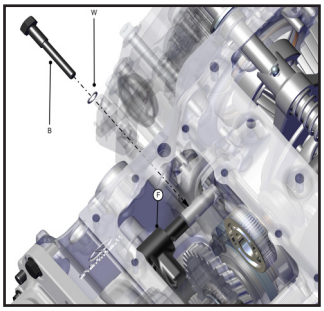
Assemble the range Fork (F) to the Rail (R) along with the spring (S) and ball (B).

2



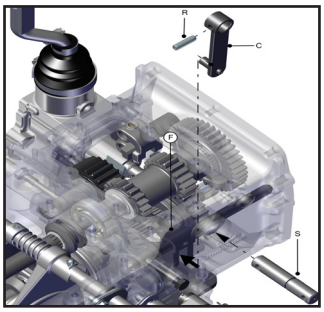
Insert Range and Rail sub assembly to the rear housing such that it aligns with low driven gear.

3



Fix Range & Rail sub assembly (F) with Rail lock bolt (B) along with Copper washer (W). Apply Torque (20-27) NM.

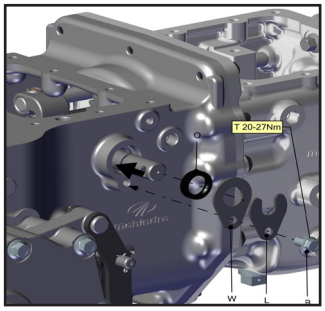
4



Fitment of Range cam shifter (C) with Range & Rail sub assembly (F) Lock sub assembly with cross shaft (S) using Roll pin (R)

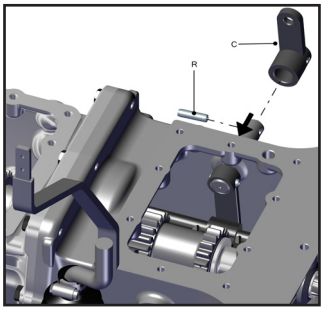
RANGE SHIFTER ASSEMBLY & MOUNTING

5



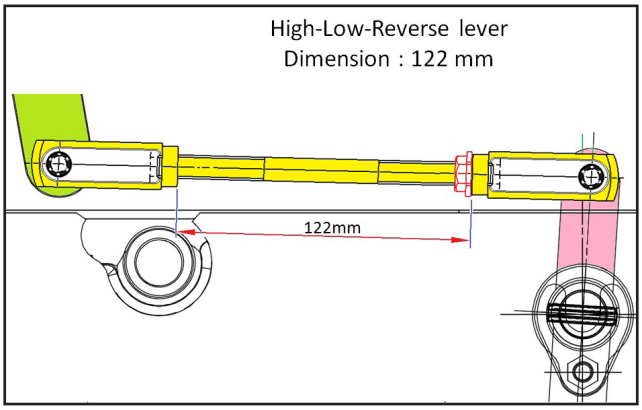
Press the oil seal (O) on cross shaft. Lock the cross shaft with Washer (W), lock plate (L) & bolt (B) with Torque (2 0 - 2 7) N m

6



Lock Range cam link outer (C) to cross shaft using Roll pin (R)

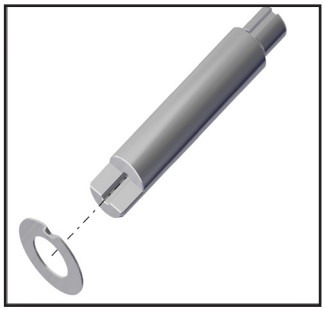
RANGE SHIFTER ASSEMBLY CRITICAL SETTINGS



Maintain Range Shifter lever length to 122 mm

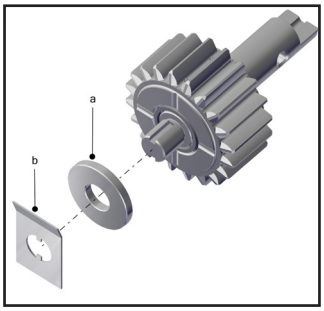
REVERSE IDLER SHAFT ASSEMBLY AND MOUNTING

1



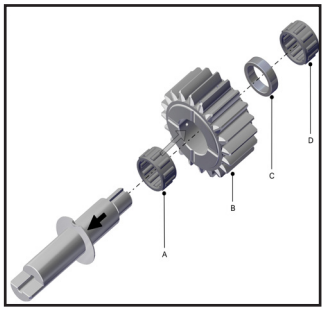
Insert the thrust washer on reverse idler shaft ⚠ **NOTE-** Washer notch to be opposite to gear (B) as shown in figure

3



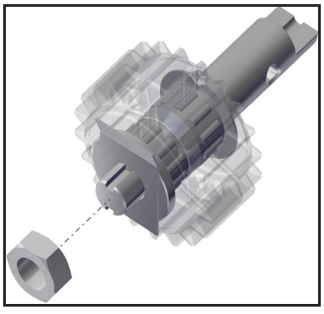
Insert the spacer (a) in the shaft and above gearMount the lock plate (b) on the shaft

2



Mount Gear (B) on reverse idler shaft with NRB (A) spacer (C) & NRB (D) inserted in gear.

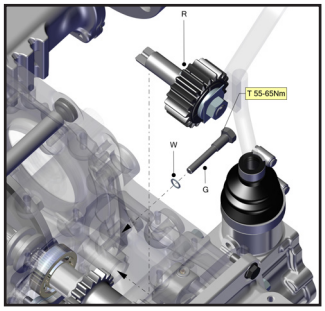
4



Fit the lock nut and apply Torque (41-46) Nm & bend the lock plate against flat surface with bending tool

REVERSE IDLER SHAFT ASSEMBLY AND MOUNTING

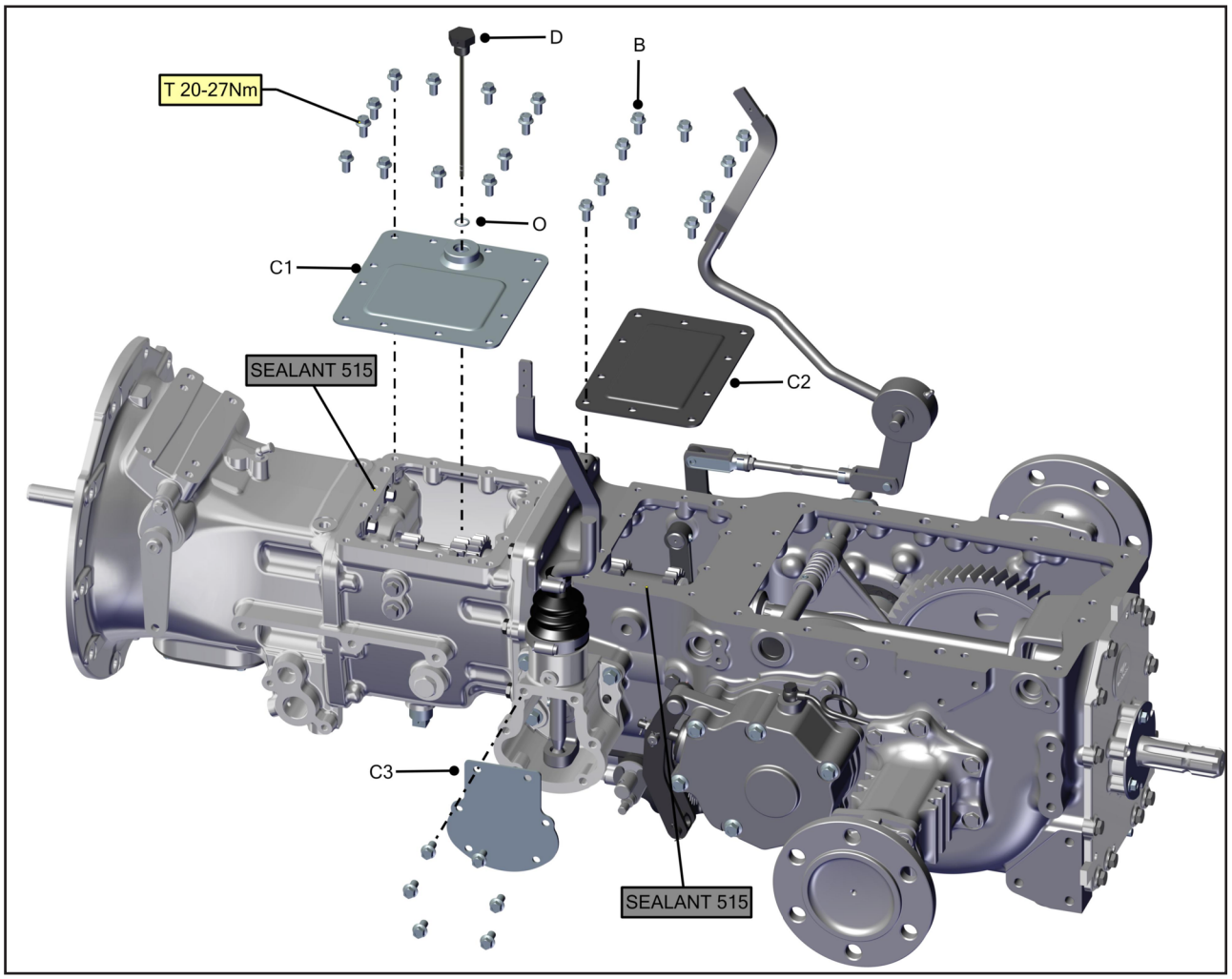
5



Assemble Reverse idler sub assy (R) on housing Lock it with bolt (G) & washer (W) to Rear Housing Apply Torque (55-65) NM on bolt

NOTE:- Ensure oil application on NRB Assembly should be free from dust and foreign particles
No grease application.
Cut portion of shaft should face upward
Lock plate should be hammered on lock nut after Torque

TRANSMISSION COVERS MOUNTING



Apply liquid sealant 515 on speed housing top cover's (C1) mounting area & range top cover's (C2) mounting area. Fix speed top cover (C1) on speed housing with 12 number of bolts (B) applying torque (20-27)Nm. Insert Dipstick (D) with O ring (O) in speed housing through speed housing top cover's (C1)

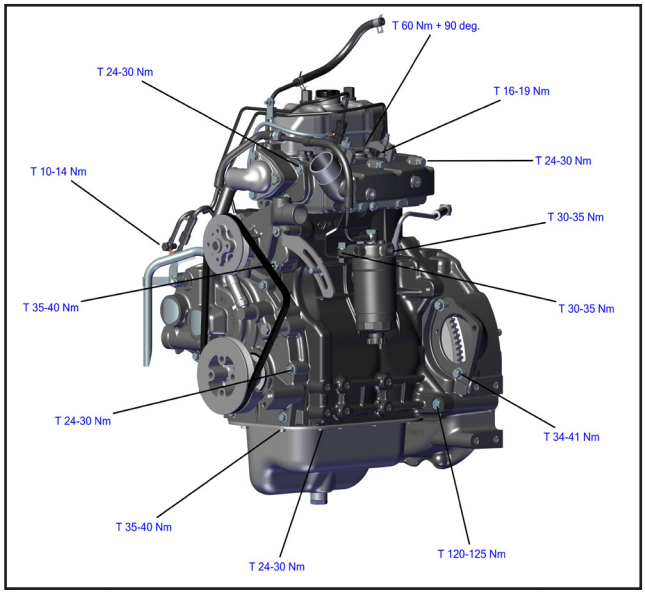
Fix Range top cover (C2) on speed housing with 10 number of bolts (B) applying torque (20-27)Nm. Fix cover plate (C3) on speed shifter housing with bolts (B) with torque (20-27)Nm and sealant 515

ENGINE

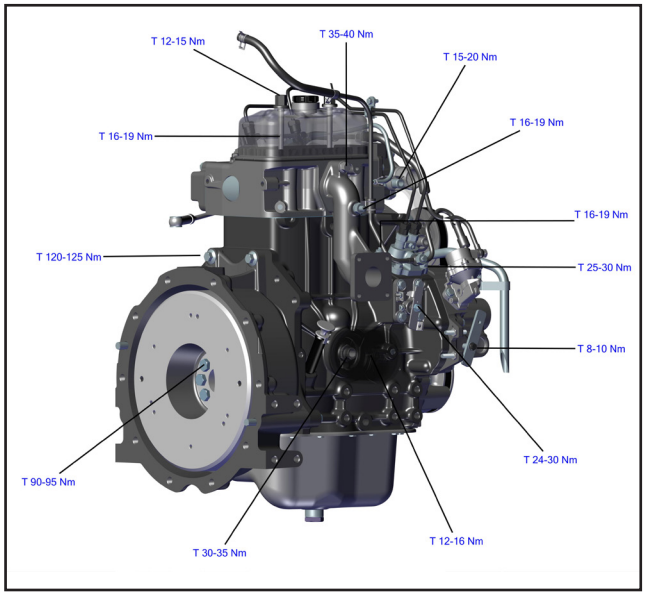
DETAILED ENGINE SPECIFICATIONS

S.No	Particulars	Specifications
Engine Specification		
1	Construction	Inline vertical cylinders, 4 stroke
2	Model Name	MDI1365NX20 (20 Hp) and MDI1365NX24 (24 Hp)
3	No. of cylinders	2
4	Type of injection	direct
5	Bore	88.9 mm
6	Stroke	110 mm
7	Total displacement	1.365 L
8	Compression ratio	19.8:1
9	Firing order	1-2
10	Direction of rotaion	Counterclockwise when looking from flywheel end
System data		
Intake		
11	Type of aspiration	Naturally aspirated
12	Air filter	Dry type (5 inch)
Fuel injection		
13	Type of fuel	Diesel
14	Fuel injection pump	PF type pump PFR2K E 041 310 800 - for 20 HP (Development Number) EE 41 269 200 - For 24 hp (Development Number)
15	Injector (Nozzle holder and Nozzle number)	P type multi hole F 002 C70 552 A 433 390 456 (DSLA144P5522)
16	Nozzle Tip Protrusion	1.63 - 2.21mm
17	Injector Opening Pressure	250-258 bar
18	Fuel filter	0.6 L Spin on Filter F002 H20 130 (Insert F002 H20 364)
19	Timing advance	Nil
Cooling		
20	Water pump type	Centrifugal, belt driven
21	Volume of coolant (With radiator)	5.7 lit (Water + ethylene glycol, 90:10)
	(without radiator)	2.8 lit
22	Water working temperature	
	Nominal	80 -90°C
	Maximum	105 °C
23	Thermostat Valve	
	Opening start	80 to 85 °C
	Fully opened	96 °C
	Fully open travel	9.5 mm min
Lubrication		
24	Type	Gerotor
25	Filtration	Spin on oil filter
26	Minimum pressure	
	At rated speed	3 - 4 bar
	At idle speed	1.5 bar Min
27	Oil temperature	
	Nominal	90-110 °C
	Maximum	120 °C
28	Oil capacity	
	Minimum	2.1 L
	Maximum with filter (Without filter)	4.3 L (3.8 L)
29	Recommended grade of lubricating oil	15W40- CF4 Maximile 10 K - Factory filled 15W40- CI4 Mstar Premium - Service
Basic engine data		
30	Face run out for oil seal (Rear&Front)	0.2 mm Max
31	CrankShaft End clearance (float)	0.08 to 0.35 mm
32	Connecting rod side clearance	0.1 to 0.3 mm
33	Bumping Clearance	0.8 to 0.9 mm
34	Camshaft end float	0.05 to 0.4 mm
35	Backlash between Crank and Cam gear	0.09 to 0.194 mm
36	Flywheel Lateral runout	0.3 mm Max
37	Parallelism of Clutch mounting face on flywheel with crankcase face	0.2 mm Max
38	Injection timing	10.5° ± 0.5° BTDC for 24 HP 9.5° ± 0.5° BTDC for 20 HP
	crank rotation Theta (deg. from TDC)	Piston displacement from TDC (mm)
	9	0.89
	9.5	0.992
	10	1.098
	10.5	1.211
	11	1.328
39	FIP BDC dimension on crankcase	82.8 ± 0.2 mm for 10.5 83 ± 0.2 mm for 9.5
40	Tappet valve clearance (Inlet/Exhaust)	
	Inlet	0.4 mm (cold)
	Exhaust	0.5 mm (cold)
41	Belt Tension - Installation (Span between waterpump pulley and crank pulley)	202 -216 N (110 Hz - 114Hz)
	Belt tension - after testing (Span between waterpump pulley and crank pulley)	173 - 187 N (102 Hz - 106 Hz)

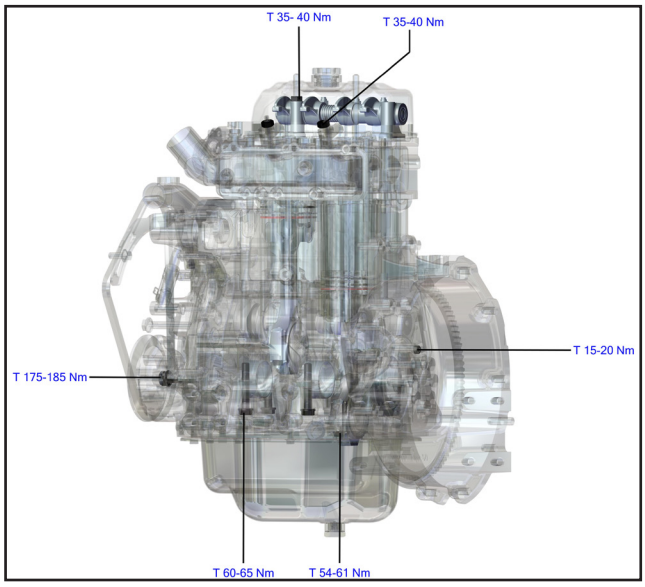
ENGINE TORQUE CHART



PART DESCRIPTON	Torque (Nm)
BOLT assembling Crankcase to flywheel housing	120-125
BOLT mounting oil pan to crankcase	24-30
BOLT mounting oil pan to front cover	35-40
BOLT mounting FC to crank case	24-30
BOLT mounting Brace to water pump stud	35-40
BANJO BOLT conecting hose to feed pump	10-14
BOLT for thermostat housing	24-30
BOLR for mounting Cylinder head with crankcase	60 Nm+90˚
STUDS for holding injector	16-19
BOLTS for mounting Intake manifold	24-30
BOLT for Fuel filter pipe outlet connection	30-35
BOLT for mounting fuel filter to bracket	30-35
BOLT for starter motor mounting	34-41



PART DESCRIPTON	Torque (Nm)
OIL FILTER	12-16
ADAPTOR oil filter	30-35
BOLT mounitng Flywheel to Crank Shaft	90-95
BOLT mounting from flywheel side	120-125
STUD for mounting Valve housing cover	16-19
CAP NUT for Valve housing cover	12-15
BOLT head to stub pipe mounting	35-40
STUD head to stub pipe mounting	16-19
ADAPTER water pump	15-20
STUD mounting FIP to crank Case	16-19
NUT mounting FIP to crank Case	25-30
BOLT mounting Pull to stop lever to pull to stop shaft	08-10
NUT nylock locking pull to stop lever	24-30



PART DESCRIPTON	Torque (Nm)
NUT assembling con rod with crankshaft	54-61
BOLT main bearing cap M12 x1.75	60-65
BOLT mounting Crank pulley to Crank Shaft	175-185
BOLT mounting rocker arm with stud	35-40
NUT for Nozzle holder clamp	35-40
MOG Plug	15-20

ENGINE TORQUE CHART

Sr No	Assembly Stage	Part Name	Part Number	Torque Values	Remarks
1	Crankcase sub Assy	PRECOATED PLUG M13 X 1.5 X 8	006017519V1	15-20	MOG Plug
2		PLUG M10 X 1.0 HEX SOCKET PIPE	000020786E05	11-14	COG plug
3		OIL PRESSURE SWITCH	000013085P05	15-20	
4		HEX HEAD PLUG M12 X 1.5 X 18 TAPER	006022117Y1	20-25	Water Drain plug
5		STUD BOTHENDS M10X1.5X60X10.9	007203080D1	16-19	Water pump stud
6		STUD BOTHEND M10X1.5X64X10.9	SF1001044	16-19	Water pump stud, new stud 006025082Y1,
7		ADAPTOR OIL FILTER	006002021B1	30-35	For Filter mounting
8		STUD M8 X22X8.8	006008962B1	16-19	For mounting FIP to crank Case
9		BOLT MAIN BEARING CAP	006017516V1	115-122	For MB cap bolt
10	Starer motor Fitment	BOLT HEXFL M10X1.5X35.5X8.8	000020314E05	34-41	For starter motor mounting - starter motor 007702577Y91
11	Cam shaft Sub assy	BOLT HEXFL M8X1.25X20X8.8	000020307E05	24-30	Mounting thrust housing
12		ALLEN COUNTERSUNK SCREW	SF0211020	08-10	For mounting supporting plate to Cam Gear
13	FIP Fitment	SCREW SOCKET M5X0.8X12X12.9	007205393B1	08-10	For mounting starting spring
14		NUT HEX FL M8X1.25X8.7X8	000020777E05	25-30	For mounting FIP to crank Case
		FUEL INLET BANJO IN FIP	----	27-34	For connecting fuel inlet to FIP
15		FUEL AIRVENT SCREW IN FIP	----	06-07	For connecting fuel inlet to FIP
16	Pull to stop sub assy	BOLT HEX HD, M6x1x12	000020797E05	08-10	For mounting Pull to stop lever to pull to stop shaft
17		NYLOCKNUT M8*1.25	000020742E05	24-30	For locking pull to stop lever
18		SCREW SOCKET M5X0.8X12X12.9	007205393B1	08-10	For preventing pull to stop shaft to move horizontally
19		NUT HEX M5	000934871R1	08-10	For setting of pull to stop lever & CR to start position
20		BOLT HEXFL M8X1.25X20X8.8	000020307E05	24-30	For mounting cover plate Assembly to crankcase
21	Oil pump Assy	BOLT FLANGED HEX. HEAD M6X1.0X12-H3	000020797E05	08-10	For Screen assy
22		ALLEN BOLT M10 X 1.5 X 30	007205397B1	35-40	Allen bolt for mounting oil pump
23	Front cover and Governor system	BOLT HEXFL M8X1.25X45.5X8.8	000020254E05	24-30	Mounting FC to crank case
24		FLANGED HEX. HEAD BOLT M8 X 1.25 X 115	000020260E05	24-30	Mounting FC to crank case
25		BOLT HEX (M8x1.25x16)	000020308E05	24-30	Mounting Breather Cover Plate on Front cover
26		BOLT HEX HD, M6x1x12	000020797E05	08-10	For locking hinge pin with Tensioing lever
27		SCREW SOCKET M5X0.8X12X12.9	007205393B1	08-10	For preventing hinge pin shaft to move horizontally
28		NYLOCKNUT M8*1.25	000020742E05	24-30	For locking lever to accelerator shaft
29		BOLT HEX HD, M6x1x12	000020797E05	08-10	for locking accelerator lever to accelerator shaft.
30		SCREW SOCKET M5X0.8X12X12.9	007205393B1	08-10	For preventing accelerator shaft to move horizontally
31		NUT HEX M6 X 1.0 X 5 X 6.6	001233807R1	08-10	Added new
32		NUT HEX M8X1.25X4X5	SF0301009	20-25	For low & high idle screw
33		NUT HEX M10X1.25X5X8XZN	SF0301023	20-25	For idling pin and max speed shaft
34		CAP NUT	0108DAD00101N	20-25	For Idling pin - to assembeld in TCE & max speed cam

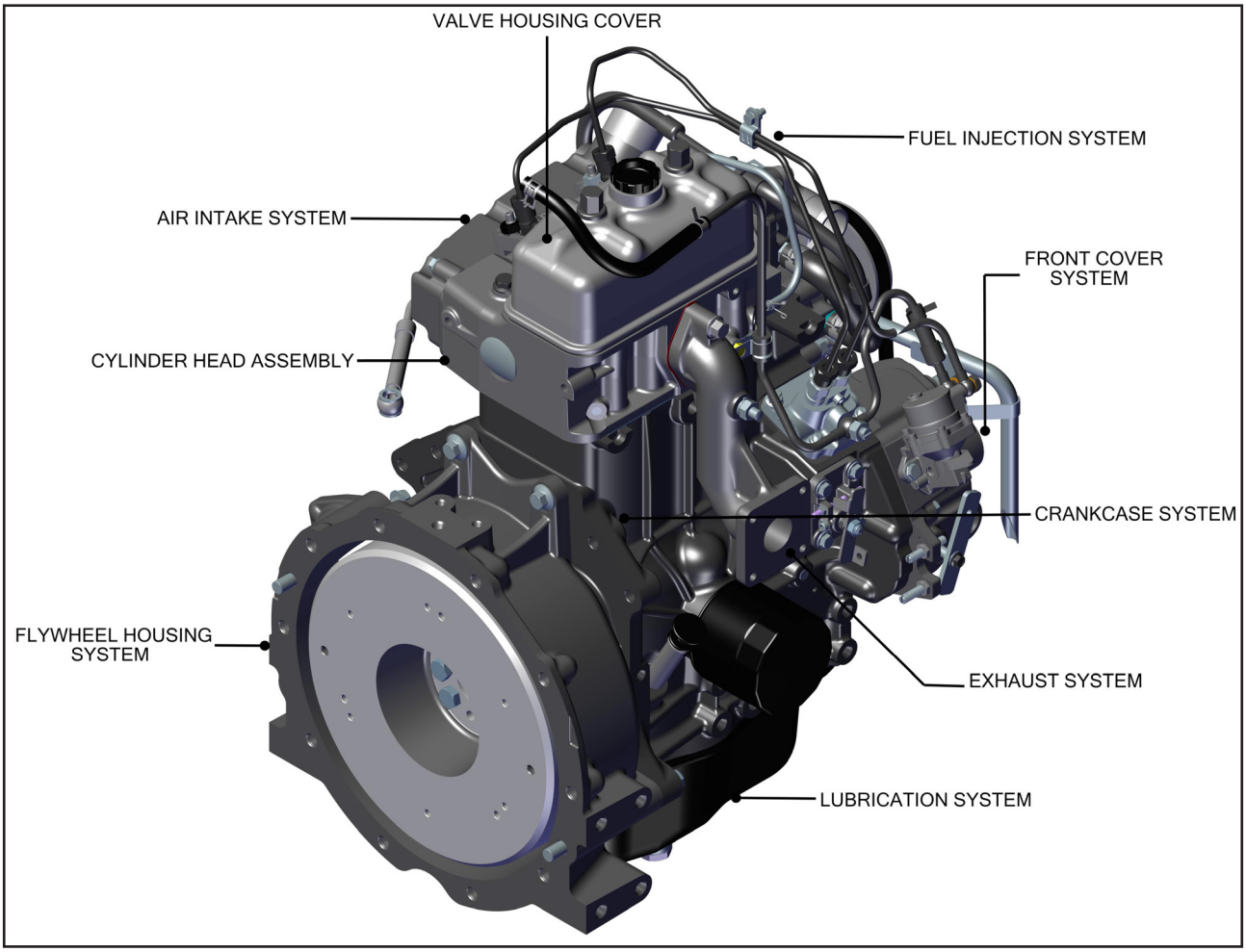
ENGINE TORQUE CHART

Sr No	Assembly Stage	Part Name	Part Number	Torque Values	Remarks
35	Wat er pump Assy	NUT HEX M10 X 1.5 X 8 X 8	000022055RD	35-40	
36	Crank pulley Assy	BOLT HEXFL M14X1.5X50X10.9	006505679D1	175-185	For mounting Crank pulley to Crank Shaft
37	Flywheel Hsg Fitment	BOLT M12 x 1.75 x 40L X10.9 FLANGED	000013898P04	120-125	Mounting from flywheel side
38		Bolt M12 x 1.75 x 55L G8.8GRZNPL	000020304E05	120-125	For mounting from C Case side
39	Oil Sump Assy	BOLT M8X1.25X16 FLANGE HEADED-H3	000020308E05	24-30	Oil pan mounting to crankcase
40		BOLT FLANGE HEX.HEAD - M10 X 1.5 X 20.5-H3(20.5)	000020565E05	35-40	Oil pan mounting to front cover
41	Cyl Head Sub Assy	STUD 10X1.5X120 VALVE HOUSING COVER DHRUV	006022865V1	16-19	VHC mounting stud
42	Con Rod Assy	CON ROD NUT WHILE ASSEMBLING WITH CRANKSHAFT	----	54-61	Con Rod Assy
43	Injector Assy	STUD CLAMP NOZZLE HOLDER P TYPE INECTOR	006002569B1	16-19	Stud for holding injector
44		NUT HEX M10 X 1.5 X 8 X 8	000022055RD	35-40	Nut for Nozzle holder clamp
45		SPILL PIPE TO INJECTOR CONNECTION	----	05-08	Spill pipe to injector connection
46	Temp Sensor Fitment	SENSOR TEMP. GAUG Alt Part # 005551425R2	005551426R2	24-30	to be added
47	Intake Manifold Fitment	BOLT HEX M8X1X40X8.8	000022061RD	24-30	Bolts for mounting Intake manifold
48	Thermostat Hsg Fitment	BOLT Flanged M8 X 1.25- 6g X 20 HEX-H3	000020307E05	24-30	
49		BOLT M8 X 1.25 X 22	000022271RD	24-30	
50		BOLT HEX M8X1.25X22X8.8	005557810R1	24-30	
51		ADAPTER WTR.PUMP F' OIL COOLER-H3	006000556F1	15-20	For connecting bypass hose on thermostat housing
52	Cyl head Mount-ing	BOLT CYLINDER HEAD (LONG)	006014999V1	60 Nm+90°	For mounting from Cyl Head
53		BOLT CYLINDER HEAD (SHORT)	006014998V1	60 Nm+90°	For mounting from Cyl Head
54	Push rod and rocker arm assy	NUT HEX M10 X 1.5 X 8 X 8	000022055RD	35-40	Mounting rocker arm with stud
55	Fead Sysytem	NUT HEX M10 X 1.5 X 8 X 8	000022055RD	35-40	Mounting Brace to water pump stud
56		BOLT M10 X 1.5 X 25 L-H3	00020313E05	35-40	For mounting Alternator to Brace
57		BOLT MAIN BEARING CAP M12 x1.75	006017516V1	60-65	For mounting Alternator -007701962V91 dhruv ref
58	HPP Assy	PIPE - HPP CYL NO 1- ID 1.5MM	006026966Y1	25-30	
59		PIPE - HPP CYL NO 2- ID 1.5MM	006026967Y1	25-30	
60		BOLT HEX M6X1X16X8.8	000022206RD	08-10	For mounting clamp, (HPP)
61		NUT HEX M6 X 1.0 X 5 X 6.6	001233807R1	08-10	For mounting clamp, (HPP)
62	Exhaust Assy	STUD BOTH ENDS M10X1.5X100	005550271R1	16-19	Head to stub pipe mounting
63		NUT M10X1.5 X 8	000022055RD	35-40	Head to stub pipe mounting
64		BOLT HEX FL M10X1.5X45X10.9	SF0102123	35-40	Head to stub pipe mounting / He x type flange bolt
65	Valve Housing Cover Assy	CAP NUT M10X1.5 VALVE HSG COVER	006022908V1	12-15	Cap Nut for VHC
66		OIL FILLER CAP TIER4	006013002H1	Hand tight	

ENGINE TORQUE CHART

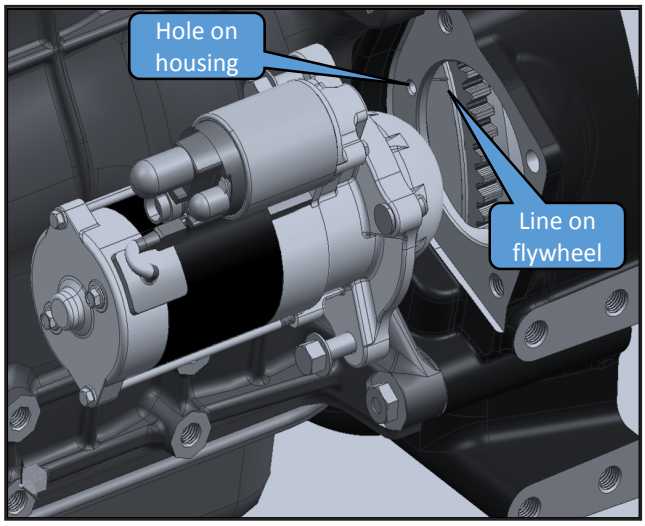
Sr No	Assembly Stage	Part Name	Part Number	Torque Values	Remarks
67	**Flywheel Assembly**	BOLT HEX M12 X 1.5 X 40 X 10.9	006017528V1	Pre 40-45 Final 90-95	For Mounitng Flywheel to Crank Shaft
68	**Fuel Filter Assy**	BOLT BANJO M14X1.5X26	001232932R1	30-35	Fuel filter pipe outlet connection
69		FLANGED BOLT M10X25	000020313E05	30-35	For mounting fuel filter to bracket
70		BOLT HEX (M8x1.25x14)	000020308E05	24-30	For mounting Fuel filter bracket
71	**Feed pump Assy**	BOLT_M8x1.25x20	000012190P04	24-30	For mounting Feed pump to front cover
72		BANJO BOLT TURBO INLET	0303EM0160N	10-14	For conecting hose to feed pump-0303EM0160N
73	**Tractor Level Assy**	BOLT BANJO M14X1.5X26	001232932R1	30-35	Fuel filter pipe inlet connection
74	**Oil Filter Assy**	OIL FILTER ASSLY - YUNXT	006025734Y91	12-16	

ENGINE SUB ASSEMBLIES

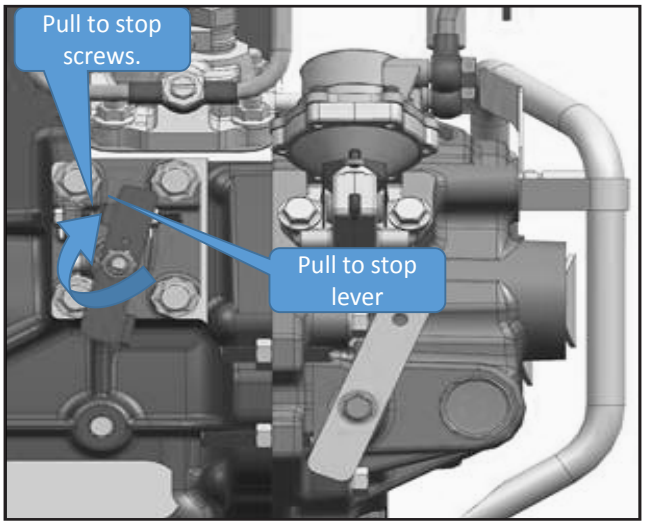


RECOMMENDED FIP REMOVAL INSTRUCTION

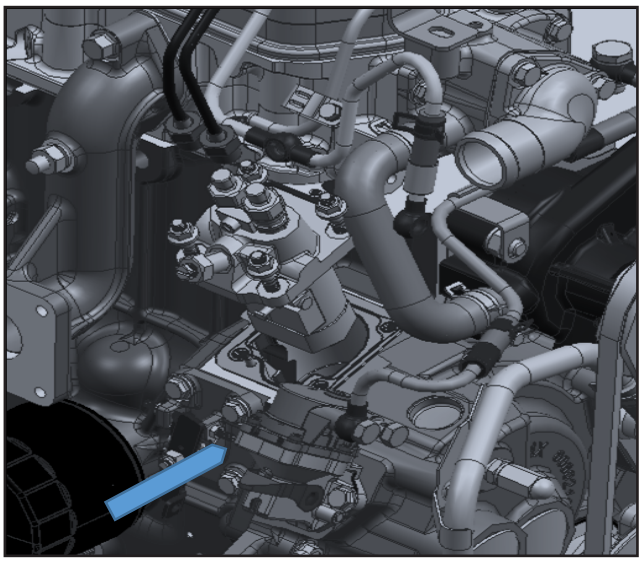
CAUTION:- FIP MAY GET DAMAGED IF NOT FOLLOWED THE FIP REMOVAL INSTRUCTION



1. Remove starter motor.
2. Match line on flywheel by rotating flywheel to hole on flywheel housing (see Fig. no.1).
   (rotate flywheel in anti clockwise direction viewing from driver seat position)

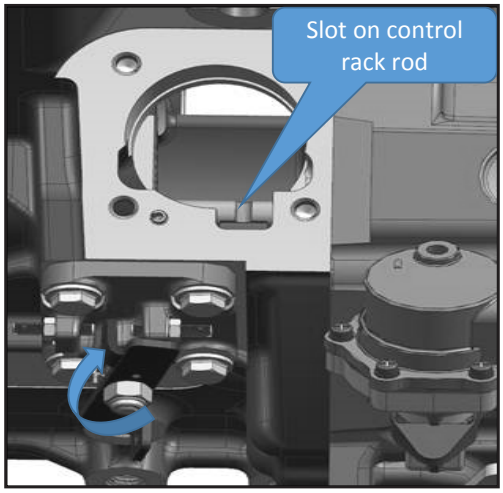


3. Remove fuel line and HPP pipes from FIP
4. Remove mounting nuts of FIP to crankcase
5. Push Pull to stop lever towards front so as that it is in between the front and rear pull to stop screws.

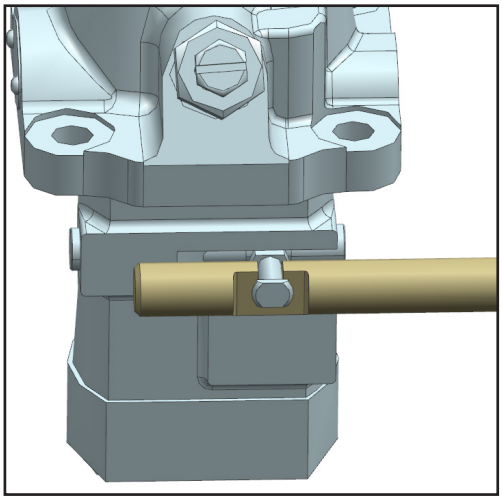


6. Remove FIP from its position with out altering position of pull to stop lever by slightly inserting a thin screw driver wedge, at bottom of the FIP flange

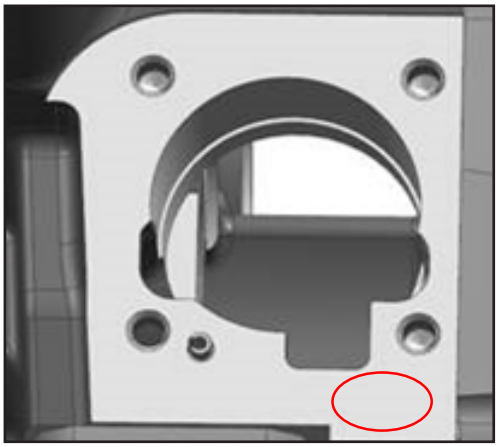
RECOMMENDED FIP MOUNTING INSTRUCTION



1. Make sure to match line on flywheel to hole on flywheel housing
2. Make sure FIP mounting studs and dowel are properly torqued in crankcase,
3. Place selected shim assembly (based on the crank case punch mark) on crankcase face making sure all dowels and mounting studs are matched to shim holes.
4. Rotate pull to stop lever so that it pushes Control rack rod slot to come in between the slot on crankcase.
5. Place FIP on crankcase and make sure FIP Rack rod position is set to come in between slot of crankcase & Control rack rod.



6. Figure shows how the Pump comes to rests in rack rod after seating on crank case surface .
7. With utmost care gently tap FIP on its flange, so as to get it seated and check pull to stop lever for free actuation.
8. Tighten FIP mounting flange nuts to studs with 25 Nm torque value.



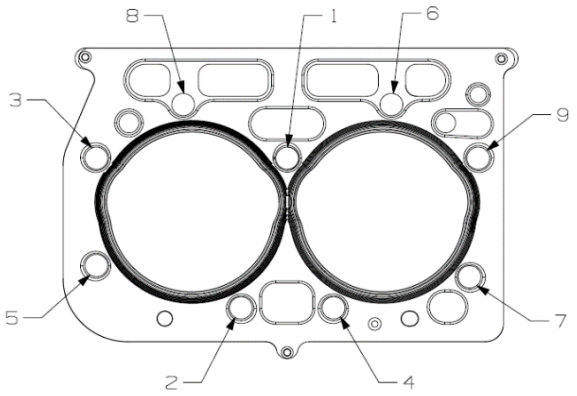
Shim selection

1. Shim thickness used during engine assembly is based on BDC gauge value as per table 2 and is punched on the Crank case surface as shown in fig
2. Shims to be stacked up to match value as punched on crank case, 1 steel shim to be sandwiched in between 2 NBR coated shim.
   (BDC gauge dimension in table 2 is given for different shim thickness punched on crank case) .
3. Make sure the FIP flange and Crank case surface is clean and there is no need of liquid sealant to be applied on mounting surface during assembly .

Punch value on crankcase	Shim thickness to be selected
8	0.8
9	0.9
10	1.0
11	1.1
12	1.2

SHIMS		BDC Gauge Value				
		0.8	0.9	1	1.1	1.2
Plain	0.15		1		1	
Plain	0.2					
Plain	0.25			1		1
Plain	0.3	1				
NBR Coated	0.25	2	3	3	4	4

CYLINDER HEAD BOLT TORQUE

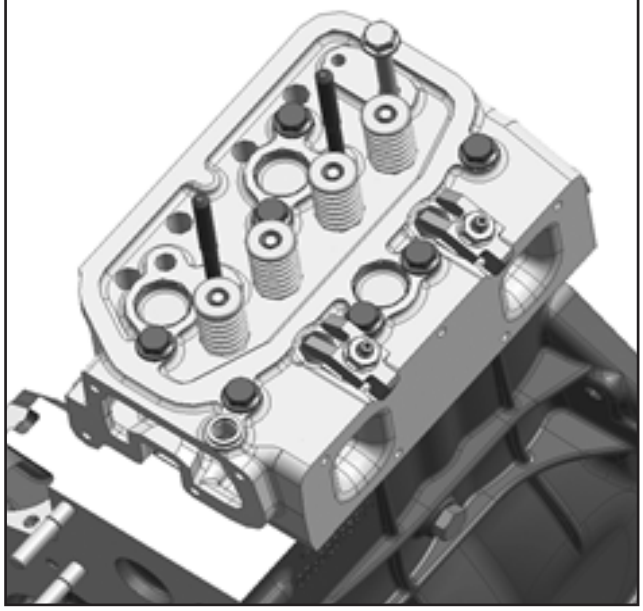


BOLT TORQUE PATTERN
NOMINAL BOLT FORCE 62 kN
TORQUE: 60Nm + 90 °

Cylinder head mounting bolts torque sequence should be followed sequentially & in two stages.

a. Tighten all bolts (Bolt no. 1 to 8) sequentially as shown, with 60 Nm torque then apply 90 degree angular torque.
b. For angular torque, Mark the bolt with chalk / marker at one position
c. Then apply torque till mark rotate by 90 degree.

⚠ **NOTE:- (Use special torque wrench with angular dial for getting uniform clamping load.)**



1. Insert push rods & rocker arm assembly.
2. Tighten M11, Long bolt (bolt no. 9) with 60 Nm torque and then apply 90 degree angular torque.
3. Tighten 1 no. washer & M 10 Nut on front side rocker assembly stud with 40 Nm torque.
4. Do tappet setting.
5. Insert gasket, & Valve housing cover.
   Tighten 2 nos., rubber washer & cap nut on valve housing cover with 15 Nm torque.

TAPPET SETTINGS

⚠ **NOTE:-** Filler gauge movement should not be more tight or loose.

1. Rotate flywheel anti-clockwise
2. Press 1st cylinder exhaust valve.
3. Do tappet setting of 3rd cylinder.
4. Insert filler gauge **of 0.30 mm for Inlet valve**
5. Loose nut, tighten grub screw & insert filler gauge.
6. Tighten the nut by keeping filler gauge in insert position.
7. Insert filler gauge of 0.40 mm for Exhaust valve

8. Insert filler gauge of 0.40 mm for Exhaust valve
9. Loose nut, tighten grub screw & insert filler gauge.
10. Tighten the nut by keeping filler gauge in insert position.
11. Rotate flywheel anti-clockwise.
12. Press 3rd cylinder exhaust valve.
13. Do tappet setting of 2nd cylinder.

TAPPET SETTINGS

14. Loose nut, tighten grub screw & insert filler gauge.
15. Tighten the nut by keeping filler gauge in insert position.
16. Insert filler gauge of 0.30 mm for Inlet valve
17. Loose nut, tighten grub screw & insert filler gauge.
18. Tighten the nut by keeping filler gauge in insert position
19. Rotate flywheel anti-clockwise.
20. Press 2nd cylinder exhaust valve.
21. Do tappet setting of 1st cylinder.
22. Insert filler gauge of 0.30 mm for Inlet valve
23. Loose nut, tighten grub screw & insert filler gauge.
24. Tighten the nut by keeping filler gauge in insert position.
25. Insert filler gauge of 0.40 mm for Exhaust valve
26. Loose nut, tighten grub screw & insert filler gauge.
27. Tighten the nut by keeping filler gauge in insert position.

REFILLING OF COOLANT IN TO THE SYSTEM

Procedure for refilling of Coolant in to the system :-

⚠ **NOTE:- Replace the coolant after every 1 year / 1000 hours. (Which ever earlier)**

Allow the engine to cool if it is hot.

1. Open the hood.
2. Remove radiator Cap,

⚠ **Warning:- Do not remove the radiator cap when the engine is in hot condition. It may result in severe burns.**

1. Remove drain plug, Allow to drain entire coolant. From cooling system.
2. To flush the radiator, inject pressurized clean water (pressure range- 0.5 to 1 bar) through radiator cap for 10 minutes.
3. Then Blow pressurised air to allow dirt & water to come out through outlet.
4. Refit drain plug.
5. Fill recommended coolant in to the radiator from top & fill in to the recovery bottle up to mark “MAX” Level.
6. Start the engine & keep it at low Idle with open pressure cap.

⚠ **NOTE:- This to ensure no air entrapped in to cooling system.**

1. Stop the engine.
2. Again top up the radiator & recovery bottle, if require.
3. Close the radiator & recovery bottle cap.
4. Close the hood.

ENGINE TROUBLE SHOOTING

SR. NO.	TROUBLE	PROBABLE CAUSE	REMEDY
A	Engine Fails to Turn	1. Battery too low to turn engine.	Charge battery or install new one.
		2. Starting switch inoperative	Inspect for faulty cables and terminals. Replace s artıng switch if necessary
		3. Cranking motor inoperative	Refer to Service Manual “Electrical Equipment”.
		4. Engine oil too heavy	Use correct grade of lubricating oil as specified in the operator’s manual.
		5. Internal seizure	Hand crank the engine. If the engine does not turn easily, seizure due to internal damage; including gear train, pistons, sleeves, connecting rods or main bearings, is indicated.
		6. Hydrostatic lock	Remove all the injection nozzles and crank the engine. Check for fuel or coolant in the cylinder
		7. FIP Solenoid not operating	Check connection Plunger Jam
B	Engine does not start, Engine starts but does not develop full power	1. Low or no fuel pressure.	
		a. Insufficient fuel	Check fuel tank.
		b. Fuel oil filter clogged	Replace filters.
		c. Fuel filter gaskets defective (air being drawn into fuel)	Replace gaskets.
		d. Moisture in fuel tank	Drain entire system including water trap and filter. Refill with clean fuel, and vent the air from the system.
		2. Poor fuel	Use a good grade of fuel.
		3. Air cleaner clogged	Remove and service air cleaner as described in operator’s manual
		4. Injection pump not properly timed to the engine.	Check timing. (Refer to Section “INJECTION PUMP”.)
		5. Fuel line clogged or air in line	Clean fuel line and vent fuel system. Refer operator’s manual.
		6. Injection pump not operating prop-erly	Remove injection pump and test it. Refer to Service Manual “Fuel System” for test specifications
		7. One or more fuel injection nozzles not operating properly	Replace the injection nozzles
		8. Loose or broken fuel lines or fittings between injection pump and injection nozzles.	Tighten or repair.

ENGINE TROUBLE SHOOTING

SR. NO.	TROUBLE	PROBABLE CAUSE	REMEDY
B	Engine does not start, Engine starts but does not develop full power	9. Loose or broken connections or leaking gaskets at intake manifold or exhaust manifold	Tighten or repair.
		10. Improper valve settings	Reset as necessary. If out of adjustment an excessive amount, check for bent push rods.
		11. Lack of compression	Refer to “Poor Compression”
		12. Restricted air duct from compr essor to intake manifold	Remove and clean
		13. Restricted intake manifold.	Clean.
		14. Air leak in feed from compressor to intake manifold.	Tighten the hose clips, check for hose condition, check the gasket at intake manifold. Tighten the joints & if required replace gasket.
		15. Air leakage between intake mani-fold and engine.	Check gasket, if required replace.
		16. Foreign object in exhaust manifold (from engine)	Remove & clean if damaged replace.
		17. Restricted exhaust system.	Remove the restriction.
		18. Exhaust manifold cracked, gasket blown or missing.	Replace by new.
		19. Fuel return pipe to tank blocked.	Locate the blockage in return pipe and clean.
		20. Defective fuel injection pump.	Repair or replace the pump.
C	Engine Emits Blue/White Smoke	1. Dirty air cleaner/clogged element.	Clean or replace elements.
		2. Restricted compressor intake duct.	Locate & remove restriction.
		3. Air leak between intake manifold & engine.	Check & Replace gasket.
		4. Foreign object in exhaust manifold.	Check and clean exhaust manifold.
		5. Restricted engine crankcase breather/distorted.	Remove & clean, if required replace.
		6. Worn engine piston rings or liner.	Check the compression pressure, replace rings & liners.
		7. Burnt valve and/or piston.	Replace the piston and valve.
		8. Excessive dirt build up on compressor wheel and/or diffuser vanes.	Remove and clean with decarbonizing solution.

ENGINE TROUBLE SHOOTING

SR. NO.	TROUBLE	PROBABLE CAUSE	REMEDY
C	Engine Emits Blue/White Smoke	9. Piston ring sealing defective.	Replace if required.
		10. Improper fuel in tank.	Drain fuel from tank and fill with new fuel.
		11. Fuel Tank vent blocked.	Check tank fuel level and clean tank cap for blocked vent
		12. Air in fuel system.	Bleed the system.
		13. Fuel filter blocked.	Replace.
		14. Fuel supply line blocked/ restricted.	Remove & clean.
		15. Pump to engine timing	Check & Correct the timing.
		16. Overflow fitting interchanged with inlet fitting.	Correct the fuel line.
		17. Supply to cold start device not proper.	Check wiring or fused glow plug and correct it.
		18. Cold start device not functioning properly.	Check and replace.
		19 FIP defective.	Repaired by authorised dealer or replace.
		20. Low engine water temperature	Warm engine to normal operating
		21. Defective Thermostat	Remove & Check thermostat.
D	Engine Turns But Will Not Start	1.No fuel delivery to injection injection pump.	Check fuel supply
		2. Intake or exhaust system	Remove air flow restriction and clogged clean exhaust system. Service the air cleaner.
		3. Improper adjustment on pump linkage and controls.	Re adjust as necessary.
E	Poor Compression	1. Piston rings worn, broken or cracked.	Install new rings.
		2. Cylinder sleeve worn/distorted	Install new sleeves.
		3. Valves damaged or worn	Install new valves
		4. Broken valve spring	Install new springs.
		5. Worn cylinder head gasket	Install new gasket
		6. Valve seats worn or cracked	Grind valve seats. If cracked, install new valves.
		7. Worn pistons	Install new pistons.
		8. Excessive valve guide wear	Install new valve guides.

ENGINE TROUBLE SHOOTING

SR. NO.	TROUBLE	PROBABLE CAUSE	REMEDY
E	Poor Compression	9. Sticking valves or bent valves stems	Free stem and correct cause. Replace valves with bent stems.
		10. Faulty valve action	Adjust valve clearance.
F	Engine Overheats	1. Water pump air bound	Vent air from water pump and thermostat housing.
		2. Insufficient coolant in cooling system	Check level and add if necessary. Check hose connections for leaks.
		3. Dirt & trash on outside of Radiator	Clean between the tube fins with air or water pressure.
		4. Cooling system clogged	Drain and flush cooling system.
		5. Hose connection leaking or collapsed.	Change hose.
		6. Insufficient oil	Maintain proper oil level.
		7. Engine oil diluted with fuel	Change oil. Inspect for loose fuel line connections on the injection nozzles. Check for defective injection pump.
		8. Radiator cap not sealing or defective.	Replace.
		9. Defective thermostat	Remove and test thermostat. Replace if necessary.
		10.Water pump defective	Repair pump.
		11. Clogged oil filter	Replace oil filter element.
		12. Fan belt slipping	Adjust belt tension.
		13. Engine overloaded	Reduce load.
		14. Cylinder head gasket/leaking	vInstall new head gasket properly using sealing compound.
		15. Insufficient water	Add water, inspect for leaks.
		16. Faulty Thermostat	Test, if necessary, replace.
		17. Dirty Water	Drain & clean system, refill fresh coolant.
		18. Defective Connections	Replace swollen, worn out connections or tighten loose hose connections.
		19. Radiator Defective	Repair. If necessary, replace.
		20. Fan Defective	Inspect Fan. If damaged, replace.
		21. Defective Radiator Cap	Replace.
		22. Defective Water Pump	Inspect water pump impeller & shaft. If necessary, replace.
		23. Dirty, Scaled Coolant passages	Clean & flush passages.
		24. Radiator Clogged	Flush out radiator.

ENGINE TROUBLE SHOOTING

SR. NO.	TROUBLE	PROBABLE CAUSE	REMEDY
F	Engine Overheats	25. Fan Belt Roll Slippage	Check the tension; replace, if greasy or worn.
G	Engine Misses on One or More Cylinders	1. Insufficient air to engine	Remove and clean air cleaner and air cleaner pipe.
		2. Defective injection nozzles	Replace with serviceable unit.
		3. Air lock in the injection pump or fuel filter	Vent air from system and check all fuel lines and connections for leaks.
		4. Poor fuel	Use good grade of fuel.
		5. Air leaks around intake manifold.	Remove and install new manifold gasket.
		6. Injection pump not operating properly.	Remove injection pump and test it.
		7. Injection pump not properly timed to the engine.	Check and adjust timing if necessary.
H	Excessive Oil Consumption	1. Piston rings worn or broken	Install new rings.
		2. Oil level in crankcase too high	Maintain proper oil level.
		3. Crankcase oil pan gasket leaking	Install new gasket.
		4. Worn valve guides/stem seals	Install new valve guides/stem seals.
		5. Cylinder sleeves worn/distorted	Install new sleeves.
		6. Front and rear crankshaft oil seal.	Install new oil seals. leaking.
		7. Piston rings not seating	Install new rings.
		8. Piston rings fitted upside down	Remove and check.
		9. Clogged oil ring	Remove and inspect and, if necessary, replace.
		10. Oil pan drain plug loose or worn.	Install new drain plug and gasket tighten plug.
		11. Overheating	Refer to “Engine Overheats” on preceding page.
		12. Excessive oil poured into crankcase	Drain oil and fill to correct level only.
		13. Wrong specification oil used	Install oil meeting specifications in the operator’s manual.
		14. Air cleaner clogged	Disassemble & clean air cleaner.
		15. Restricted compressor intake dust	Remove and clean.
		16. Restricted air duct from compressor to intake manifold.	Remove and clean.
		17. Air leak in feed from compressor to intake manifold.	Tighten or correct the joints.

ENGINE TROUBLE SHOOTING

SR. NO.	TROUBLE	PROBABLE CAUSE	REMEDY
H	Excessive Oil Consumption (Contd.)	18. Air leak between intake manifold and engine.	Tighten or correct the joints.
		19. Foreign object in exhaust manifold.	Remove and clean.
I	Engine Does Not Idle Properly	1. Injection Nozzle defective	Test Nozzle and repair and reset as per Manufacturer's Recommendation.
		2. Restriction to fuel delivery or leaking fuel lines	Inspect fuel lines and valves; inspect for proper level in fuel tank.
		3. Poor compression	See poor compression problems.
		4. Slicking valves	See valves sticking problem.
		5. Improper adjustment of injection pump linkage and controls	Readjust
		6. Valve and spring assembly in operative	Repair and install parts needed.
		7. Leaking high pressure pipe/unions.	Tighten the union or replace the high pressure pipe.(Injector pipes)
		8. Accelerator cable sticky	Replace the cable.
		9. Air in the fuel system	Replace all the banjo washers and check for cracks in fuel line.
		10. Idling stop out of adjustment	Adjust the idling stop.
		11. Defective fuel injection pump	Repair or replace.
J	Engine Knocks	1. One or more cylinders misfiring	Locate and correct cause. Disconnect the injection lines at the valve housing one at a time and check for rpm drop of each cylinder.
		2. Loose connecting rod	Tighten connecting rod.
		3. Poor grade of fuel, or water in fuel.	Use good grade of fuel and check for water in fuel.
		4. Incorrect engine temperature	Keep temperature in work range of heat indicator. Check thermostat for proper operation.
		5. Injection pump timing not correct	Time the injection pump correct. Refer fuel injection system manual
K	Bearing Failure	1. Low oil level	Maintain proper oil level.
		2. Lack of oil	Maintain proper oil level.
		3. Engine runs too hot	Keep engine at normal operating tempera-ture

ENGINE TROUBLE SHOOTING

SR. NO.	TROUBLE	PROBABLE CAUSE	REMEDY
K	Bearing Failure	4. Loose bearings	Install new bearings.
		5. Use of improper lubricating	Use grade of oil specified in operator's manual.
		6. Foreign materials entering engine	Use clean oil containers when filling engine with oil and see that there no leaks in the air cleaner or in the air induction system.
		7. Oil lines clogged	Clean all oil passages.
		8. Connecting rod bent	Align rod or install new.
		9. Crankshaft out of alignment	Install new crankshaft.
		10. Faulty oil pump or relief valve	Repair or replace.
L	Valves Sticking	1. Valve springs weak	Install new springs.
		2. Valve springs broken	Install new springs.
		3. Gummy deposits from inferior fuel or oil	Clean and use proper fuel or oil.
		4. Valve stems scored or carboned.	Clean if necessary, install new valves.
		5. Insufficient clearance between valve stem and guide	Ream valve guides for proper clearance.
M	Piston and Cylinder Sleeve Wear	1. Oil of unsuitable grade of viscosity	Use oil meeting operator's manual / specifications.
		2. Piston rings stuck or broken	Install new rings.
		3. Lack of oil	Keep oil at proper level.
		4. Foreign materials entering engine	Inspect and service air cleaner. Proper care of air cleaner is very important.
		5. Piston rings not fitted properly to cylinder.	Install new rings and fit properly.
		6. Dirty containers used for lubricating oil	Lubricating oil must be kept in a clean place and clean containers used when filling engines.
N	Low Engine RPM	1. Governor control linkage bending or damaged.	Repair and install new parts needed.
		2. Governor control rod improperly adjusted.	Adjust rod to proper length.
O	Noisy Engine & Black Smoke	1. Improper injection timing.	Check and correct the timing.
		2. Faulty injectors	Clean and replace injectors.
		3. Loose main bearings, con. rod bearings	Tighten the main bearings/ con. rod bearings.
		4. Broken parts	Inspect & replace the broken parts.

ENGINE TROUBLE SHOOTING

SR. NO.	TROUBLE	PROBABLE CAUSE	REMEDY
O	Noisy Engine & Black Smoke	5. Rockers loose or out of adjustment	Adjust tappet.
		6. Valve clearance not OK	Adjust tappet.
P	Engine speed falls off	1. Defective fuel pump	Rectify the fuel pump.
		2. Sticky throttle lever or accelerator cable	Check and free the accelerator cable & throttle lever.
Q	Noisy Engine and High Smoke (White Gray)	1. Cylinder head gasket defective	Replace the cylinder head gasket.
		2. Worn out or damaged valve seats.	Lap the valve seats or regrind.
		3. Fuel inj. pump timing	Check the FIP timing.
		4. Leaking injector holder	Tighten the injector holder or check for proper fittings.
		1. Air Intake restricted	Check hoses, clean or replace
		2. Incorrect tappet setting	Adjust tappets
		3. Defective injectors	Check injectors
		4. Improper FIP timing	Correct the timing.
		5. Gas leaking between Exhaust	Replace manifold gaske t or parts manifold and cylinder head
		6. Restricted exhaust system	Remove restriction or replace parts.
		7 Defective Fuel Inj. Pump	Rectify or replace fuel inj. pump
		8. Worn out rings liners and valves	Overhaul Engine.
R	Black Smoke	1. Low Oil level	Check engine oil
		2. Defective oil pressure sensor	Install new sensor
		3. Clogged oil filter	Replace filter
		4. Clogged oil cooler	Clean the oil cooler
		5. Clogged oil strainer	Clean the strainer
		6. Pressure relief valve in oil filter bracket stuck	Clean the valve and bore and assemble
		7. Oil leaks internal part	Check the gasket between block and fr ont cover
		8. Excessive oil clearance or oil pump parts worn.	Check oil clearance of oil pump housing and pump gear. Replace worn parts.
		9. Thin or diluted oil.	Change oil to correct viscosity.
		10. Oil pump relief valve stuck	Remove valve inspect, clean & reassemble.
		11. Excessive bearing clearance	Check bearing clearances, (main, conrod, and camshaft bearing)
		12. Oil pump cover warp or cracked.	Inspect the parts and replace.
S	Oil Pressure Drop	1. Tappets loose	Set tappet clearance.
		2. Rocker arms touching to rocker cover	Install the correct rocker gasket. If still problem persist change the rocker cover.

ENGINE TROUBLE SHOOTING

SR. NO.	TROUBLE	PROBABLE CAUSE	REMEDY
S	Oil Pressure Drop	3. Thin or diluted oil	Change oil
		4. Bent push rods	Install new push rods
		5. Worn rocker arm	Replace the rocker arms
		6. Worn valve guides	Replace valve guides
		7. Valve clearance not OK.	Adjust clearance.
		8. Weak valve spring.	Replace valve spring.
		9. Wornout gears	Replace.
		10. Broken teeth of gears	Replace
		11. Foreign material	Clean
		12. Fouling of gears with front cover	Check & Repair
T	Noisy Valves	1. Belt over tensioning	Check & Adjust
		2. Belt low tensioning	Check & Adjust
		3. Improper tensioning	Check & Adjust