

FARMTRAC

25G

SERVICE MANUAL

ENGLISH

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INFORMATION

SAFETY FIRST

This symbol, the industry's "Safety Alert Symbol", is used throughout this manual and on labels on the machine itself to warn of the possibility of personal injury. Read these instructions carefully. It is essential that you read the instructions and safety regulations before you attempt to assemble or use this unit.

DANGER

- Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

WARNING

- Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION

- Indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury.

■ IMPORTANT

- Indicates that equipment or property damage could result if instructions are not followed.

■ NOTE

- Gives helpful information.

1. Preparing for emergencies



IBM010A

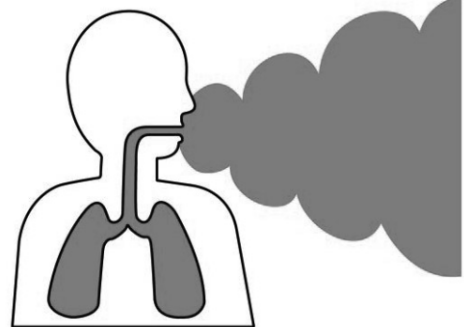
- Keep a first aid kit and fire extinguisher ready at all times.
- Keep emergency numbers near your telephone at all times.

2. Working cautions



2KBTA00034A01

- Wear proper service attire when performing work. Do not wear loose clothing as they could get caught on machine components.
- Wear the proper protective equipment when working around the machine. For example helmet, eye protector and protective shoes.
- Do not work around the machine if you are tired or have consumed alcohol or drugs.



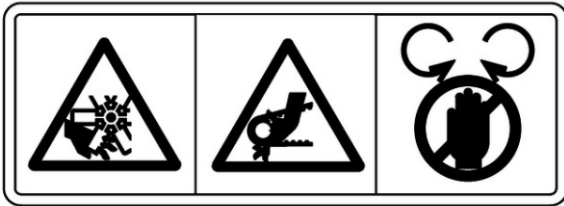
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- Keep the machine away from obstacles and hazardous materials.
- Ensure the working environment is properly ventilated.
- Do not allow third parties to come near the machine.



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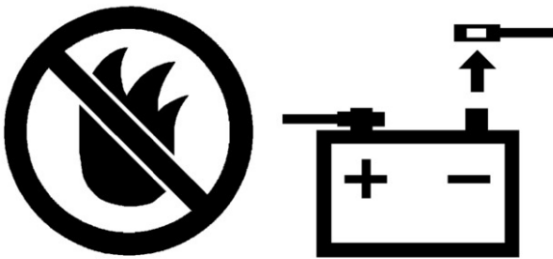
- Make sure you have the support of the 3 points with both hands holding the handle and one foot at the step when getting on and off the machine.
- When working under the machine, make sure the machine does not move back and forth or side-to-side.
- When working under the machine, provide secure support for the machine.
- When using a hydraulic jack, always use with a rigid rack to prevent the machine from falling.



2KBTA00040A01

- Lock the covers before starting the machine.
- Keep away from rotating and moving objects.
- Keep tools and waste cloth away from rotating and moving objects.

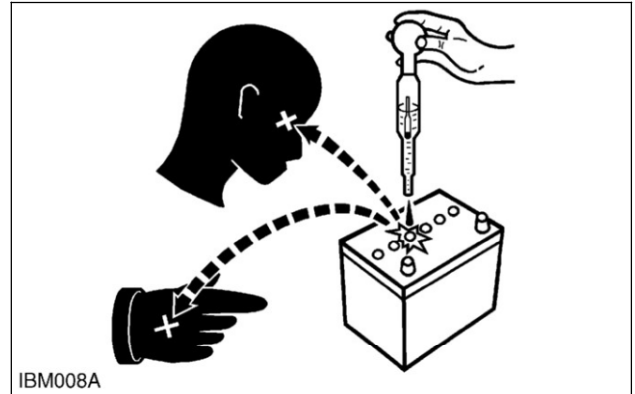
4. Preventing fires



IBM006A

- Keep fire (welding sparks, grinding sparks, cigarettes) away from the battery. The battery produces oxygen and hydrogen gas that are flammable.
- Disconnect the negative (-) terminal first when disconnecting the battery cable.
- Connect the positive (+) terminal first when connecting the battery cable.
- Do not short circuit the machine.
- Do not splash the hydraulic oil on the exhaust components.

5. Preventing acid burns



IBM008A

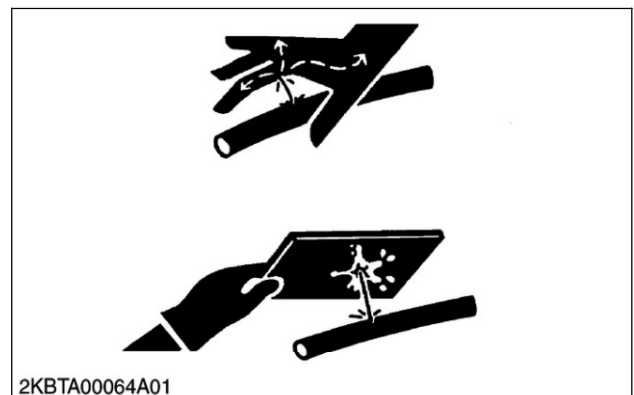
- Keep the electrolyte away from your eyes, hands, and clothes. Sulfuric acid in the battery electrolyte is poisonous: it can cause blindness and is strong enough to burn your skin and clothing. If you spill electrolyte on yourself, clean yourself with water and get a medical aid immediately.

6. Avoiding high pressure fluid



9Y1200165INI019A

- Keep away from high pressure fluids bursting from a hose or pipe. The fluid can penetrate your skin and cause serious injuries.
- Get a medical aid immediately if an accident occurs.



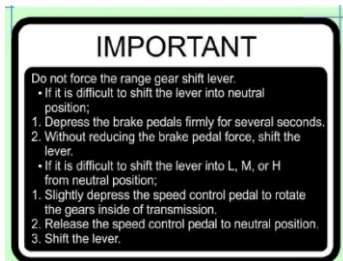
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- Release residual pressure in the hydraulic circuit before removing the hydraulic components.
- Pay attention when releasing pressure in hydraulic circuit, because the machine or attachment might move unexpectedly.

SAFETY DECALS

The safety decals (pictorial safety labels) are installed on the machine. If a decal becomes damaged, illegible or is not on the machine, replace it. The decal part number is listed in the parts list.

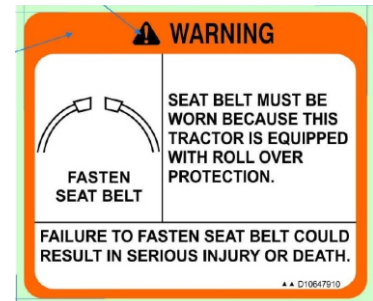
D10616510



D10616570



D10647910



D10570030



D10570050



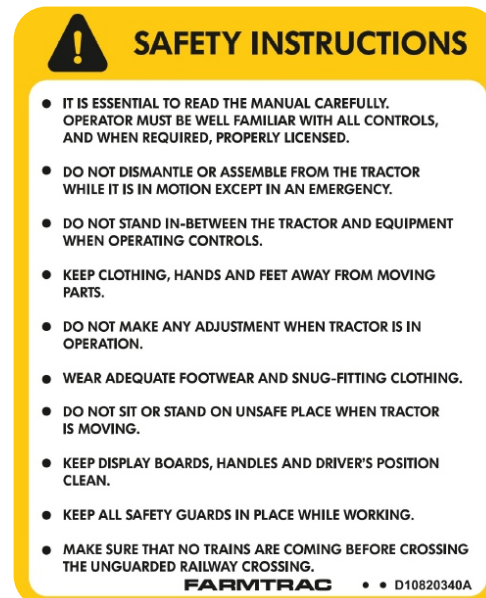
D11043230



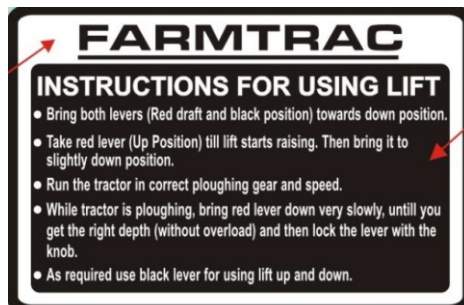
D10647840



D10820340



D10570900



D10817700



D10817680



D10647880



D10647900



D10817660



D10817690



1. Care of pictorial safety labels

1. Keep pictorial safety labels clean and free from obstructing material.
2. Clean pictorial safety labels with soap and water, dry with a soft cloth.
3. Replace damaged or missing pictorial safety labels with new labels.
4. If a component with pictorial safety label(s) affixed is replaced with new part, make sure new label(s) is (are) attached in the same location(s) as the replaced component.
5. Mount new pictorial safety labels by applying on a clean dry surface and pressing any bubbles to outside edge.

Abbreviation List: -

MSD	Manual Service Disconnect Switch
IGN	Ignition
OPC	Operator presence switch
SOP	Standard Operating Procedure
RPM	Revolution per Minute
V	Voltage
AMP	Ampere
RCD	Residual Current Device
HST	Hydro-Static Transmission
SOC	State of Charge
BMS	Battery management system
NMC	Lithium-Nickel-Manganese-Cobalt-Oxide
CAN	Controller Area Network
W/L	Warning Light
S/W	Software
KSI	Key Switch Ignition

CLUSTER & DASHBOARD SWITCHES

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SAFTYFIRST: -

Electric Tractor represent a completely different technology compared with internal combustion engines. This means that new safety hazards.

This symbol means that this station is Special Safety Station, any process that does not follow the rule or wrong operation can cause personal safety, the product may explode, burn, or not function, the operator must follow the process!



This symbol means that this station is Special Quality Control Station, the operator must follow the process otherwise the product may cause quality problems of functional, dimensional, or cosmetic with final product or may affect next stations operation



Precaution while Working on Electric Tractor:

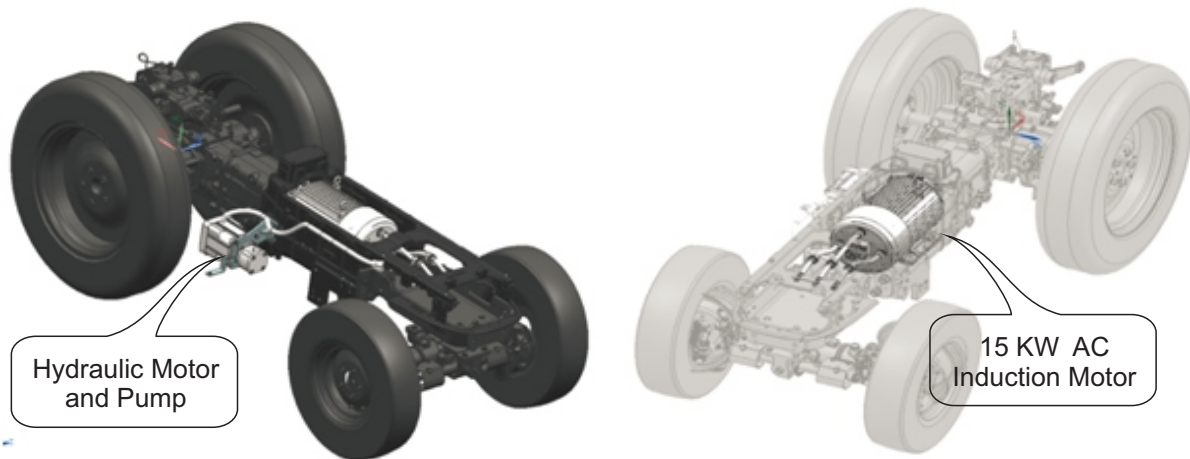
- a) Only skilled and authorized person should attend tractor for troubleshooting/ servicing.
- b) Use Personal Protective Equipment's (i.e., Electric safety gloves, shoes etc.) while working on Electric Tractor.
- c) Only use insulated tools while working on Electric tractor.
- d) Prior to working/Servicing on Electric tractor, Disconnect the HV through MSD switch.
- e) For Measurement of Resistance, IGN should be in OFF condition of Electric tractor.
- f) For Measurement of Continuity, IGN should be in OFF condition of Electric tractor.
- g) For Measurement of Voltage, IGN should be in ON condition of Electric tractor.



1 Compact Electrical Tractor with Mechanical transmission: -

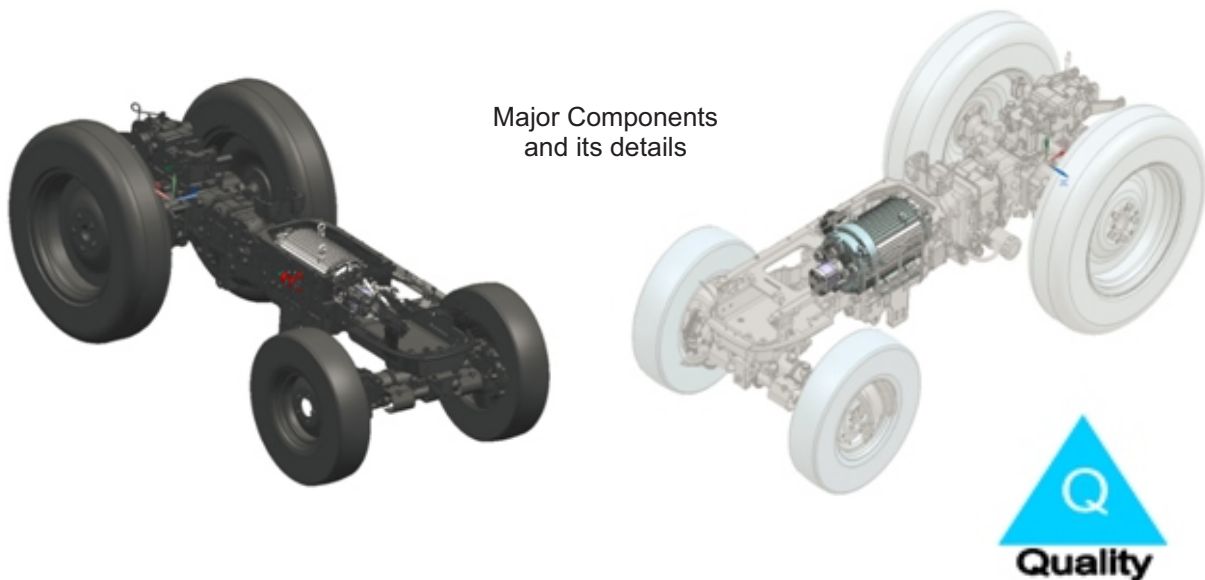
Compact Electric Tractor with Mechanical transmission with 15 KW AC induction motor closed loop system. Motor drive end connected to transmission through coupling.

Hydraulic system runs with individual motor of 2 kw coupled with 5.5 CC hydraulic pump, which supplies hydraulic oil for Power steering and hydraulic lift functions

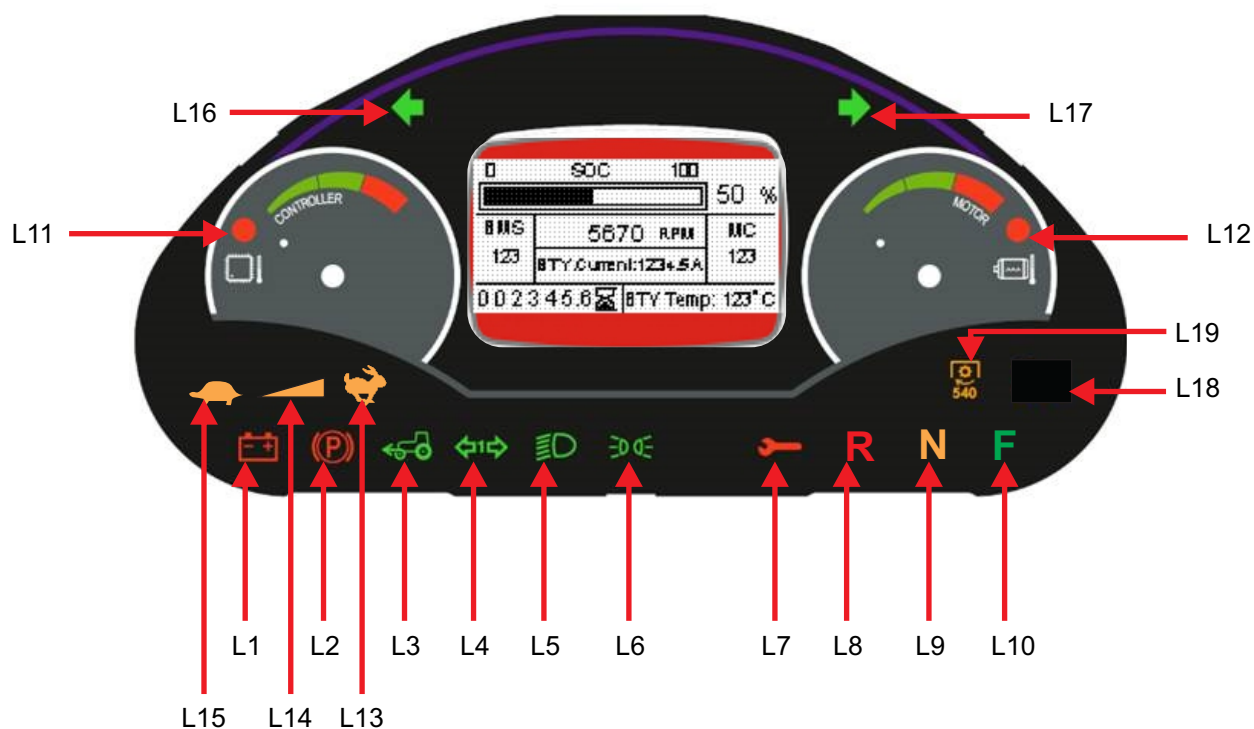


1.1 Compact Electrical Tractor with HST transmission-

Compact Electric Tractor with HST transmission with 15 KW AC induction motor closed loop system. Motor 1st drive end connected to HST unit & other end of motor is connected to **hydraulic pump 8CC** for Power steering operation and all hydraulic function.

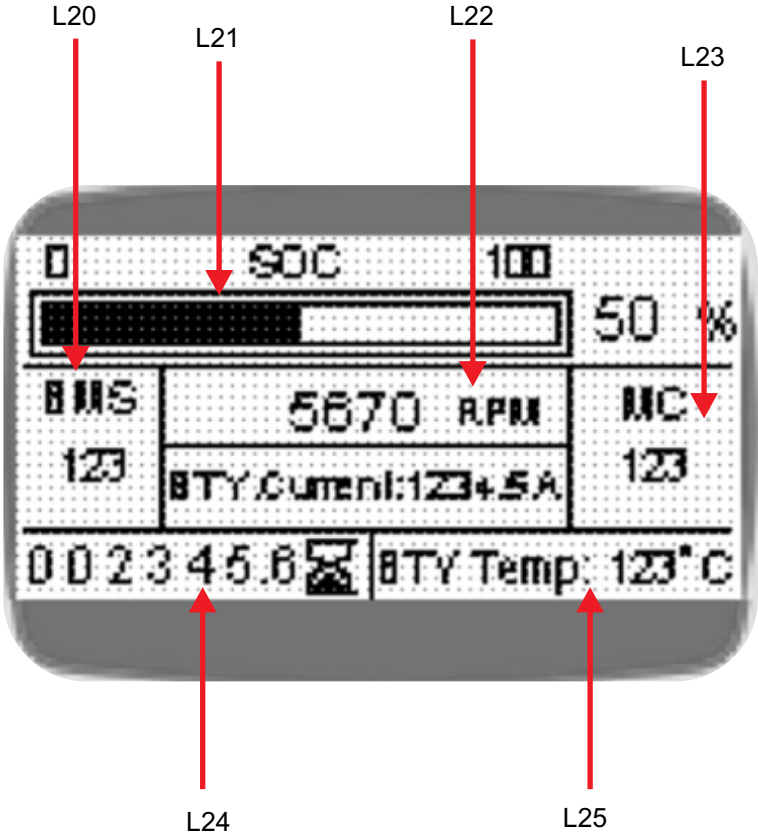


1.2 INSTRUMENT CLUSTER



Ser. No.	Function Name	Color	Symbol (attach symbol)
L1	Battery Charging Indicator	Red	
L2	Parking Brake apply	Red	
L3	4 WD	Green	
L4	Turn Trailer 1	Green	
L5	Dipped Beam	Blue	
L6	Position Lamp	Green	
L7	Warning lamp/Service lamp	Red	
L8	Reverse	Red	
L9	Neutral	Amber	

L10	Forward	Green	
L11	Controller temp high	Red	
L12	Motor temp high	Red	
L13	Fast Mode	Amber	
L14	Normal	Amber	
L15	Slow Mode	Amber	
L16	Left Direction	Green	
L17	Right Direction	Green	
L18	Mid PTO	Amber	
L19	PTO 540/540E	Amber	



L20	BMS BATTERY ERROR CODE
L21	SOC (BATTERY STATE OF CHARGE)
L22	MOTOR RPM
L 23	MOTOR CONTROLLER ERROR CODE
L24	HOUR METER READING
L25	BATTERY TEMPERATURE

1.3 CLUSTER FUNCTIONALITIES

1.3.1 L7, Service W/L:

Service W/L will be used for two functionalities.

1. L7 will start blinking whenever there is any fault.
2. L7 will be solid on after every 300 hrs.

1.3.2 Gear state:

L9 (Neutral) W/L ON
L10 (Forward) W/L ON
L8 (Reverse) W/L ON

1.3.3 Speed Mode:

L15 (Slow Mode) W/L ON
L14 (Normal Mode) W/L ON
L13 (Fast Mode) W/L ON

1.3.4 L19, Mid PTO:

L18 (Mid PTO) W/L OFF
L18 (Mid PTO) W/L ON

1.3.5 L1, Battery Indication:

During Charging

L1 W/L Solid Green ON

During Discharging/Tractor ON

L1 W/L Solid Red On

1.3.6 S1, Controller Temperature Indicator

L11 W/L Solid on Whenever motor temperature will go above 70 °C

1.3.7 S3, Motor Temperature Indicator.

W/L L12 will be ON whenever motor temperature will go above 120 °C

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1.4 TRACTOR CONTROLS SOP

MSD (Manual Service Disconnect) Switch

Manual service disconnect located on the front side of battery –To Cut off the 72 Volt output from Battery Box

Ignition Switch

To switch on the System

FNR Switch with Combination SNF Switch

FNR Switch with Combination of SNF (Slow, Normal Fast Range) Switch:

Ø FNR Switch – To select Forward/Reverse direction or Neutral

Ø SNF Range Switch – To select/restrict the motor Max RPM Range

(S- <2000 RPM, N- <2500RPM, F- <2800RPM)

Note: Reverse - <2240 RPM which is independent of SNF Switch

A. Lift Mode Selection Switch

OFF – Hydraulic motor will run on low RPM for the use of Power Steering only.

When ON – Hydraulic motor RPM will increase and lift Operation can be used.

B. Pump on/off Switch

This switch is for starting the Hydraulic Motor, It starts motor which is coupled with 8cc Hydraulic Pump to generate oil flow.

C. PTO Wet Clutch

Press the switch to engage the PTO.

D. Hazard Switch

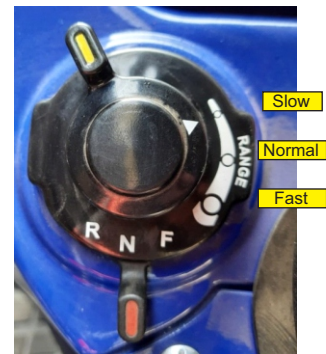
Press the switch to engage the PTO.

Indicator Combination Switch

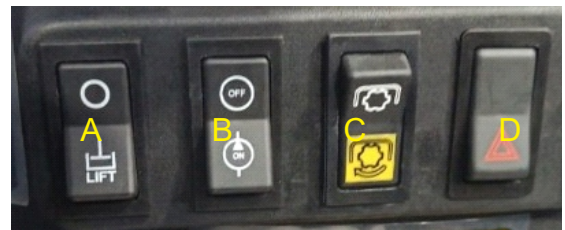
For left and right Indicators (Counter-clockwise for right turn, clockwise for left turn).
Turning headlamp on/off and Horn



Manual Service Disconnect Switch



Range and FNR Switch



Lift Mode Selection Switch

Pump on/off switch

PTO Wet Clutch

Hazard Switch



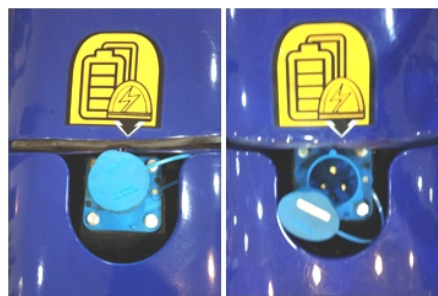
Combination Switch

1.5 Charging Point

Charging point is provided to plug in the charging cable (provided In Place of Fuel Tank Cap)

RCD (Residual Current Device) of the charging cable

The Charging Cable can be plugged directly to 15 Amp Household Socket to charge the 72V battery of the tractor



Charging point



RCD



MSD (Manual Service Disconnect) switch - To Cut off the 72 Volt output from Battery Box



Charging Interlock – If the charger is plugged on vehicle, tractor will not work (main controller will not give supply to drive motor)



Reverse Buzzer (Wherever applicable) – Buzzer will beeps if it is applicable when reverse mode is engaged

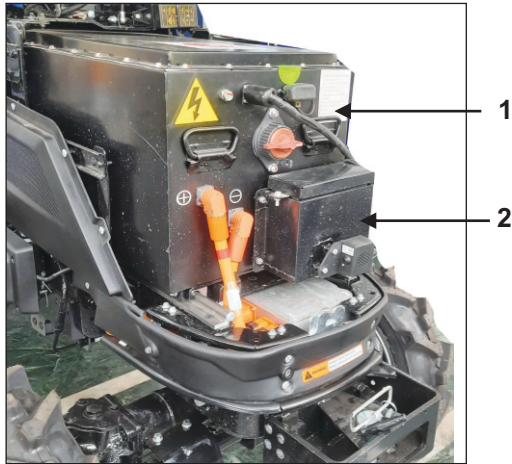
Reverse Mode speed limit – 2240 RPM (80% of the Max. RPM)

Reverse mode PTO Safety Interlock – PTO will not work in reverse mode.



Seat OPC – If driver gets down without engaging the parking brake, tractor system will automatically shut Off within 7 Sec

BATTERY CHARGING PROCEDURE & WARNING



1. Main Battery
2. Auxiliary Battery

Charge the vehicle in ventilated area, under a shade.

Step 1- Put the tractor on Parking Brake and ensure MSD is ON.



MSD "ON" POSITION

Step 2- Check voltage of auxiliary battery. Voltage should be 11 to 14V. If voltage is below 11V then charge the auxiliary battery.

Step 3- Plug the Cable into 15 Amp wall mounted socket and switch ON.



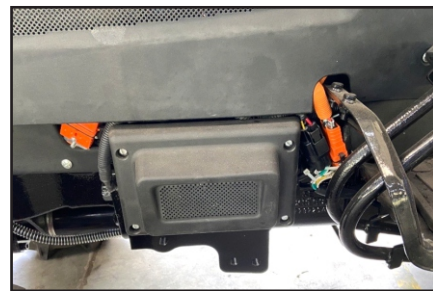
Step 4- Plug the other end of the charging cable on the vehicle side

Step 5- After Plug-in "Green light" will blink on RCD device, it will continue to blink if charging is happening.



RCD – Residual Charge Device

Step 6- Fan will start working on the charger side, if charging is ON.



(Charger & Fan) LHS of tractor

Step 7- Switch "ON" the ignition key, battery symbol will illuminate on cluster, which shows that tractor is in charging mode.



RCD Charging Cable Plugged In

NOTE : Charging Source: 15 Ampere, 220V, 4 kW (Only For Tractor Charging) e. g. If charging is being conducted at home.
Total Load Required = 4kW + Other Household loads.

How to start the tractor

- ▶ Switch on the MSD Switch



Turn On MSD

- ▶ Sit on the tractor
- ▶ Check if both the throttles(hand throttle/foot throttle) and brake pot are at zero position



All throttles zero

- ▶ FNR switch should be in Neutral
- ▶ (if ignition key is turned on and FNR switch is in For R mode, we need not switch off the ignition we just need to neutral the FNR switch and again select the F/R mode)
- ▶ Parking brake should be disengaged



Parking Brake

- ▶ Pump on/off switch should be off (if ignition key is turned on and Pump switch is on, do not switch off the ignition, just switch off and again switch on the pump switch)
- ▶ HLM Range lever should be in Neutral
- ▶ SNF switch can be used in any position, any time (Condition: if we change from S to N on the same throttle RPM, the RPM will rise wrt previous mode)

NOTE : Charging Source:

15 Ampere, 220 V , 4 kW (Only For Tractor Charging) e.g. If charging is being conducted at home, total Load Required = 4kW + Other Household loads.

How to increase battery life:

- Use the battery from full charge of 100 % to 20 % before charging again so that number of charging cycles can be kept to minimum.
- Keep MSD "OFF", when tractor is not in use or during long storage of tractor.
- Do not operate the tractor when battery temperature goes beyond 50 °C (Battery temperature is shown on cluster)

Handling of Charging Cable

- RCD should not be in hanging position while charging. It may lead to damage of cable due to RCD unit weight.
- Store charging cable carefully. Avoid the contact of charging cable with any sharp objects, it can damage the cable.
- Check charging cable thoroughly before putting in socket.

General Warnings

Precautions while charging the battery –

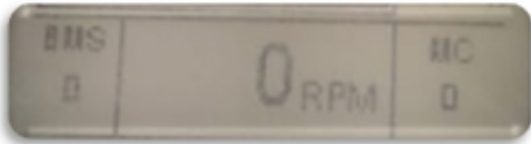
- Do not charge the tractor in open area while it is raining or thundering.
- Do not plug-in or unplug the RCD plug with wet hands and do not stand in water, liquid or snow. This may cause an electric shock which may result in serious personal injury or death.
- Make sure the Charge port cap is closed when charging is completed. If the charger cord is removed and the cap is open, water or foreign materials may enter the charge port.
- Make sure there is no water or foreign materials in the charge port, charge connect or electrical plug, and that they are not damaged or effected by rust or Corrosion.

- Do not charge the tractor instantly after washing. Wait for 30 minutes so that tractor gets dry.
- If Warning indicator glows on cluster, contact your dealer for assistance and repair



Malfunction indicator on cluster

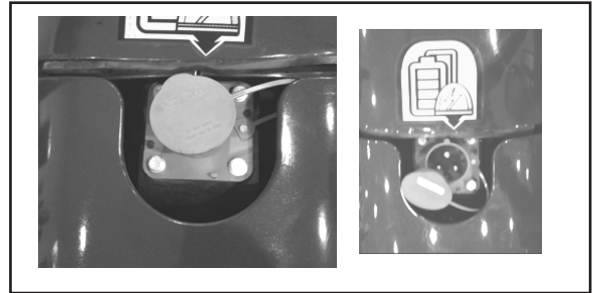
- If error code appears on cluster, look for the problem according to the error code chart.



Error Code Display

- If any high heat condition or burning smell is noticed, immediately park the tractor in a safe location, place the ignition in the OFF position, move yourself away quickly to a safe distance from the tractor and contact your dealer for assistance and repair.
- Do not store your tractor inside if any of the above noted conditions exist.
- Do not attempt to alter the tractor in any manner which would affect stability, control, or top speed. Such alterations may lead to serious injury or death, violate state and local laws, and will void the manufacturer's warranty.
- Charge the vehicle in a ventilated area, under a shade.
- Do not touch the vehicle and charger when there is lightning. A lightning strike may back feed into the charger causing damage and possible personal injury or death.
- Do not plug in or unplug the plug with wet hands and do not stand in water, liquid or snow. This may cause an electric shock which may result in serious personal injury or death.

- Make sure the cap is closed on the charge port when charging is completed. If the charger cord is removed and the cap is open, water or foreign materials may enter the charge port.
- Make sure there is no water or foreign materials in the charge port, charge connector or electrical plug, and that they are not damaged or affected by rust or corrosion.



Charging Port

- Look for cluster alerts and error codes on cluster
- Clean the dust on electrical components
- Inspect and clean battery wires. Damage or frayed wires should be replaced by a qualified technician.
- Apply the parking brake
- Fully charge the battery before storing the tractor for long periods
- Turn Off the MSD switch
- Charge the battery once within 3 months, if tractor is not in use

BATTERY

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2. Main Battery Pack-

Lithium-ion (NMC) 350AH Battery pack at 73VDC is the energy source for driving the motor.

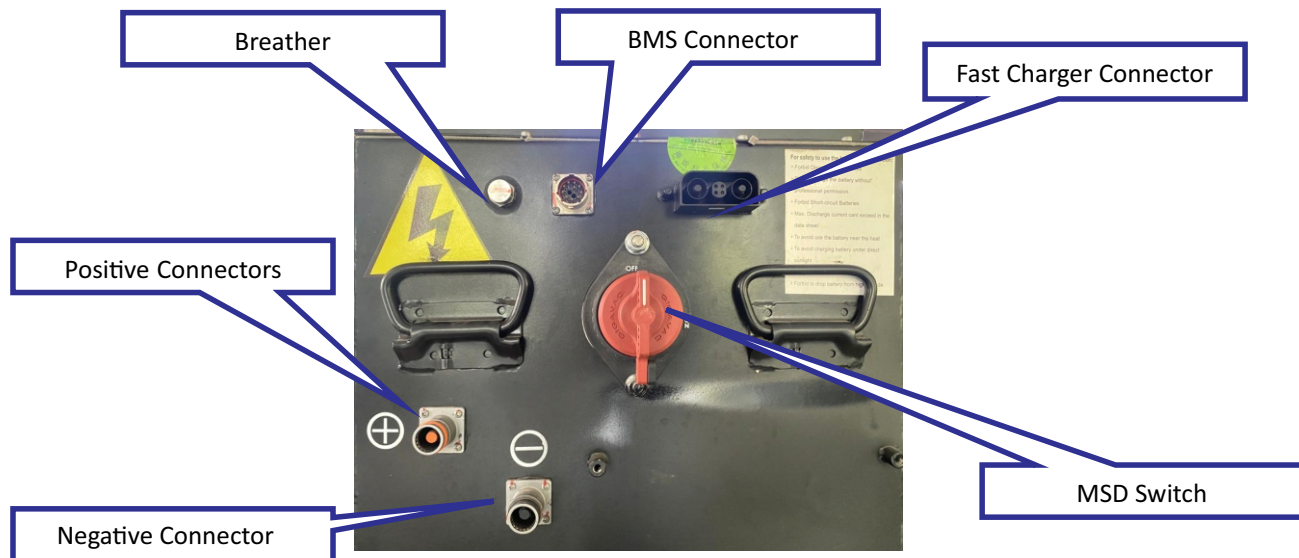
Information of main battery pack-

S.N	Parameter	Escorts Solution (NMC)
1	Dimension (Battery Box),mm	(900x400x400)
2	Energy Density, Wh/Kg.	178.218
3	Cell Type	SEPNI-8688190P-17.5AH-5P
4	Parallel / Series	5P1S
5	Module Rated Capacity AH	87.5
6	Module Rated Voltage, V	3.65
7	Nominal Voltage, V	73
8	Total Power Module(73V-350Ah)	20S4P
9	Voltage Range, V	60--84
10	Battery System Whole Energy (KWH), 23±2°C, Whole	25.5
11	Battery System Wholecapacity (Ah), 1/3C	350



Main Battery Pack

2.1. Components of Main Battery.



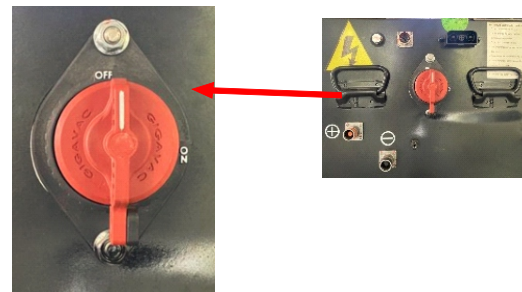
Front view of Battery

2.2. MSD (Manual Service Disconnect Switch) Function-

Disconnect main battery supply from system (73 Volt)

Checking procedure-

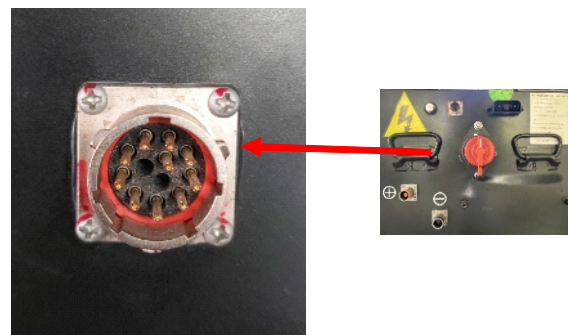
1. Check the BMS connector should be connected properly to the main Battery
2. Switch "ON" MSD switch by rotating CW direction.
3. Check supply 73 Volt at Fast charger connector Location.



2.3. BMS Connector

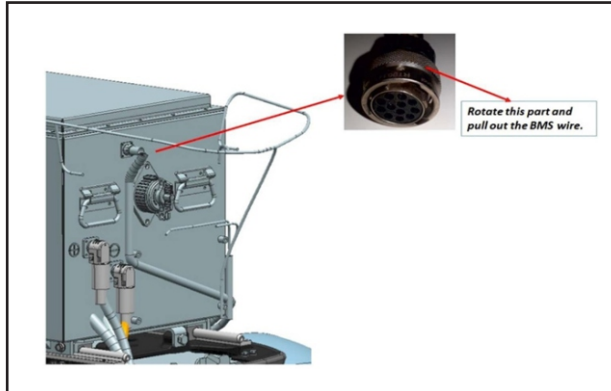
Function-

This is type of CAN communication wiring which communicates BMS with other units like main motor controller, Instrument panel.

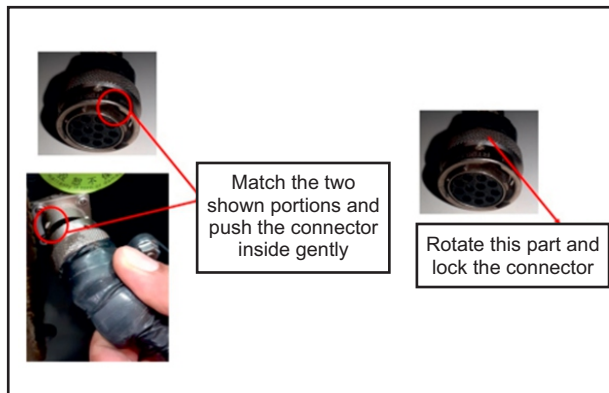


2.4 SOP for removing & Assembly of BMS CAN connector-

Removing procedure-



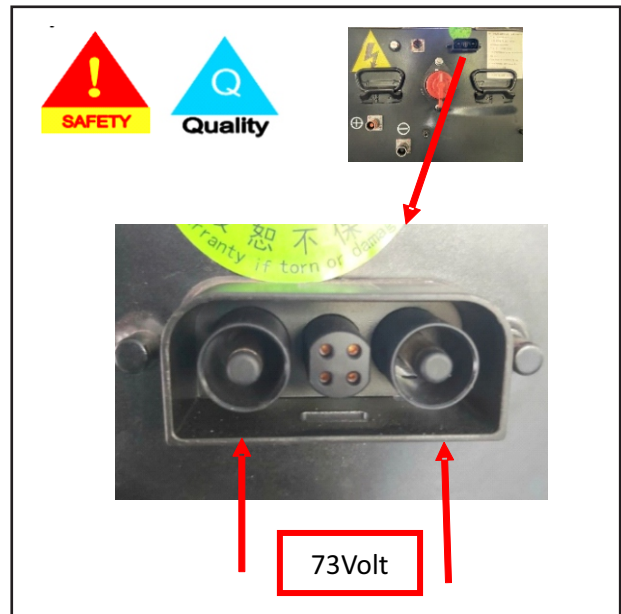
Assembly procedure-



2.5. Fast Charger Connector

Function-

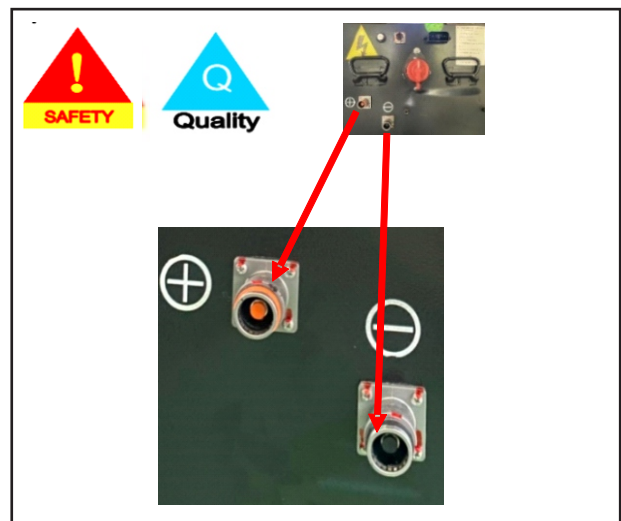
1. Connector for off board fast charger. Voltage -73V
2. We can check battery voltage from connector terminal, for Charged battery it should be 73 Volt.



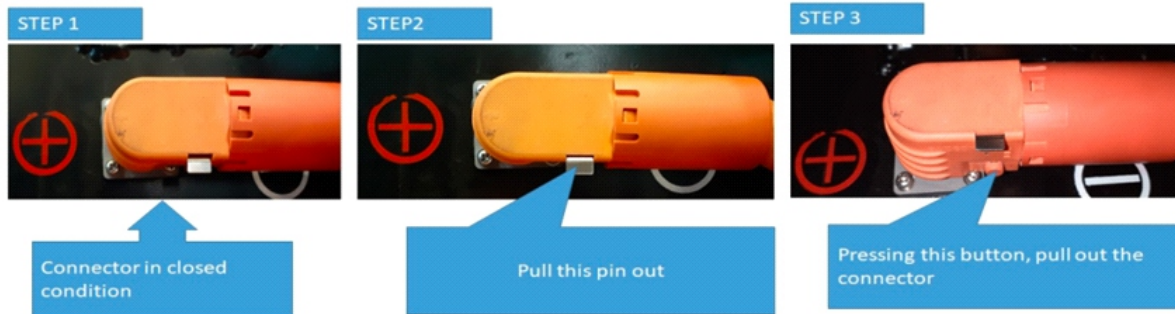
2.6. Battery positive and negative connectors

Function-

From +ve and -Ve connector location will connect supply to system



2.7 SOP for removing Battery positive and negative connectors.

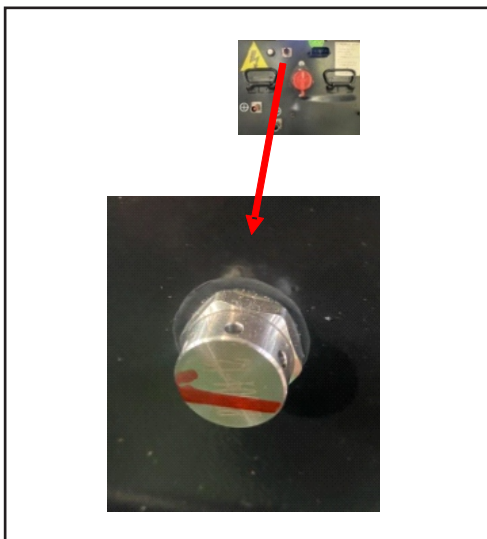


2.8 SOP for assembly Battery positive and negative connectors



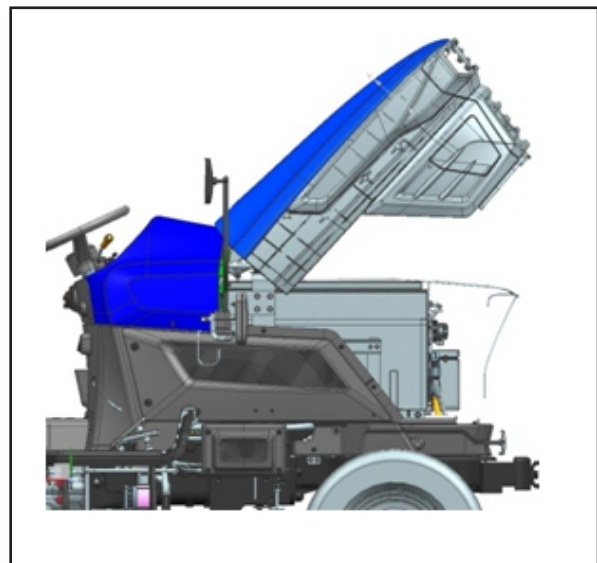
2.9. Breather

The explosion proof valve is coated with anaerobic glue, and the installation tightening torque is $8 \pm 0.5 \text{ N} \cdot \text{m}$. It is confirmed by marking the riding

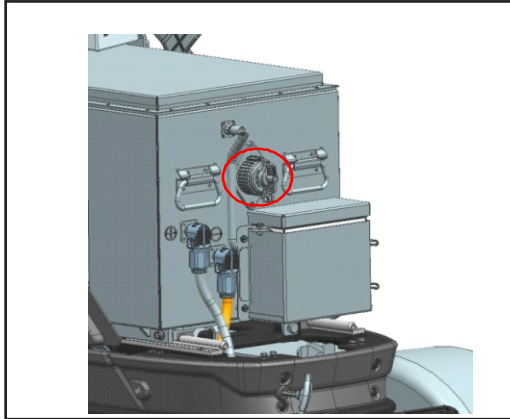


2.10 Battery Dismantling Procedure: -

Step-1: Open front Hood



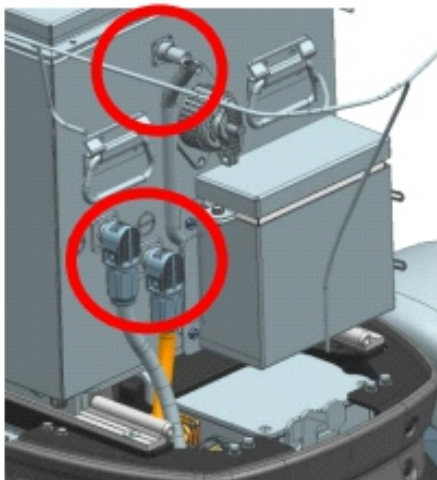
Step 2 - Switch Off MSD



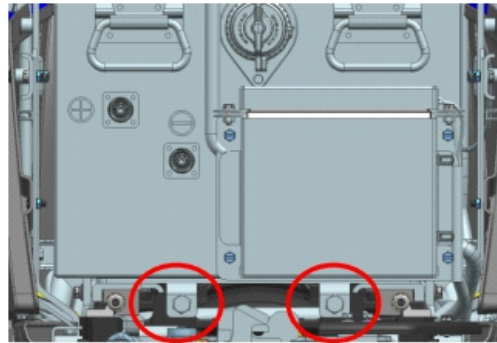
Step 3 - Disconnect Auxiliary battery connectors



Step 4 – Disconnect BMS controller and HV cables



Step 5 - Push the battery inside by sliding & tighten battery holding bolts as shown in fig.



Step 6 – Dismantle the all screw from front axle cover by using screwdriver & 10mm socket. Now remove cover from axle (keep cover and fasteners aside for re-use).



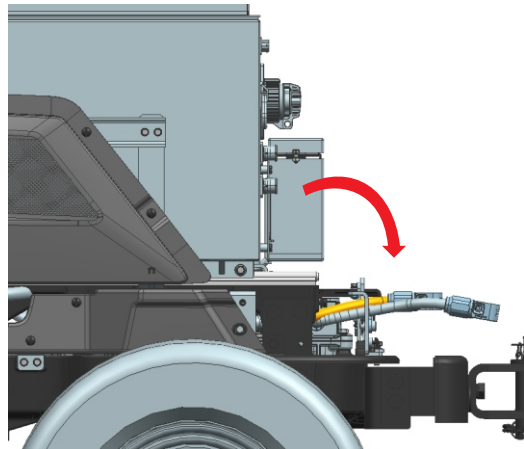
Step 7 – Dismantle the all screw from battery side cover & remove the side cover RH/LH as shown in below figure. (keep cover and fasteners aside for re-use).



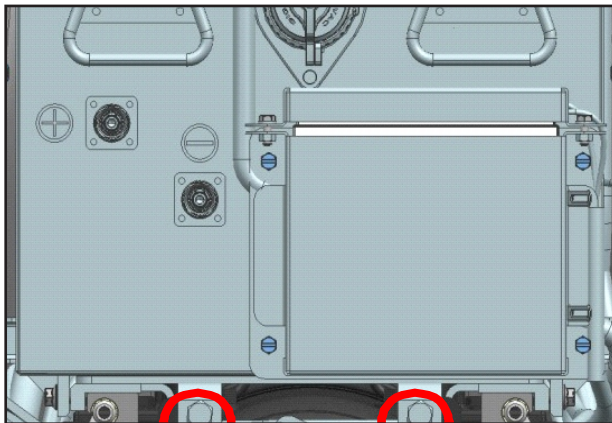
Step 8 - Dismantle baffle plate assembly LH/RH by using 10mm socket.
(Keep bracket aside with fasteners for re-use)



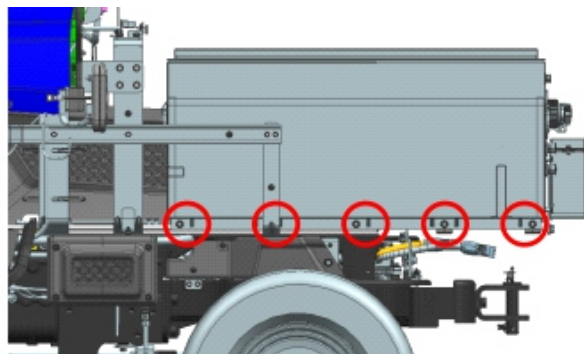
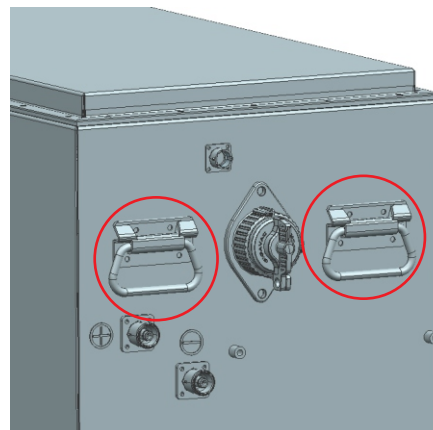
Step 10 - Rotate high voltage cables.



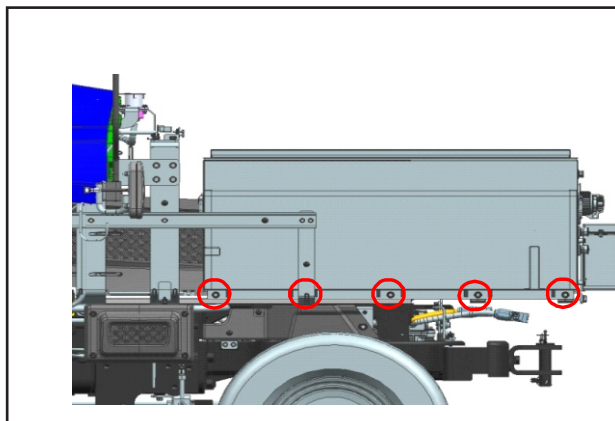
Step 9- Remove Battery holding hardware



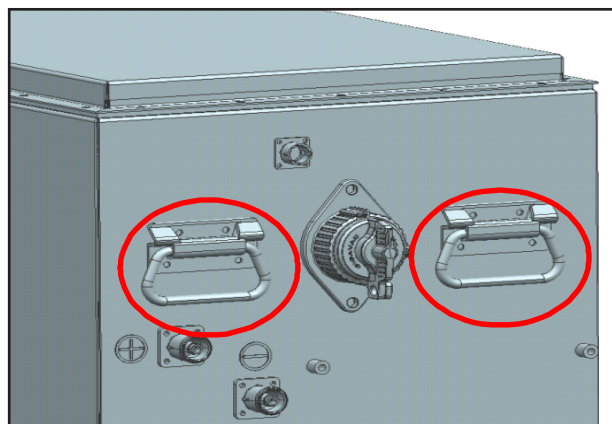
Step 11 - Use belts to anchor the battery box from handles and lift the battery box upside.



NOTE - Repeat the process in reverse direction to assemble the battery.

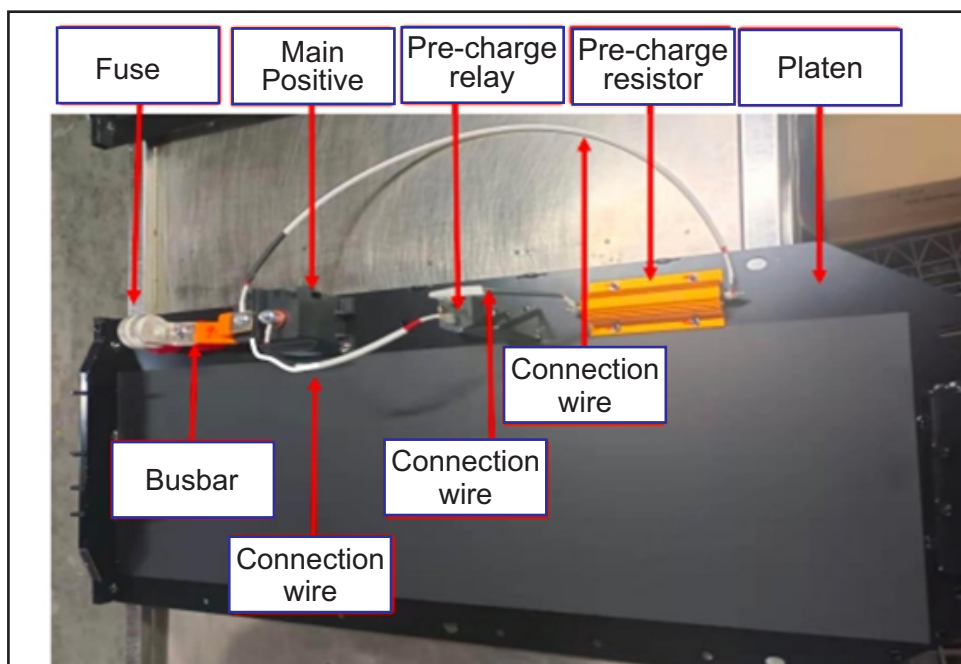


13. Take out the battery till stopper. It will come out side by 485mm and remove battery holding bolts



14. Use belts to anchor the battery box from handles and lift the battery box.

2.11 Repeat the process in reverse direction (14→1) to assemble the battery



Top View of main Battery

2.12 Battery Diagnostic

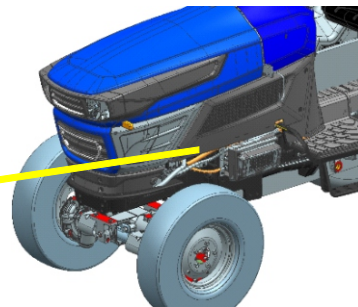
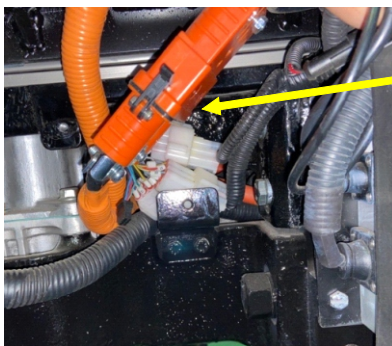
2.13 WIRE COLOUR CODING

WIRE COLOUR		
Colour Code	Description	
B	Black	
G	Green	
GR	Grey	
L	Blue	
O	Orange	
P	Pink	
R	Red	
V	Violet	
W	White	
Y	Yellow	
BR	Brown	
SK	Sky Blue	
LG	Light Green	

Error Code 100: SOC is too high

Normal Operations	BMS will calculate actual SOC and display on the Instrument cluster.
ERROR CODE Detecting Conditions	If Tractor having pack voltage more than 84 volts.
Probable cause	1. BMS S/W faults which allow battery to get over charged 2. BMS S/W get corrupted 3. BMS not working
Lamp status	Malfunction tell-tale lamp will blink
ERROR CODE Reaction	Battery over charged
Healing Conditions	Rectify fault and cycle KSI.

Component Location



Connector (Placed beside the charger)

Step 1: Connect Diagnostic tool and note down the ERROR CODE. If ERROR CODE is present, go to step 2.

YES	NO
STEP 2	Clear the ERROR CODE

Step 2: Check the Battery Pack voltage. It should be < 84 Volts.

YES	NO
STEP 3	Put LOAD on Tractor and check for voltage dropping if No then this is a Replace BMS

Step 3: Drive the tractor and then connect the Tractor on Charging and check for the charging cutoff at 100% (i.e., Battery Pack Voltage= 84 Volts)

YES	NO
Clear the DTC and Check	Replace BMS(Contact EKL before replacing)

Error Code 101: SOC is too Low

Normal Operations	BMS will calculate actual SOC and display on the Instrument cluster.
ERROR CODE Detecting Conditions	If Tractor is driven $\leq 15\%$ SOC
Probable cause	Battery is discharged below the threshold limit
Lamp status	Malfunction tell-tale lamp will blink
ERROR CODE Reaction	Instrument cluster indicate low SOC to User
Healing Conditions	Plug in for charge

Step 1: Connect Diagnostic tool and note down the ERROR CODE. If ERROR CODE is present, go to step

YES	NO
STEP 2	Clear the ERROR CODE

Step 2: Check the Battery Pack voltage and SOC. It should be > 60 Volts and SOC $>15\%$.

YES	NO
Replace BMS	Charge the Tractor and check

Error Code 102: Total voltage is too high

Normal Operations	BMS will calculate actual SOC and display on the Instrument cluster.
ERROR CODE Detecting Conditions	If Tractor having pack voltage more than 84 volts.
Probable cause	1. BMS S/W faults which allow battery to get over charged 2. BMS S/w get corrupted 3. BMS not working
Lamp status	Malfunction tell-tale lamp will blink
ERROR CODE Reaction	Battery over charged
Healing Conditions	Rectify fault and cycle KSI.

Step 1: Connect Diagnostic tool and note down the ERROR CODE. If ERROR CODE is present, go to step 2.

YES	NO
STEP 2	Clear the ERROR CODE

Step 2: Check the Battery Pack voltage. It should be < 84 Volts.

YES	NO
STEP 3	Put LOAD on Tractor and check for voltage dropping if No then this is a replace BMS

Step 3: Drive the tractor and then connect the Tractor on Charging and check for the charging cutoff at 100% (i.e., Battery Pack Voltage= 84 Volts)

YES	NO
Clear DTC and Check	Replace BMS

Error Code 103: Total voltage is too low

Normal Operations	BMS will calculate actual SOC and display on the Instrument cluster.
ERROR CODE Detecting Conditions	If Tractor is driven $\leq 15\%$ SOC
Probable cause	Battery is discharged below the threshold limit
Lamp status	Malfunction tell-tale lamp will blink
ERROR CODE Reaction	Instrument cluster indicate low SOC to User
Healing Conditions	Plug in for charge

Step 1: Connect Diagnostic tool and note down the ERROR CODE. If ERROR CODE is present, go to step 2.

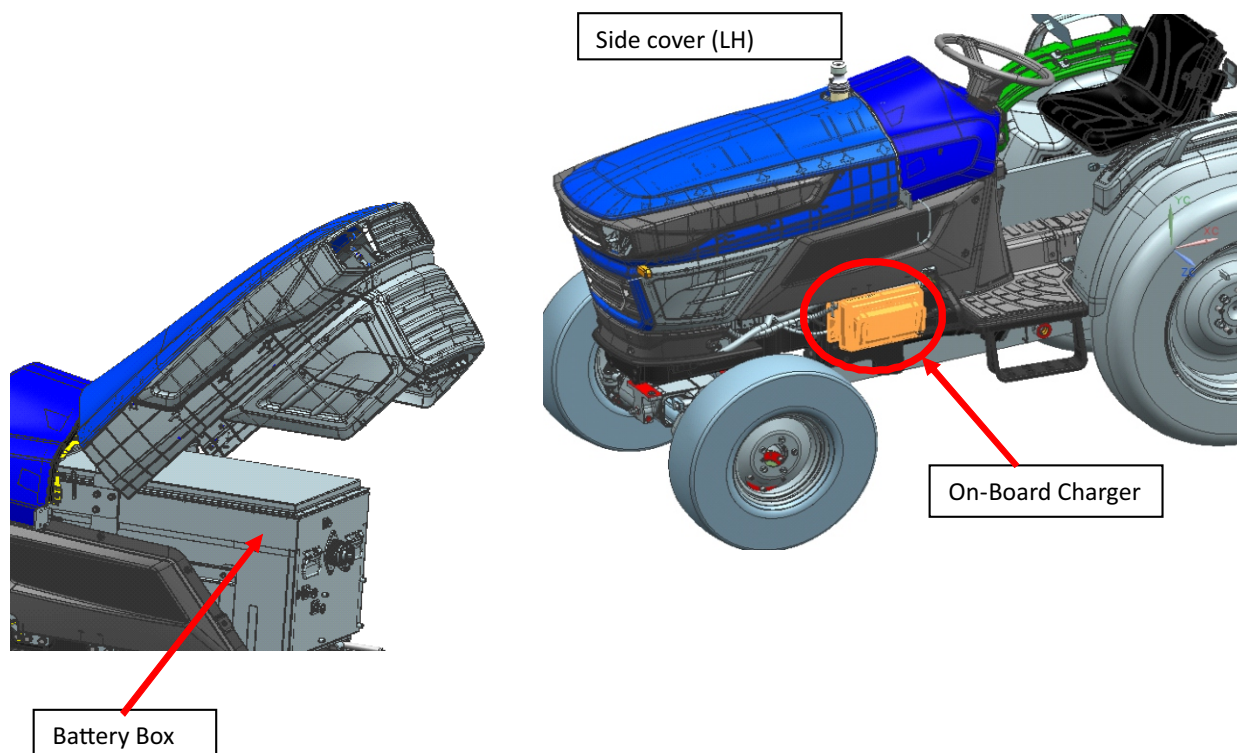
YES	NO
STEP 2	Clear the ERROR CODE

Step 2: Check the Battery Pack voltage and SOC. It should be > 60 Volts and $SOC > 15\%$.

YES	NO
Replace BMS	Charge the Tractor and check

Error Code 104: Charge current fault

Normal Operations	BMS will read actual Charge Current.
ERROR CODE Detecting Conditions	If there is difference between charging current and programming current.
Probable cause	1. Current sensor not working 2. Current sensor calibration not okay 3. Charging status from charger coming wrong
Lamp status	Malfunction tell-tale lamp will blink
ERROR CODE Reaction	Battery will not charge
Healing Conditions	Rectify the Fault

Component Location:

Step 1: Connect Diagnostic tool and note down the ERROR CODE. If ERROR CODE is present, go to step 2.

YES	NO
STEP 2	Clear the ERROR CODE

Step 2: Check the Current while charging form Ammeter on +ve Cable of On Board Charger which is going towards E-Box.

It should be < 40 A.

YES	NO
STEP 3	Replace On Board Charger

Step 3: Check the Current while charging form Ammeter on +ve Cable of On Board Charger which is going towards E-Box and check the current in Instrument Cluster.

It should me same.

YES	NO
Clear DTC and Verify if persist Replace Battery Pack	Replace BMS

Error Code 105: Discharge current fault

Normal Operations	BMS will read actual Discharge Current.
ERROR CODE Detecting Conditions	If there is difference between Discharging current and programming current.
Probable cause	1. Current sensor not working 2. Current sensor calibration not okay 3. Charging status from charger coming wrong
Lamp status	Malfunction tell-tale lamp will blink
ERROR CODE Reaction	Battery will not discharge
Healing Conditions	Rectify the Fault

Step 1: Connect Diagnostic tool and note down the ERROR CODE. If ERROR CODE is present, go to step 2.

YES	NO
STEP 2	Clear the ERROR CODE

Step 2: Check the Discharge current at Instrument Cluster and in Live data of UDAAN.

It should be equal.

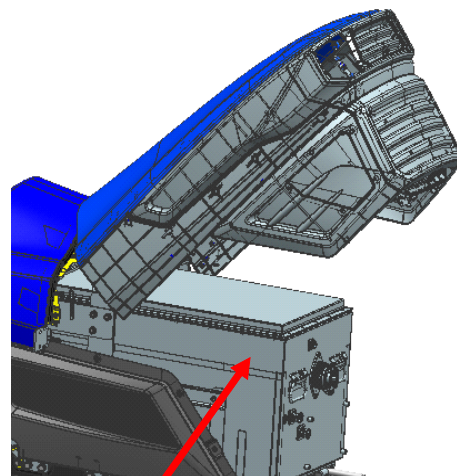
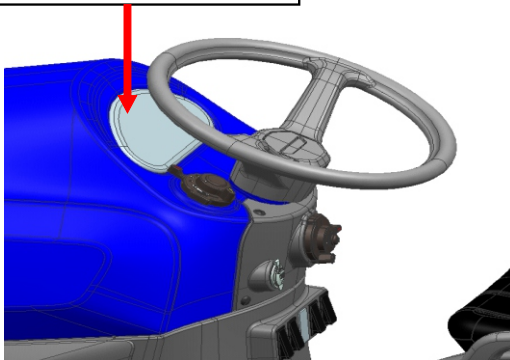
YES	NO
Replace Battery Pack	Replace BMS

Error Code 106: Battery temperature is too low

Normal Operations	BMS will read actual temperature
ERROR CODE	If Battery Cell Temp is lower than the set value.
Detecting	Due to erratic readings of Battery Cell Temp Sensor.
Conditions	Due to mismatch in Battery Cell Temp Sensor Type in Calibration Settings.
Probable cause	1. Check the ambient temp, it should not be below -10Deg C 2. Temp sensor is faulty 3. Check the wiring of temp sensor
Lamp status	Malfunction tell-tale lamp will blink
ERROR CODE Reaction	Battery will not allow charge and discharge
Healing Conditions	Rectify Fault

Component Location:

Instrument cluster



Battery Box

Step 1: Connect Diagnostic tool and note down the ERROR CODE. If ERROR CODE is present, go to step 2.

YES	NO
STEP 2	Clear the ERROR CODE

Step 2: Check the Battery temp Shown in Instrument Cluster.

Is it < -10 Deg Celsius.

YES	NO
Follow the Battery Winter care as per OPM	STEP 3

Step 3: Connect UDAAN and check the minimum cell voltage.

It should be > -10 Deg Celsius.

YES	NO
If ambient Temp is 0 Deg Celsius then Replace battery Pack	Bring it to 0 Deg Celsius

Error Code 107: Battery temperature is too High

Normal Operations	BMS will read actual temperature
ERROR CODE	If Battery cell Temp is higher than the set value on a particular state
Detecting	Due to erratic readings of Battery cell Temp Sensor
Conditions	Wrong calibration parameters
Probable cause	1. Temp sensor is faulty 2. Check the wiring of temp sensor 3. Battery is charging and discharging at full load condition and the temp rises at 54 Deg C
Lamp status	Malfunction tell-tale lamp will blink
ERROR CODE Reaction	Battery will not allow charge and discharge
Healing Conditions	Rectify Fault

Step 1: Connect Diagnostic tool and note down the ERROR CODE. If ERROR CODE is present, go to step 2.

YES	NO
STEP 2	Clear the ERROR CODE

Step 2: Check the Battery temp Shown in Instrument Cluster.

It should be <50 Deg Celsius.

YES	NO
STEP 3	NO Cool Down the Tractor

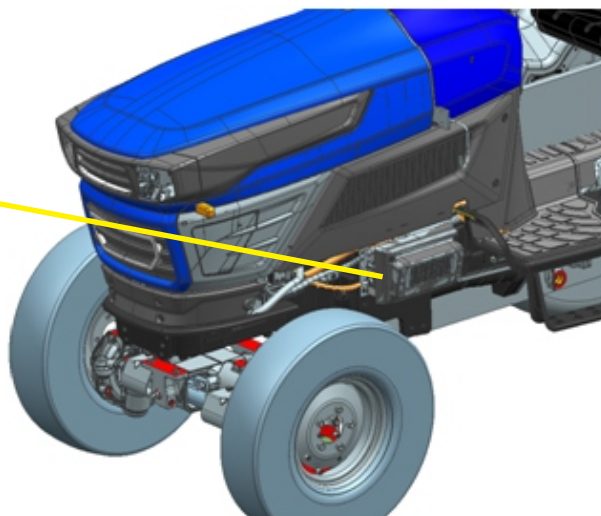
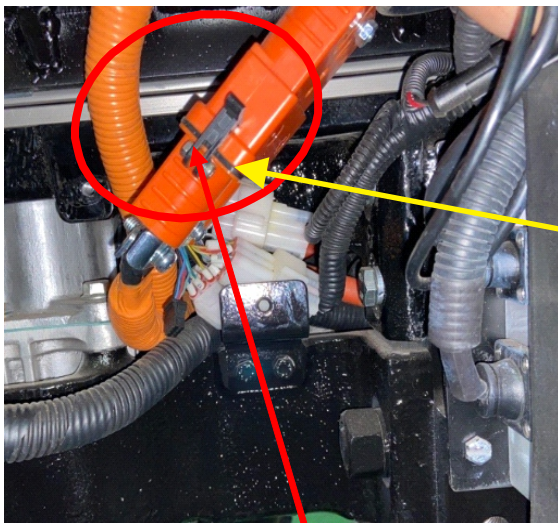
Step 3: Connect UDAAN and check the Maximum cell voltage.

It should be <50 Deg Celsius.

YES	NO
Replace BMS	Cool down the Tractor

Error Code 108: Battery under voltage

Normal Operations	BMS will calculate actual SOC and display on the Instrument cluster.
ERROR CODE	
Detecting Conditions	If Tractor is driven ? 15% SOC
Probable cause	Battery is discharged below the threshold limit
Lamp status	Malfunction tell-tale lamp will blink
ERROR CODE Reaction	Instrument cluster indicate low SOC to User
Healing Conditions	Plug in for charge

Component Location:

Connector (Placed beside the charger)

Step 1: Connect Diagnostic tool and note down the ERROR CODE. If ERROR CODE is present, go to step 2.

YES	NO
STEP 2	Clear the ERROR CODE

Step 2: Check the Battery Pack voltage and SOC. It should be > 60 Volts and SOC>15%.

YES	NO
BMS Issue, Replace BMS	Charge the Tractor and check

Error Code 109: Battery overvoltage

Normal Operations	BMS will calculate actual SOC and display on the Instrument cluster.
ERROR CODE	
Detecting Conditions	If Tractor having pack voltage more than 84 volts.
Probable cause	1. BMS S/W faults which allow battery to get over charged
	2. BMS S/w get corrupted
	3. BMS not working
Lamp status	Malfunction tell-tale lamp will blink
ERROR CODE Reaction	Battery over charged
Healing Conditions	Rectify fault and cycle KSI.

Step 1: Connect Diagnostic tool and note down the ERROR CODE. If ERROR CODE is present, go to

YES	NO
STEP 2	Clear the ERROR CODE

Step 2: Check the Battery Pack voltage. It should be < 84 Volts.

YES	NO
STEP 3	Put LOAD on Tractor and check for voltage dropping if No then this is a BMS issue Replace BMS

Step 3: Drive the tractor and then connect the Tractor on Charging and check for the charging cutoff at 100% (i.e., Battery Pack Voltage= 84 Volts)

YES	NO
Clear DTC and Check	BMS Issue, Replace BMS

Error Code 110: battery temperature unbalance

Normal Operations	BMS will read actual cell temperature
ERROR CODE	If the temp delta is more
Detecting	Due to erratic readings of Battery cell Temp Sensor
Conditions	Wrong calibration parameters
Probable cause	1. Check the ambient temp, it should be between 0-25 Deg C 2. Temp sensor is faulty 3. Check the wiring of temp sensor
Lamp status	Malfunction tell-tale lamp will blink
ERROR CODE Reaction	Battery will not allow charge and discharge
Healing Conditions	Rectify Fault

Step 1: Connect Diagnostic tool and note down the ERROR CODE. If ERROR CODE is present, go to step 2.

YES	NO
STEP 2	Clear the ERROR CODE

Step 1: Connect UDAAN and check for Temperature Delta.

It should be 0.

YES	NO
Replace BMS	Replace BMS

Error Code 118: Cell voltage detection fault

Normal Operations	BMS measures cell voltage
ERROR CODE Detecting Conditions	Hardware fault
Probable cause	1. Faulty cell 2. Cell wiring issue
Lamp status	Malfunction tell-tale lamp will blink
ERROR CODE Reaction	Battery will not allow charge and discharge
Healing Conditions	Check the cell connections & Rectify Fault

Step 1: Connect Diagnostic tool and note down the ERROR CODE. If ERROR CODE is present, go to STEP 2.

YES	NO
STEP 2	Clear the ERROR CODE and verify

Step 2: Check the cell voltage in UDAAN.

It should not read "NA" and voltage should be >3.2 volts

YES	NO
STEP 3	Charge and check is same persists replace BMS

Step 3: Check the Current while charging from Ammeter on +ve Cable of On Board Charger which is going towards E-Box.

It should be < 40 A.

YES	NO
STEP 4	Check the cell connections & Rectify Fault

Step 4: Follow below step

YES	NO
Clear DTC and Verify if persist Replace BMS	Contact EKL. Replace Battery Pack

Error Code 119: Temperature detection fault

Normal Operations	BMS measures cell temperature
ERROR CODE Detecting Conditions	Hardware fault
Probable cause	1. Check the ambient temp, it should be between 0-25 Deg C 2. Temp sensor is faulty 3. Check the wiring of temp sensor
Lamp status	Malfunction tell-tale lamp will blink
ERROR CODE Reaction	Battery will not allow charge and discharge
Healing Conditions	Check the cell connections & Rectify Fault

Step 1: Connect Diagnostic tool and note down the ERROR CODE. If ERROR CODE is present, go to STEP 2.

YES	NO
STEP 2	Clear the ERROR CODE and verify

Step 2: Check the cell temp in UDAAN.
It should be <50 Deg Celsius

YES	NO
Replace BMS	Cool the temperature of tractor.

Error Code 120: Current detection fault

Normal Operations	BMS will read actual Charge Current.
ERROR CODE Detecting Conditions	If there is difference between Charge current and programming current
Probable cause	1. Current sensor not working 2. Current sensor calibration not okay 3. Charging status from charger coming wrong
Lamp status	Malfunction tell-tale lamp will blink
ERROR CODE Reaction	Battery will not charge
Healing Conditions	Rectify fault

Step 1: Connect Diagnostic tool and note down the ERROR CODE. If ERROR CODE is present, go to step 2

YES	NO
STEP 2	Clear the ERROR CODE

Step 2: Check the Current while charging form Ammeter on +ve Cable of On Board Charger which is going towards E-Box.

It should be < 40 A.

YES	NO
STEP 3	Replace On Board Charger

Step 3: Check the Current while charging form Ammeter on +ve Cable of On Board Charger which is going towards E-Box and check the current in Instrument Cluster.

It should me same.

YES	NO
Clear DTC and Verify if persist Replace BMS	Replace BMS

Error Code 121: Internal total voltage detection fault

Normal Operations	BMS will read actual battery internal voltage.
ERROR CODE Detecting Conditions	Hardware fault or any loose connections of BMS connectors.
Probable cause	<ol style="list-style-type: none"> 1. Cells connections 2. BMS loose connections 3. Loose connection of bus bars
Lamp status	Malfunction tell-tale lamp will blink
ERROR CODE Reaction	Battery will not allow charge and discharge
Healing Conditions	Check BMS connections and rectify the faults

Step 1: Connect Diagnostic tool and note down the ERROR CODE. If ERROR CODE is present

YES	NO
Replace Battery Pack	Clear the ERROR CODE and verify

Error Code 122: External total voltage detection fault

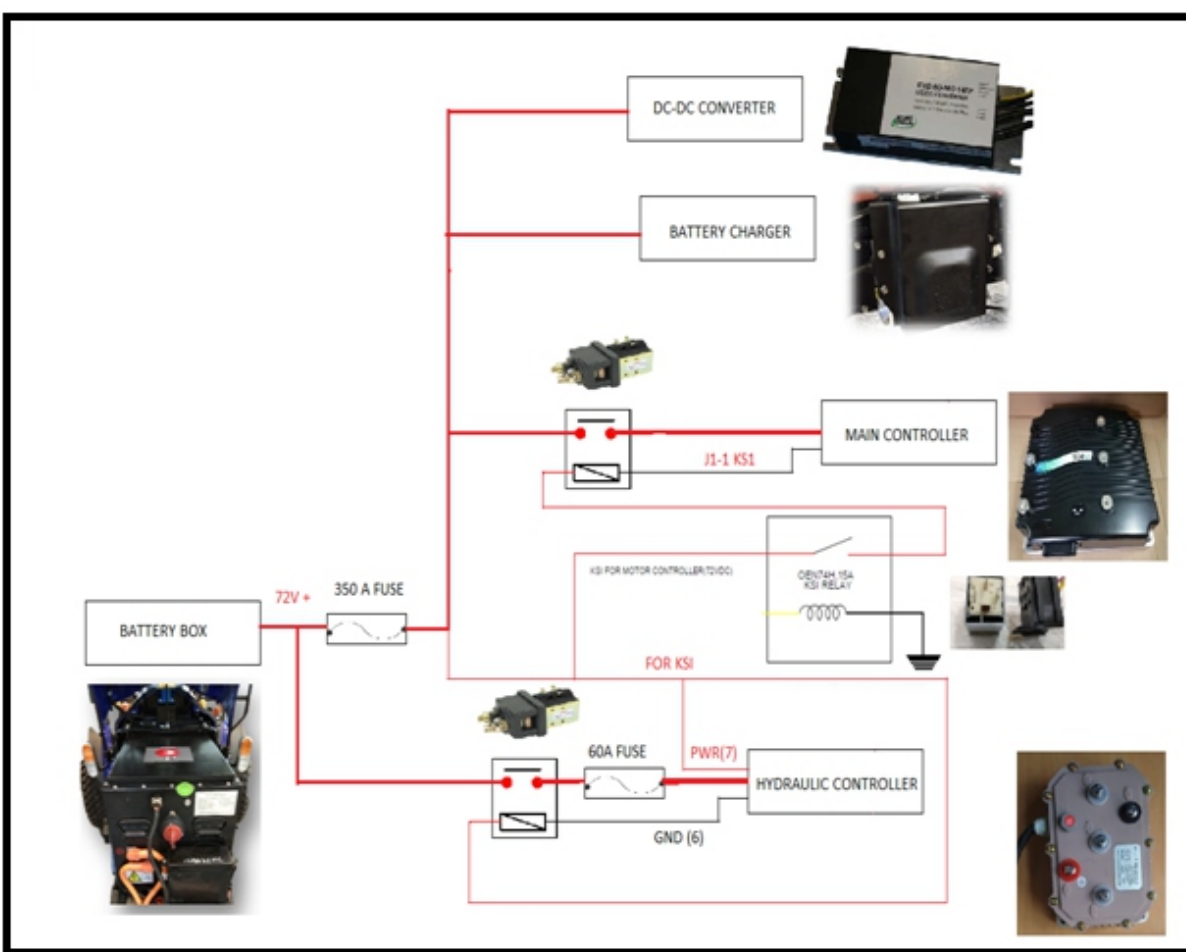
Normal Operations	BMS will read actual battery internal voltage.
ERROR CODE Detecting Conditions	Hardware fault or any loose connections of BMS connectors.
Probable cause	1. Cells connections
	2. BMS loose connections
	3. Battery B+ and B- loose connection
Lamp status	Malfunction tell-tale lamp will blink
ERROR CODE Reaction	Battery will not allow charge and discharge
Healing Conditions	Check BMS connections and rectify the faults

Step 1: Connect Diagnostic tool and note down the ERROR CODE. If ERROR CODE is present.

YES	NO
Replace BMS	Clear the ERROR CODE and verify

Error Code 123: Insulation monitoring fault

Normal Operations	BMS Measure the insulation of the vehicle
ERROR CODE Detecting Conditions	Hardware fault
Probable cause	1.Wiring fault 2. Wear and tear might have occurred
Lamp status	Malfunction tell-tale lamp will blink
ERROR CODE Reaction	Vehicle will not move
Healing Conditions	Rectify Fault



Step 1: Connect Diagnostic tool and note down the ERROR CODE. If ERROR CODE is present.

YES	NO
Check HV Wiring for any damage, crack and rectify the same	Clear the ERROR CODE and verify

Error Code 124: Fast Charger CAN connection fault

Normal Operations	Fast charger connected.
ERROR CODE Detecting Conditions	NO charging of battery with either On board charger(OBC) or Fast charger
Probable cause	1.Input supply to OBC or Fast charger is not present
	2.CAN communication issu
	3. between OBC or Fast charger and battery
Lamp status	Malfunction tell-tale lamp will blink
ERROR CODE Reaction	Battery will not charge.
Healing Conditions	Rectify Fault

Step 1: Connect Diagnostic tool and note down the ERROR CODE. If ERROR CODE is present.

YES	NO
Check charger input supply	Clear the ERROR CODE and verify

Error Code 125: Internal CAN communication fault

Normal Operations	BMS read data through CAN bus
ERROR CODE Detecting Conditions	Hardware fault. No CAN communication and no data display
Probable cause	1.Missing terminating resistor
	2.CAN connection damaged
Lamp status	No data display on cluster
ERROR CODE Reaction	Rectify fault

Step 1: Connect Diagnostic tool and note down the ERROR CODE. If ERROR CODE is present, go to STEP 2.

YES	NO
STEP 2	Clear the ERROR CODE and verify

Step 2: Check the resistance on BMS connector between Pin E and Pin D of battery pack,

It should = 60 ohms.

YES	NO
Replace BMS	Check for wiring and rectify

Error Code 126: Serious insulation fault

Normal Operations	BMS Measure the insulation of the vehicle
ERROR CODE Detecting Conditions	Hardware fault
Probable cause	1. Wiring fault 2. Wear and tear might have occurred
Lamp status	Malfunction tell-tale lamp will blink
ERROR CODE Reaction	Vehicle will not move
Healing Conditions	Rectify Fault


Step 1: Connect Diagnostic tool and note down the ERROR CODE. If ERROR CODE is present.

YES	NO
Check CAN connections	Clear the ERROR CODE and verify

Error Code 127: Slight insulation fault

Normal Operations	BMS Measure the insulation of the vehicle
ERROR CODE Detecting Conditions	Hardware fault
Probable cause	1.Wiring fault 2. Wear and tear might have occurred
Lamp status	Malfunction tell-tale lamp will blink
ERROR CODE Reaction	Vehicle will not move
Healing Conditions	Rectify Fault

Connector View

BMS CONNECTOR		RT061412SNHEC03	12 PINS	To connect with Main Battery BMS connector
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Step 1: Connect Diagnostic tool and note down the ERROR CODE. If ERROR CODE is present.

YES	NO
Check HV Wiring for any damage, crack and rectify the same	Clear the ERROR CODE and verify

Error Code 140: System fault level

Normal Operations	Battery normal working
ERROR CODE Detecting Conditions	System level fault
Probable cause	1. BMS hardware fault 2. BMS software fault 3. Relay (main) not working 4. Battery fuse blowdown
Lamp status	Malfunction tell-tale lamp will blink
ERROR CODE Reaction	Vehicle will not move
Healing Conditions	Rectify Fault

Step 1: Connect Diagnostic tool and note down the ERROR CODE. If ERROR CODE is present, go to STEP 2.

YES	NO
STEP 2	Clear the ERROR CODE and verify

Step 2: Check the MSD Switch on Battery pack in ON?

YES	NO
STEP 3	Switch ON the MSD

Step 3: Check for 12 volts between following pin of BMS Connector (i.e., Located on Battery Pack).

- 1.Pin A and Pin B
- 2.Pin C and Pin B

YES	NO
Replace BMS	Check for the wiring and rectify

Error Code 142: BMS fault need maintenance.

Normal Operations	Battery normal working
ERROR CODE Detecting	System level fault
Conditions Probable cause	1. BMS hardware fault 2. BMS software fault 3. Relay (main) not working
	4. Battery fuse blowdown
Lamp status	Malfunction tell-tale lamp will blink
ERROR CODE Reaction	Vehicle will not move

Step 1: Connect Diagnostic tool and note down the ERROR CODE. If ERROR CODE is present, go to STEP 2.

YES	NO
STEP 2	Clear the ERROR CODE and verify

Step 2: Check the MSD Switch on Battery pack in ON?

YES	NO
STEP 3	Switch ON the MSD

Step 3: Check for 12 volts between following pin of BMS Connector (i.e., Located on Battery Pack).

- 1.Pin A and Pin B
- 2.Pin C and Pin B

YES	NO
Replace BMS	Check for the wiring and rectify

Error Code 143: Battery fault need maintenance.

Normal Operations	Battery normal working
ERROR CODE Detecting	System level fault
Conditions	
Probable cause	1. BMS hardware fault 2. BMS software fault 3. Relay (main) not working
	4. Battery fuse blowdown
Lamp status	Malfunction tell-tale lamp will blink
ERROR CODE Reaction	Vehicle will not move

Step 1: Connect Diagnostic tool and note down the ERROR CODE. If ERROR CODE is present, go to STEP 2.

YES	NO
STEP 2	Clear the ERROR CODE and verify

Step 2: Check the MSD Switch on Battery pack in ON?

YES	NO
STEP 3	Switch ON the MSD

Step 3: Check for 12 volts between following pin of BMS Connector (i.e., Located on Battery Pack).

- 1.Pin A and Pin B
- 2.Pin C and Pin B

YES	NO
Replace BMS	Check for the wiring and rectify

Error Code 144: Battery system fault needs maintenance.

Normal Operations	Battery normal working
ERROR CODE Detecting Conditions	System level fault
Probable cause	1. BMS hardware fault 2. BMS software fault 3. Relay (main) not working 4. Battery fuse blowdown
Lamp status	Malfunction tell-tale lamp will blink
ERROR CODE Reaction	Vehicle will not move
Healing Conditions	Rectify Fault

Step 1: Connect Diagnostic tool and note down the ERROR CODE. If ERROR CODE is present, go to STEP 2.

YES	NO
STEP 2	Clear the ERROR CODE and verify

Step 2: Check the MSD Switch on Battery pack in ON?

YES	NO
STEP 3	Switch ON the MSD

Step 3: Check for 12 volts between following pin of BMS Connector (i.e., Located on Battery Pack).

- 1.Pin A and Pin B
- 2.Pin C and Pin B

YES	NO
Replace BMS	Check for the wiring and rectify

Error Code 145: The battery needs to maintenance (full charging and full discharging)

Normal Operations	Battery normal working
ERROR CODE Detecting Conditions	System level fault
Probable cause	1. BMS hardware fault 2. BMS software fault 3. Relay (main) not working 4. Battery fuse blowdown
Lamp status	Malfunction tell-tale lamp will blink
ERROR CODE Reaction	Vehicle will not move
Healing Conditions	Rectify Fault

Step 1: Connect Diagnostic tool and note down the ERROR CODE. If ERROR CODE is present, go to STEP 2.

YES	NO
STEP 2	Clear the ERROR CODE and verify

Step 2: Check the MSD Switch on Battery pack in ON?

YES	NO
STEP 3	Switch ON the MSD

Step 3: Check for 12 volts between following pin of BMS Connector (i.e., Located on Battery Pack).

- 1.Pin A and Pin B
- 2.Pin C and Pin B

YES	NO
Replace BMS	Check for the wiring and rectify

Error Code 146: Maintenance mode status

Normal Operations	Battery normal working
ERROR CODE Detecting	System level fault
Conditions Probable cause	1. BMS hardware fault 2. BMS software fault 3. Relay (main) not working
	4. Battery fuse blowdown
Lamp status	Malfunction tell-tale lamp will blink
ERROR CODE Reaction	Vehicle will not move

Step 1: Connect Diagnostic tool and note down the ERROR CODE. If ERROR CODE is present, go to STEP 2.

YES	NO
STEP 2	Clear the ERROR CODE and verify

Step 2: Check the MSD Switch on Battery pack in ON?

YES	NO
STEP 3	Switch ON the MSD

Step 3: Check for 12 volts between following pin of BMS Connector (i.e., Located on Battery Pack).

- 1.Pin A and Pin B
- 2.Pin C and Pin B

YES	NO
Replace BMS	Check for the wiring and rectify

MOTOR

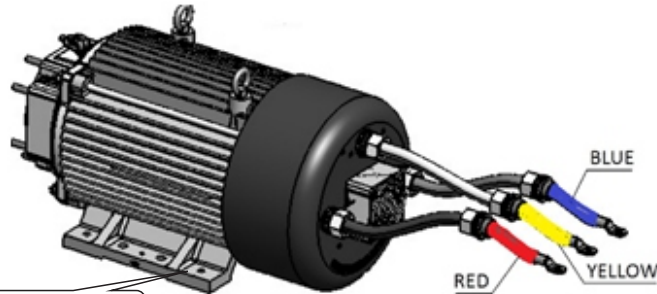
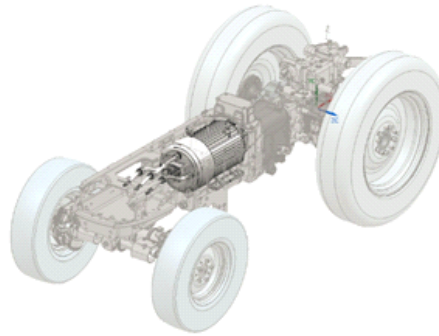
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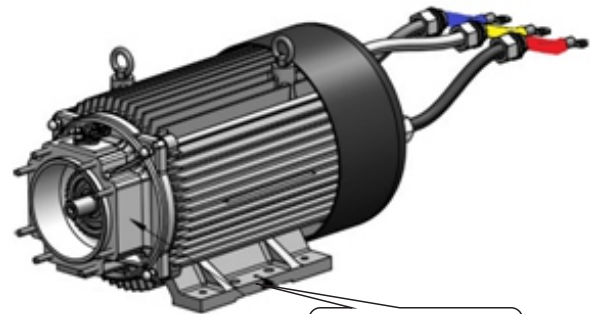
3. MOTOR ASSEMBLY POWER TRANSMISSION 15KW)

3.1 Model – FT25G (Mechanical Transmission)

Motor	
Type	ThreePhaseACinductionMotor
PowerRating	15KW
Max.Torque	90NM
Max RPM	2800
ControllerType	SpeedOrTorqueMode (200A)



Drive Side



Non-Drive

- Rotation of motor viewing from drive end counter-clockwise.
- From Non drive side 3 main cable having colors coding Blue, Yellow and red which connect to E-Box.
- From Non drive side one more cable connector which related to cooling fan, following are the details of colour coding and connections.
- On non-drive side there is a motor cooling fan which is used for to cool the motor it works on 12 V circuit.

3.2 MAIN MOTOR RECEIVING AND STORING

a) UNPACKING AND INSPECTION

A Packing case which shows external signs of damage should be opened in presence of an insurance Surveyor. Similarly, if damage to the contents is observed in opening the case, the matter should be reported immediately to the insurance Surveyor and the goods unpacked in his presence. Every machine should be inspected to see that all parts are intact. While reporting the damages or missing to the carriers or to us, always quote motor Name plate details including its machine number.

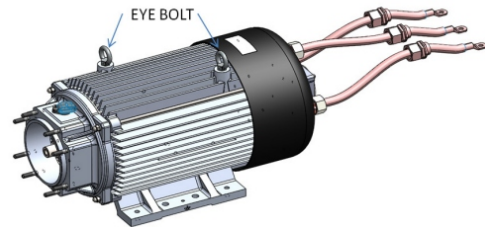
b) STORAGE

Prior to installation the machine should be stored in a clean, dry place. The machined parts have a protective coat anti-rust preventive which should not be taken off during normal storage period in case of long storage, periodic examination should be carried out and fresh preservative applied if removed. During the storage period (and during installation as well as their working life) machine should be protected from moisture, acid, alkali, oil, gas, dust, dirt and other injurious substances, except of course, in the case of a machine specially designed to withstand such conditions.

Special precaution should be taken when a machine is idle for considerable period to avoid corrosion of the bearings and loss of grease; it is advisable to rotate the shaft periodically as the grease tends to settle at the bottom of the housings.

c) HANDLING

Always use lifting hook to lift motor except, as eye bolt provided over Body Do not roll or drag the motor on floor. Do not keep motor in vertical position with external cover as base Avoid jerks and jolts to motors to increase life of the bearings.



3.3 MAIN MOTOR COMMISSIONING

a) Pre-commissioning checks

Before putting the motor into service, measure the insulation resistance between the motor windings and its frame with a megger, and if it is below one mega ohms, pre heat the stator windings to improve IR value.

b) Drying out

All motors should be dried out before the full voltage is applied to terminals, if the insulation resistance is below one mega ohm when the machine is cold.

A convenient method of doing this is to block the motor so that it cannot rotate and apply a very low voltage of about 10 percent of the normal to the stator terminals.

The motor can be placed in an oven, if available, but the temperature shall not be allowed to exceed 600 C. Alternatively, hot air may be blown into the motor but the air should be clean and dry and at a temperature of not more than 90°C, if no other means are available, coke braziers or electric radiators may be placed round the machine. Carbon filament lamps placed inside the machine can be employed quite satisfactorily, but care shall be taken that the hot bulb is not in contact with windings. If it is not possible to reach sufficient high temperature the ventilation may be reduced by covering the stator with a tarpaulin.

Whichever of the above methods of drying out is adopted the heating shall be continuous and shall be carefully watched to ensure that it does not attain a temperature sufficiently high to damage the insulation. The maximum safe temperature of the windings measured by the thermometer is 90°C. At the same time the temperature should not be allowed to fall too low as otherwise re-absorption of moisture would take place.

The insulation resistance will be found to drop considerably as the motor warms up, will reach the minimum and then remain constant for sometime depending upon the dampness of the machine and as the drying proceeds the insulation resistance will gradually rise. The drying out shall be continued as long as the insulation resistance rises. Or until a sufficiently high value has been reached which should not be less than 1 mega ohm by 500 volts megger.

During the drying out period, reading of temperature and insulation resistance shall be taken at least an hour in order to see how the drying out is progressing. The temperature of the motor shall be kept as constant as possible. Otherwise, the insulation resistance readings may be misleading.

After drying out, air drying varnish should be applied by brush on the winding surfaces only and this should be applied when winding is in hot condition to prevent absorption of moisture. The length of drying time depends on the amount of dampness but in any case it should be at least six hours.

(Please note while doing above procedure Sensor assembly to be removed out)

c) Installation

Electric machines and apparatus should always be installed where they can obtain adequate ventilation and clean dry air. They should be accessible for full inspection and repair. If the air contains dust moisture or corrosive gases the equipment should be appropriately protected or else supplied with pure air through special pipes or ducting.

The machines should be erected on solid and vibration free foundation and should preferably be anchored by means of foundation studs. The machine should always be carefully aligned, this being of special importance when it is coupling.

d) Fitting of pulleys or couplings

Clean both shafts extension and coupling bore smear lightly with oil.

Anti-rust preservative applied on the machined parts, wherever necessary can be easily taken off with white spirit, petrol (gasoline) or kerosene (paraffin). Clean spline area over shaft on both side & insert coupler for fitting properly.

e) Terminal markings

50Sq mm Cables are marked with RED , Yellow & BLUE with Lug hole size suitable to M8

f) Starting method

The motor is suitable for VFD starting. The required speed - torque requirements can be achieved through MCU. Note: MCU is not in KEC scope of supply. The motor body should be effectively earthed using the earthing provision on the motor body.

3.4 MAINTENANCE

a) Cleanliness

Both exterior and interior of every machine should be kept free from dust, oil and moisture. Dust can have a harmful effect if it is allowed to settle on the windings, to enter the bearings, or to collect in the ventilating passages.

b) Bearing replacement

Before replacing the bearings it is recommended to heat the new bearing in induction heater of SKF make upto temp of 110 °C, When bearings are removed from motors or uncovered due to partial dismantling, wrap them in a clean paper immediately to keep them free from dirt.

c) Overheating of Motor

Overheating of motors may result from overloading of motors, too low or too high supply voltages, frequency fluctuation, dirt or foreign material in the air-gap between the stator and rotor. Overloading is the result of making a motor carry too great a mechanical load. It may also be due to wrong application or excessive friction within the motor itself.

In investigating cases of suspected overheating, the actual temperature of the part in question should be taken with a thermometer held against the part with a small pad of felt or cotton wool. The ambient temperature should be deducted from the measured temperature and the result compared with the permissible temperature rise for that part of the machine.

d) Precautions

Follow regular inspection schedule with regard to insulation level, Performance etc.

Keep the motor clean and cool.

Clean and varnish "dirty and oily" windings periodically.

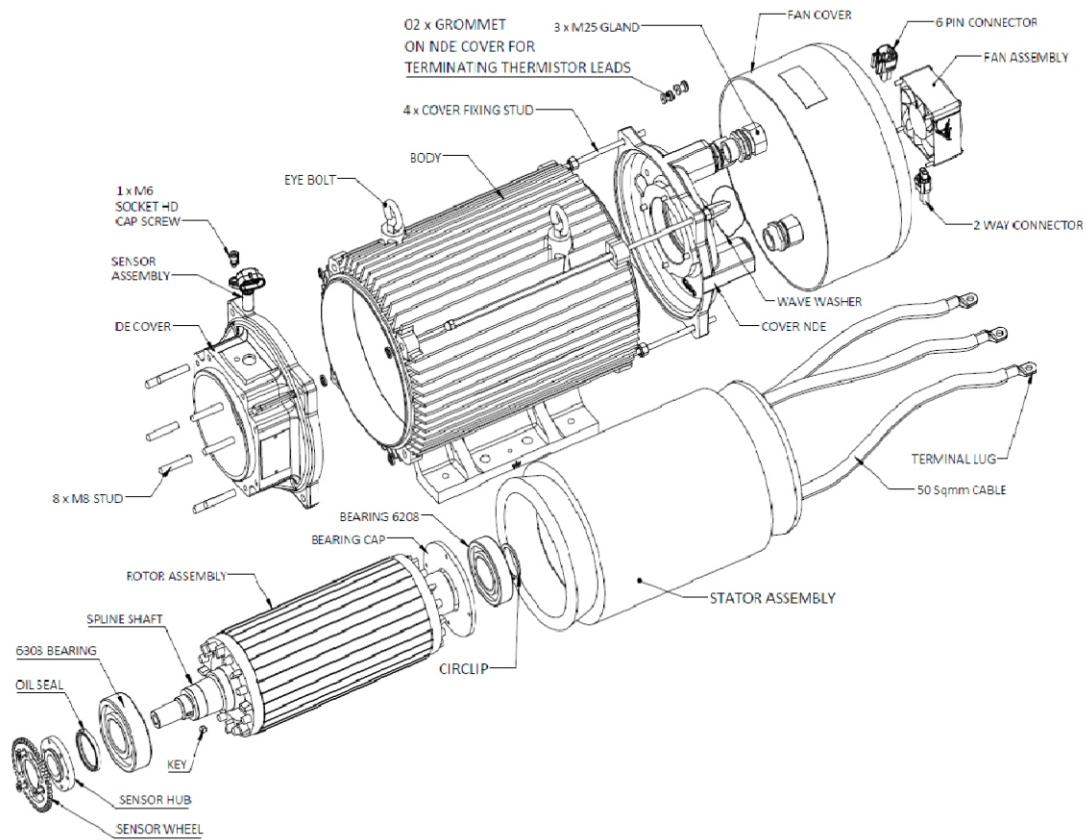
3.5 SERVICE AFTER SALES**a) Faults**

It should always be remembered that many apparent faults in the motor are not attributable to the motor itself but to external conditions to which it is subjected or to other equipment to which it is connected. It is essential that these conditions are corrected before the investigation made on the motor can give conclusive results.

b) Repairs

In the event of a breakdown, before calling the service engineer, please check the following: -
See that there are no breaks in the cables or wires and all terminals are clean and tight. -Make sure that the rated supply voltage is reaching the motor terminals. -Make sure that motor is not over loaded. Try to start the motor uncoupled from the load. When the equipment is being sent for repair of other purposes, it is advisable to communicate in advance, giving reference of the motor name- plate details including machine number. Service engineers are available at all important places to assist our customers, in case of any trouble. For any clarification, information or assistance please contact our Branch Office nearest to you before referring directly to us.

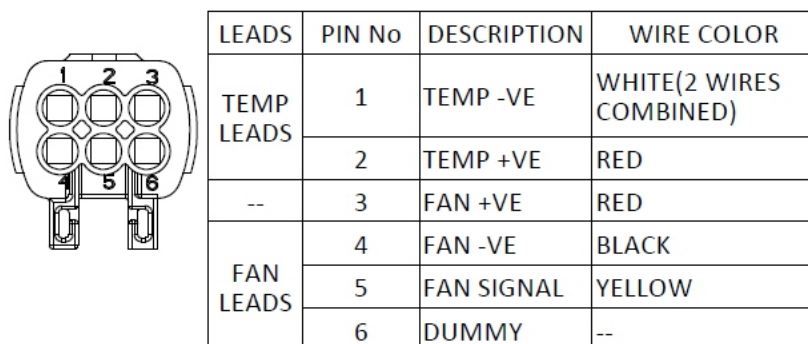
c) Spare Parts; When a spare part is ordered, a full description of the part should be given



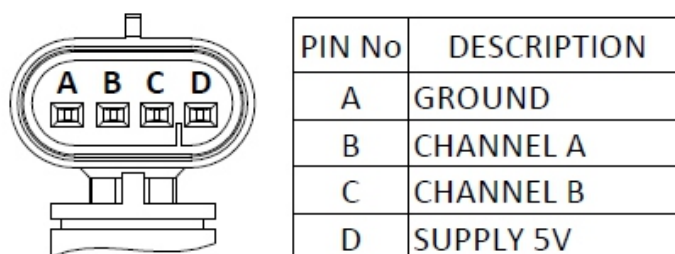
3.6 Main motor connector & cable details

Fig : 02 CONNECTOR CABLE DETAILS (VIEW FROM WIRE ENTRY SIDE)

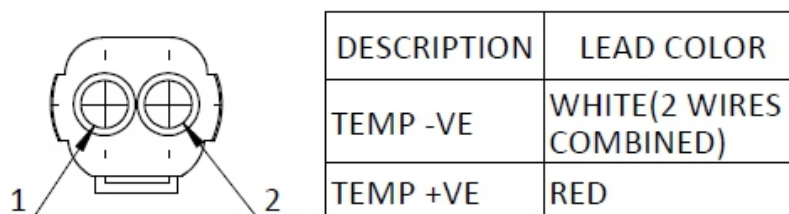
To Run the fan 12VDC supply is required



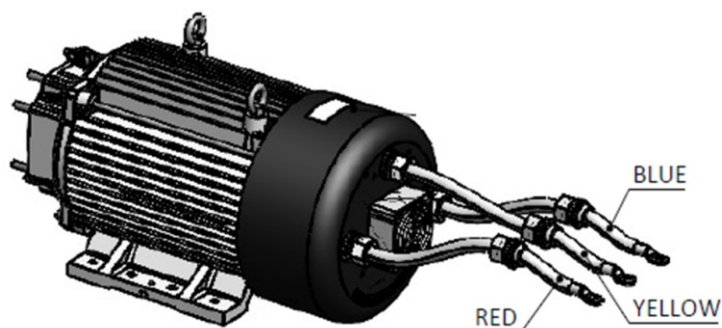
a) Fig : 03 SENSOR ASSEMBLY CONNECTOR DETAILS



b) Fig : 04 : 2 WAY CONNECTOR FOR ADDITIONAL THERMISTOR (T2)

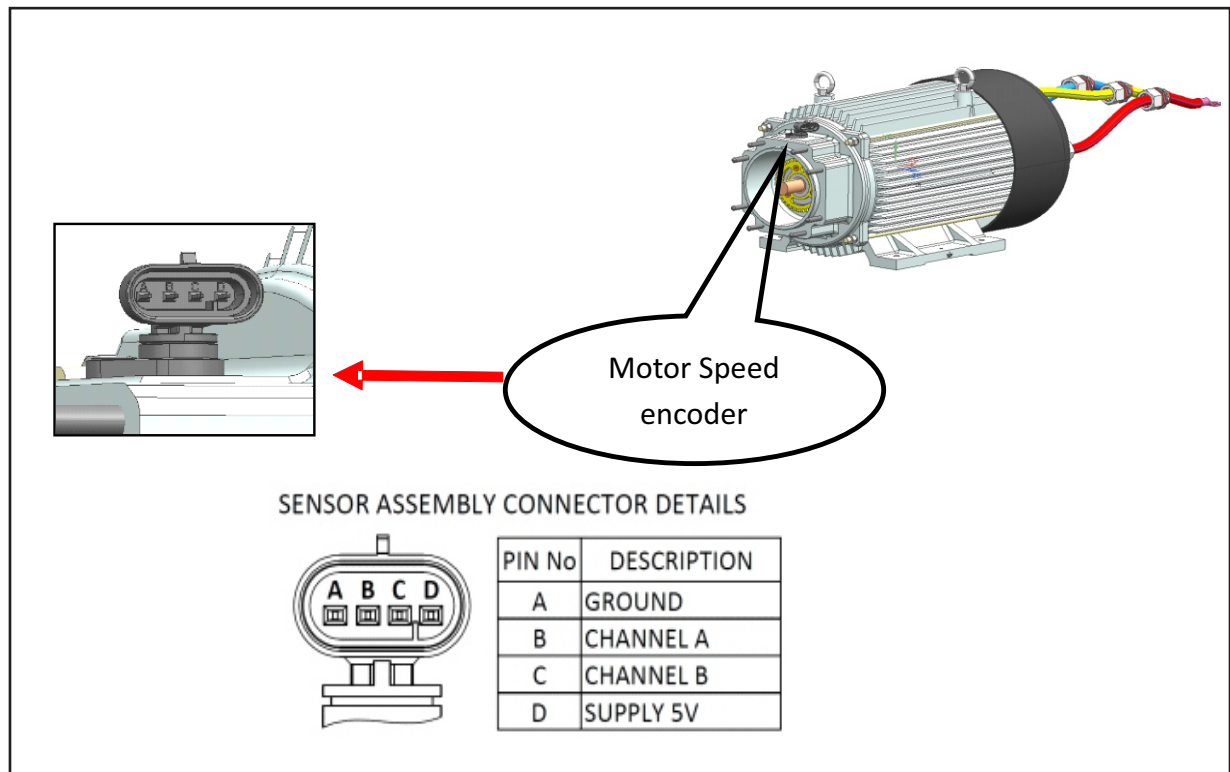


**c) Fig : 05 FROM NON DRIVE SIDE CABLE TERMINATION DETAILS
ROTATION OF MOTOR VIEWING FROM DRIVE END ANTI CLOCKWISE**



d) Sensor assembly connector details.

From Drive Side At The Top, Encoder Is Fixed Which Measures Motor Rpm.



3.7 Fault finding chart

SI No (1)	Trouble (2)	Cause (3)	Remedy (4)	SI No (1)	Trouble (2)	Cause (3)	Remedy (4)
1.	Hot bearing General	Bent or sprung shaft Excessive belt pull Pulley too far away Pulley diameter too small. Misalignment	Straighten or replaces shaft. Decrease belt tension Move pulley closer to bearing Use larger pulley. Correct realignment of drive. Maintain by proper quantity of grease in bearing	3.	Oil leakage from overflow plugs	Stream of overflow PLUG no Light Cracked or broken overflow plug. Plug cover not tight.	Remove & re-cement threads. Replace and tighten. Replace the plug Requires cork gasket or if screw type, may be tightened Dismantle entire motor and clean all windings and parts Clean motor will run 10°C to 30°C cooler.
2.	Hot bearing ball or roller	Insufficient grease Deterioration of grease of lubricant contaminated Excess lubricant Heat from hot motor Or external source. Overloaded bearing. Broken ball rough races.	Remove old grease, wash bearings thoroughly in kerosene and replace with new grease Protect bearing by reducing Motor temp. Check alignment , side thrust & end thrust. Replace bearing first clean housing thoroughly	4.	Motor dirty.	Ventilation blocked end windings filled. with fine dust or lint. Dust may be cement. sawdust, rock-dust. grain dust and the like. rotor winding clogged Bearing and brackets coated inside Subject to dripping	Clean and grid sliprings clean and treat windings with good insulating varnish Dust ads wash cleaning solvent. Wipe motor and dry by circulating heated air through motor install drip or canopy Type covers over motor for protection.
				5.	Motor wet.	Drenched condition	Motor should be covered to retain heat and the rotor position shifted frequently

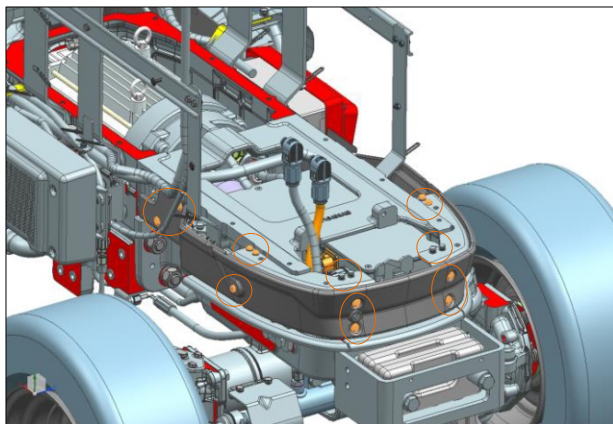
(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
6.	Motor stalls	Submerged in flood waters. Wrong application. Overloaded motor. Low motor voltage. Open circuit. Incorrect control Resistance of wound rotor Mechanical locking in bearing at air gap. No supply voltage one Phase open voltage is too low.	Dismantle and clean parts bake windings at 90° C for 24 hours or until resistance to ground sufficient Change type or size . Consult manufactures Reduce load See that nameplate voltage is maintained. Fuses blown, check Overload relay stator and push out. Check, control sequence. Repair open circuit		Motor takes too long to accelerate	Starting torque of load too high Rotor defective. Poor stator coil connection.	If of squirrel cage & with autotransformer starting Change to higher tap of slipping type : lower (ie starting resistance) Look for broken rings
7.	Motor connected but does not start	Motor may be overloaded control gear defective	Dismantle and repair. Clean air gap choked. Check voltage on each phase Reduce load or try to start uncoupled from load examine each step of the Control gear for bad contact or open circuit. Make sure that brushes are making good contact with the rings.	8.	Motor runs and then dies down. (See also SL.NO.7)	Mechanical locking in bearing or at air gap power failure. Overload Not applied properly Voltage too low at motor terminals Because of line drop if wound rotor, improper control Operation of secondary resistance	Remove end shields, check end connections Dismantle and repair, Clean air gap if choked. Check for loose connections to line to fuses and to Control Examine overload trips see that they are set correctly to approx. 150% full load current. See that the dashpots are filled with correct quantity and grade of oil. Consult suppliers for proper type Use higher voltage on transformer terminals or Reduce load. Correct secondary control
				9.	Motor does not come up to speed.		

(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
10.	Motor takes too long to accelerate	Starting load too high. Broken rotor bars. Open primary circuit excess loading	Check the load the motor is supposed to carry at start Check that all brushes are riding on rings Check secondary connection. Leave no leads poorly connected.	12.	Motor overheats while running underload	Check for overload. Wrong blowers or air-shields may be clogged with dirt and prevent proper Ventilation of motor. Motor may have one phase open Grounded coil. Unbalanced terminal voltage.	Reduce load. Good Ventilation is manifest when a continuous stream of air leaves the motor. If not check with manufacturer. Check to make sure that all leads are well connected Locate and repair Check for faulty leads Connections and transformers Repair and then check watt-meter reading.
11.	Wrong rotation	Poor circuit. Defective squirrel Cage motor. Applied voltage too low Wrong sequence of phases.	Look for cracks near the rings. A new rotor may be required as repairs are usually temporary. Locate fault & rectify. Reduce load. If motor is driving a heavy load or is starting up a long ling of shafting start more slowly allowing amply time for acceleration till over comes the difficulty. Check for high resistance Replace with new rotor. Get power company to increase voltage tap Reverse connections at motor or at switchboard.	13.	Motor vibrates after connection have been made	Shorted stator coil Faulty connection high voltage. I low voltage Rotor rubs stator bore	Rectify connection check terminals or motor with voltmeter. If not poor machining replace worn bearing Realign strengthen base Balance coupling Rebalance driven equipment Replace bearing Line up properly rebalance rotor.

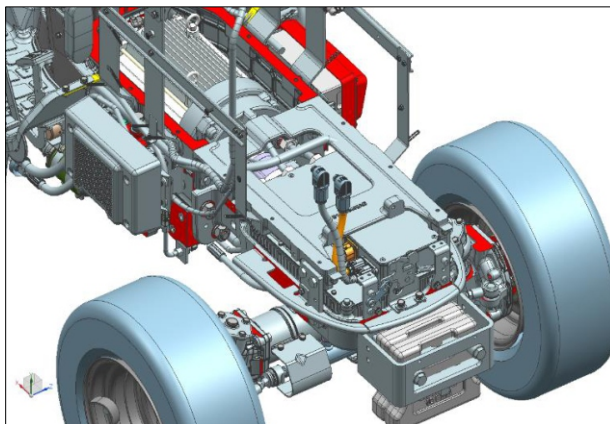
(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
14.	Motor vibrates after connections have been made,(contd) Unbalanced line current on polyphase motors during normal operation.	Wound rotor coils Replaced Poly phase motor running on single phase. Excessive end play. Unequal terminal volts. Single phase operation Poor rotor contacts in control wound rotor Resistance. Bushes not in proper position in wound rotor	Rebalance rotor Check for open circuit Adjust Bearing or add washer. Check leads and connections. Check for contacts Check control devices See that brushes are properly seated and shunts in good condition. Remove interference Clean fan Tighten holding bolts. Check and correct bracket fits bearing. Correct or renew. Rebalance.	17.	Motor sparking at sliprings	Motor may be Overload Brushes may not be of correct quality and may be sticking in the holders. Brush pressure may be too light or too much. Sliprings may be rough dairy & oily sliprings may be Ridged or out of trueness.	Reduce the load Use brushes of the grade recommended Adjust the brush pressure correctly Clean the sliprings & maintain them smooth glossy & free oil & dirt. Turn& grind the sliprings in a lathe to a smooth finish
15.	Scraping noise.	Fan rubbing air shield. Fan striking insulation		<p>Note : Certain amount of magnetic noise is inherent in some low speed designs and should not cause alarm.</p> <p>AS AND WHEN MOTOR COPMPLANTS ARE REFERRED TO WORKS, COMPLETE NAMEPLATE DETAILS OF MOTOR INCLUDING MACHINE NUMBER SHOULD BE FURNISHED ALONG WITH OTHER INFORMATION</p>			
16.	Magnetic noise.	Loose on bedplate. Air gap not uniform. Loose bearing Rotor unbalance.					

3.8 Motor replacement Procedure

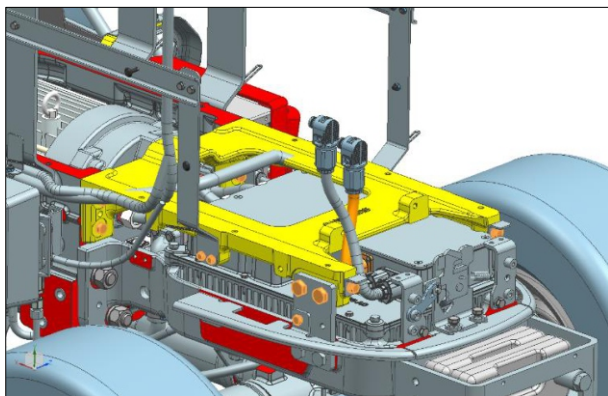
Step 1- For Motor replacement, first follow the steps for Battery removing procedure (1.2)



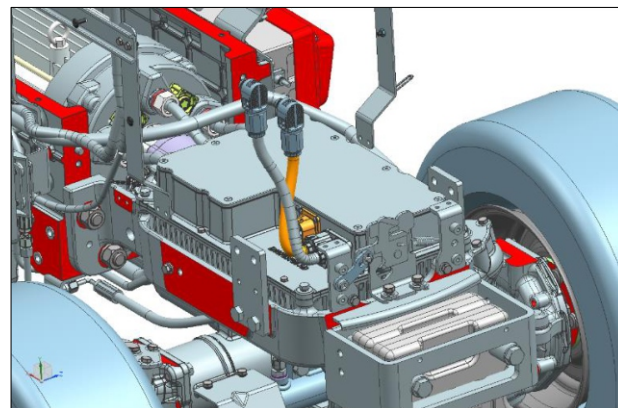
Step 2- Dismantle bolts holding front Axle support cover.



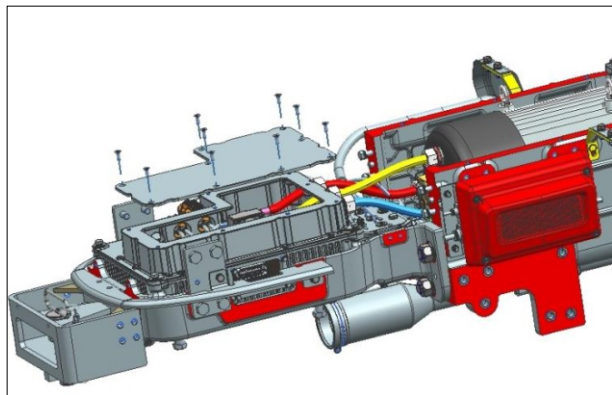
Step 3 - Dismantle front Axle support cover.



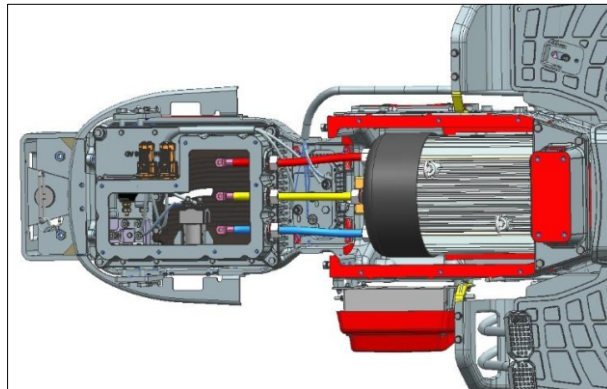
Step 4 - Dismantle bolts holding Frame battery box support & Latch Assembly Hood front



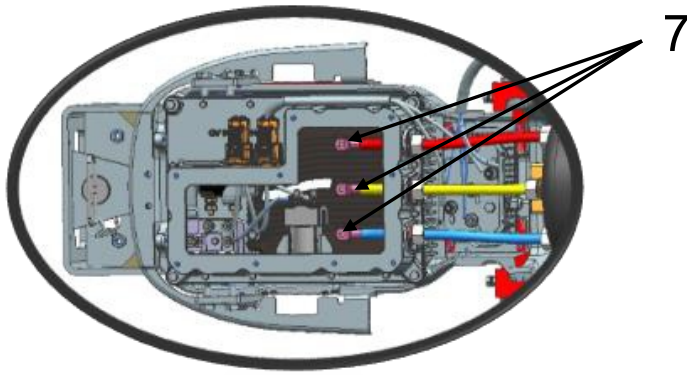
Step 5 - Dismantle Frame battery box support & Latch Assembly Hood front.



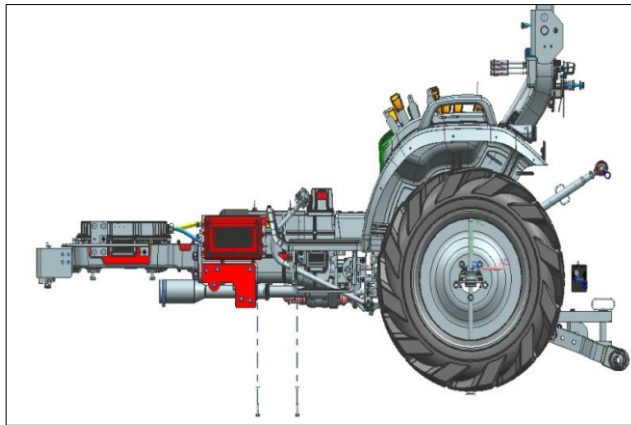
Step 5 - Dismantle bolts E-Box top plate



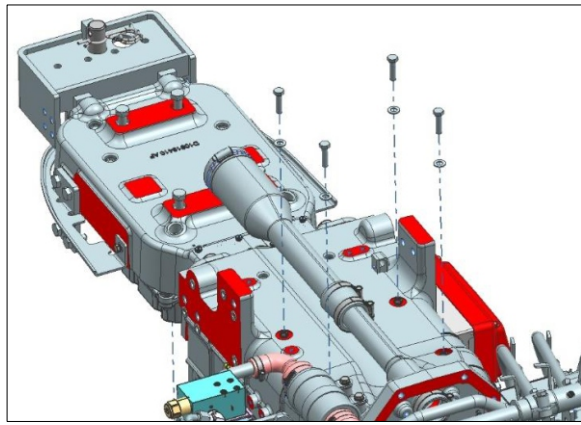
Step 6 - Dismantle E-Box top plate.



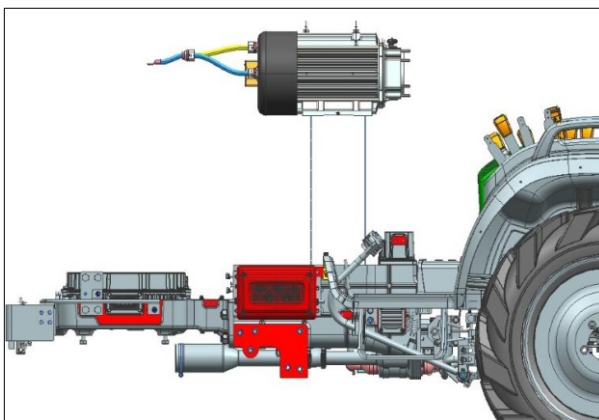
Step 7- Dismantle bolts on Electronic Controller connected to Motor Assembly.



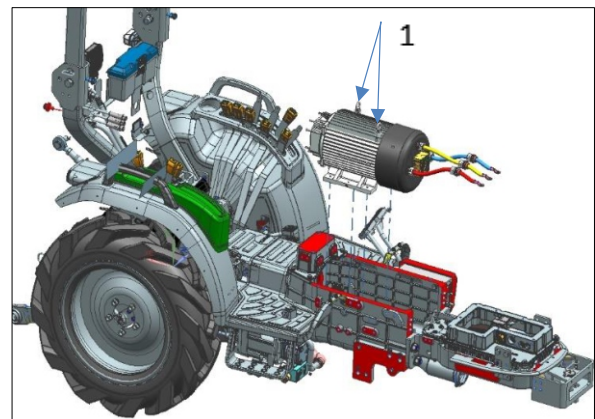
Step 8 - Dismantle bolts from Housing Motor Mounting



Under body view of motor bolt location



Step 9 – Lift the Electric Motor by towing and



1. Hooks on motor used for towing

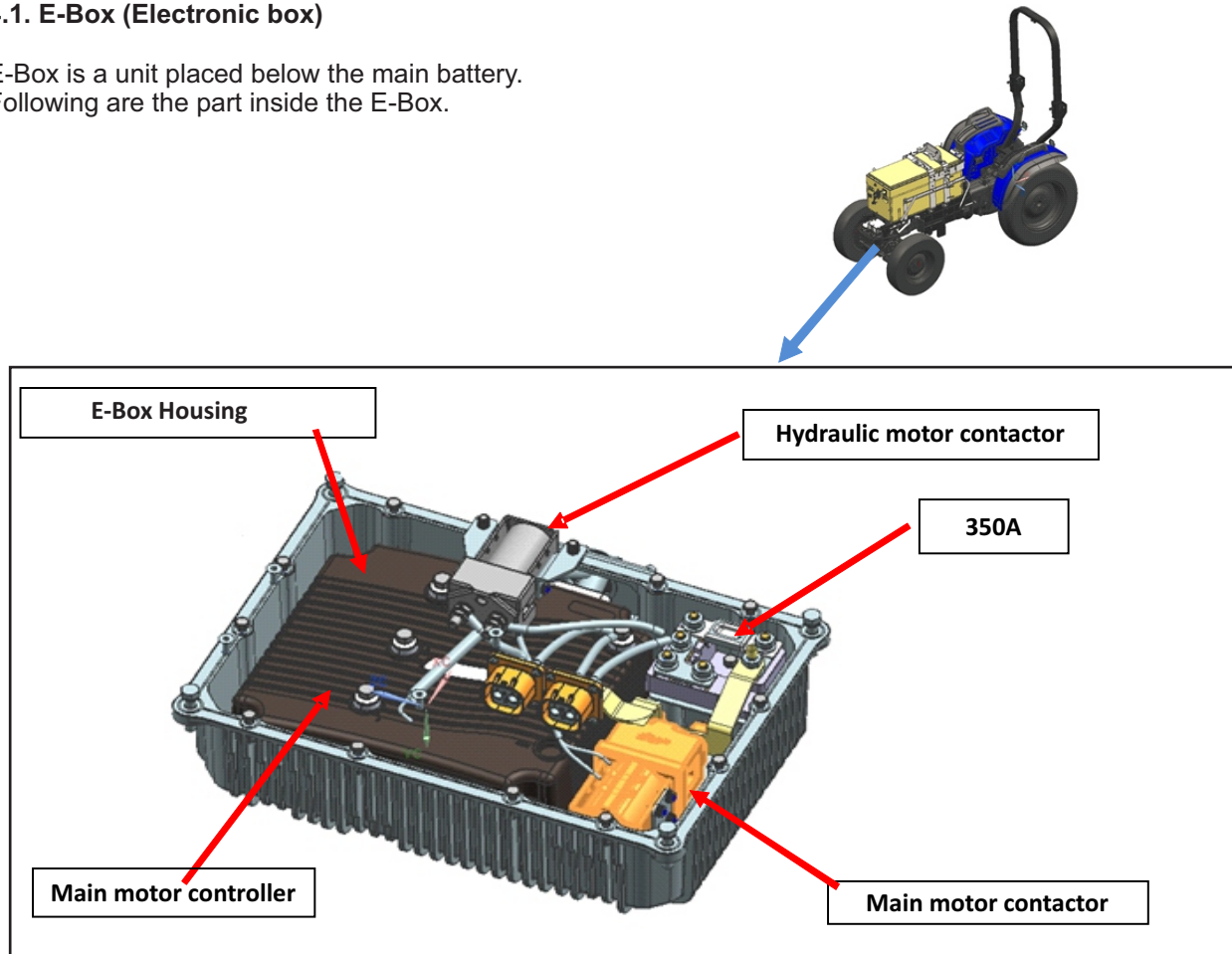
E-BOX

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4.1. E-Box (Electronic box)

E-Box is a unit placed below the main battery.
Following are the part inside the E-Box.



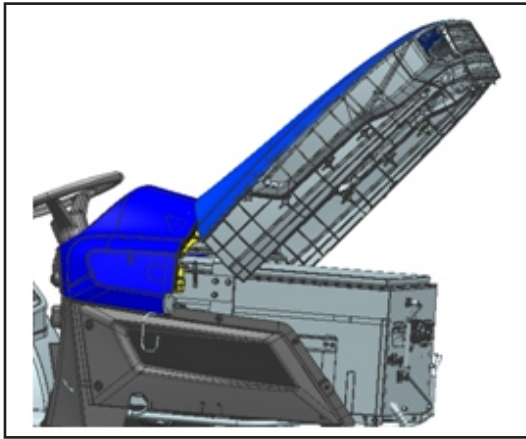
4.2. REWORK PROCEDURE

To avoid personal injury or death:

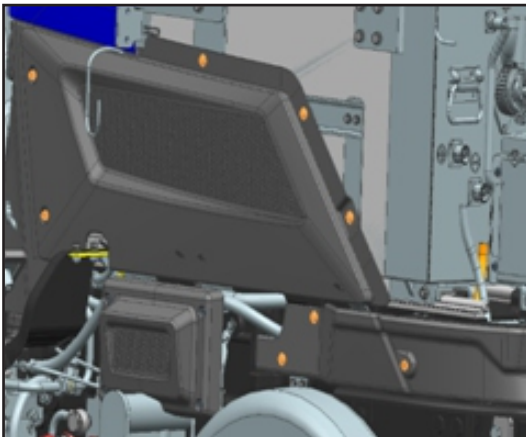
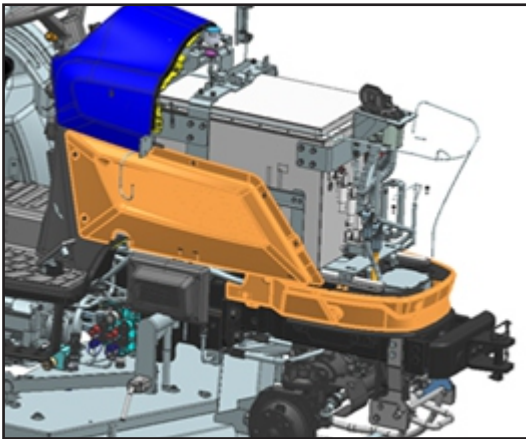
- Check the battery condition and recharge it if required.
- Park the machine on a firm and level ground and set the parking brake.
- Lower the implements to the ground.
- Set all controls in their neutral positions.
- Release all residual pressure of the hydraulic system.
- Stop the Tractor. Remove the key from the ignition.
- The hydraulic components can be hot.
Wait until all the components are cooled down sufficiently to avoid burns.
- Clean the work area and the machine.
- Hang a "DO NOT OPERATE" tag on the operator station.
- Put on working clothes and personal protective equipment.
- Read all instructions in this bulletin and safety labels on your machine.
- Follow the local safety regulations and laws in your country.
- If you are working with other people, make sure that your signals and communications are fully understandable for additional safety.
- Choke the front and back wheels.

4.2.1 Removal of E-BOX from tractor: -

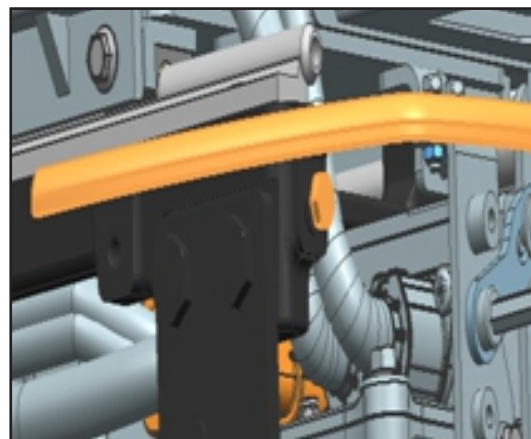
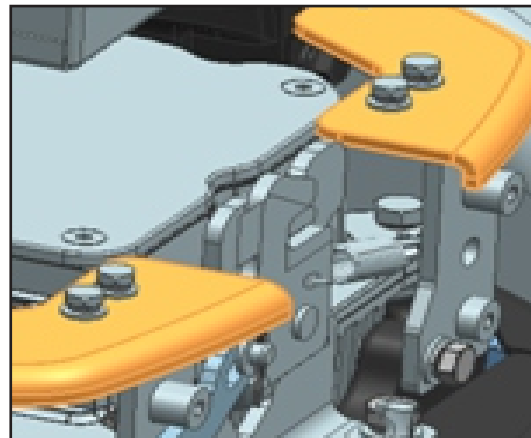
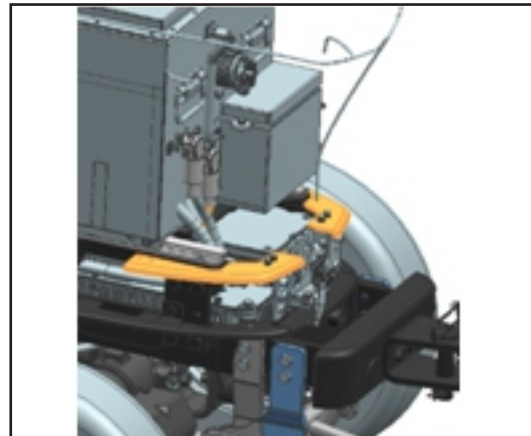
STEP 1: Open the hood



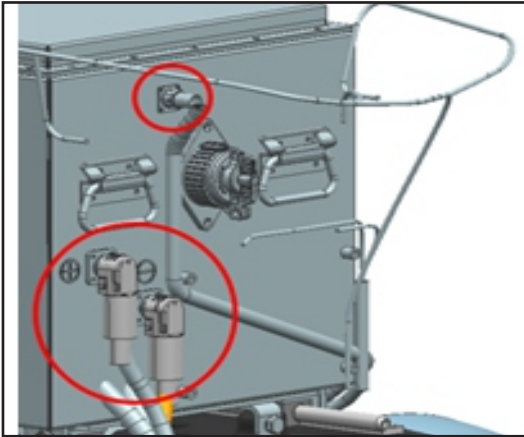
STEP 2: Remove the battery side cover and front axle cover



STEP 3. Remove the baffle plates & Hood latch



STEP 4 : Disconnect the main Battery and Aux Battery connection



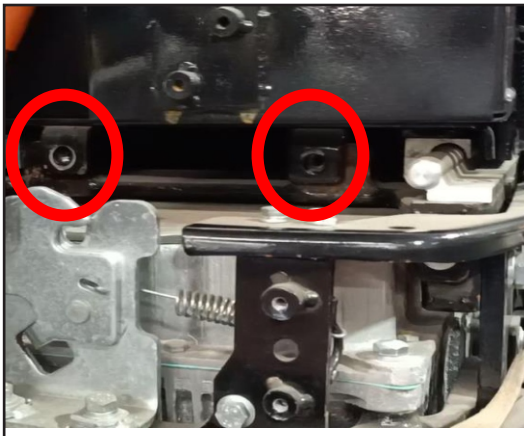
STEP 6: Slide the battery till front plate comes out from guide rail and then remove



STEP 7 : Remove the other 6 bolts (3 bolts on each side) of Plate Assembly



STEP 5: Remove two bolts of front plate battery box mounting



STEP 8 : Remove the 4 bolts (2 on each side) of frame



STEP 9 :Remove the 4 bolts (2 on each side) of Support Front Axl



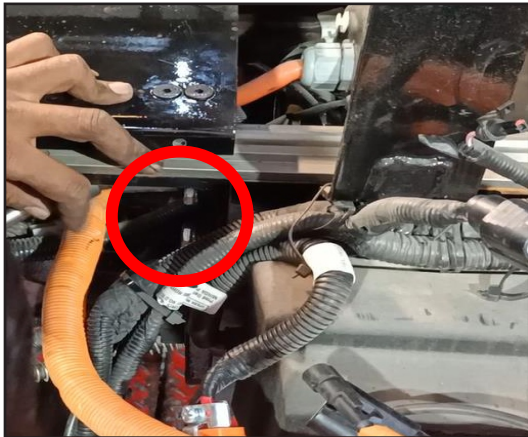
STEP 10 : Remove the Onboard charge & DC-DC Converter connector



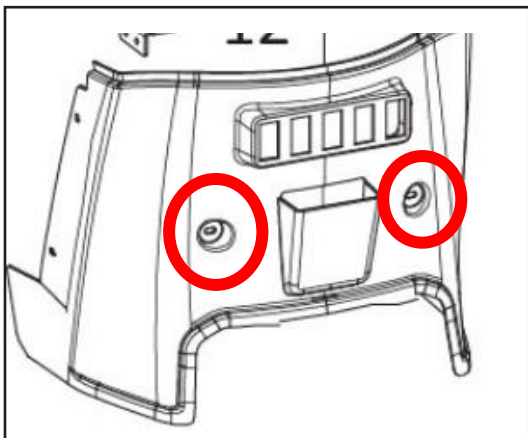
STEP 11 : Remove the Guide Rail after removing its bolt



**STEP 12 : Remove the E-box Connector of
Charger and Hydraulic Controller**



**STEP 13 : Remove the Cover dashboard lower
after removing its 2 hardware and electrical
connection of switch.**



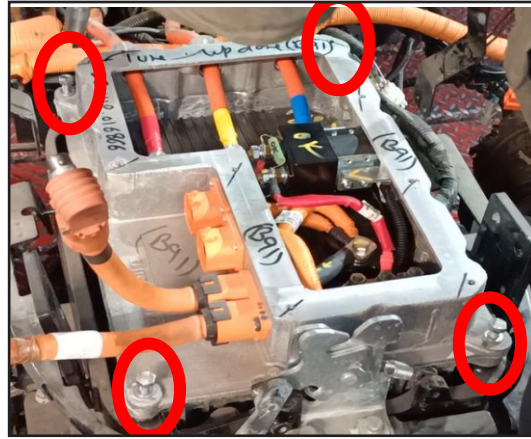
STEP 14 : Remove HV cable connection



STEP 14 : Remove the cover ECU box mounting top by removing if its 9 hardware



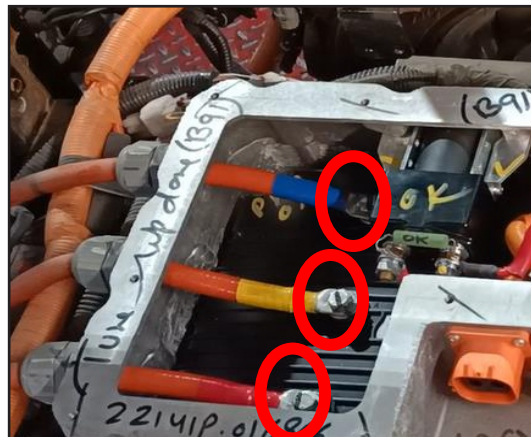
STEP 16 : Remove the 4 corner bolts of Housing ECU box mounting upper



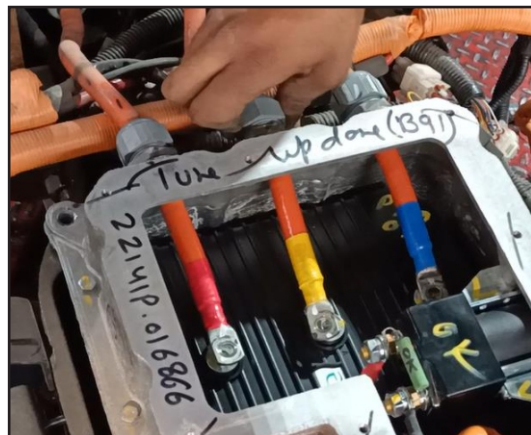
STEP 15 : Disconnect the connector of Harness assembly electronic contro



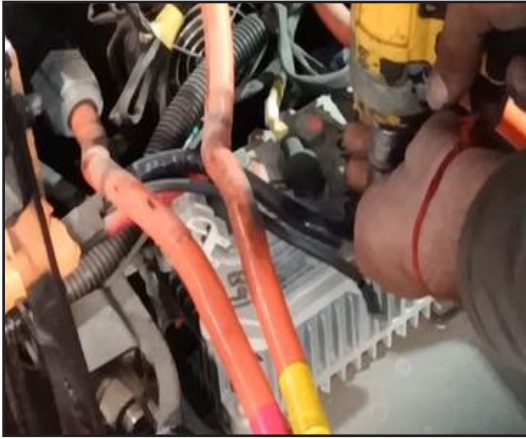
STEP 17 : Remove the RYB bolts on motor controller



STEP 18 : Loosen the gland seal of RYB and take out the ECU box



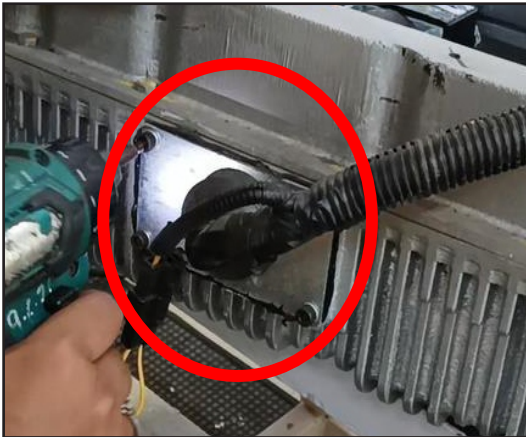
STEP 19 : Remove the +Ve and -Ve connection of cable power assembly electric hydraulic



STEP 3 :Remove orange connector connected on E-Box after removal of their hardware form inside and outside on E-Box

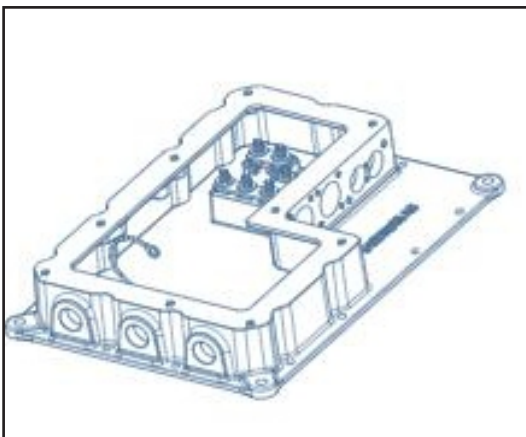
4.2.2. Dismantling of ECU:

STEP 1 :Remove the 4 hardware of Harness assembly electronic control



STEP 4 :Remove the housing ECU box mounting upper

STEP 2 :Remove the 12 hardware of housing ECU box mounting upper



STEP 5 : Remove the contactor assembly hydraulic after removing its 2 hardware



STEP 6 :Remove the all hardware present inside E box



STEP 7 :Remove the Curtis controller after removing connector of harness assembly electronic control.

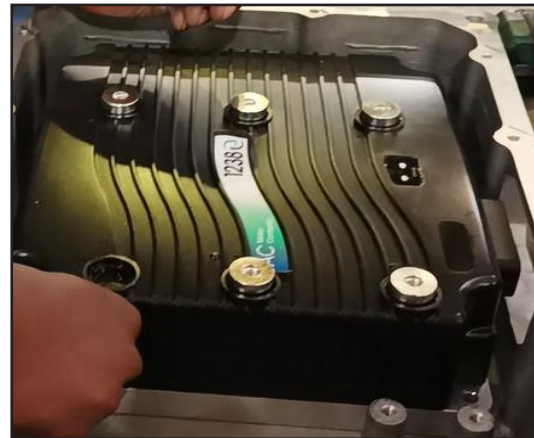


4.2.3.Assembly of ECU :

STEP 1 :Take the Curtis controller and install the pad thermal conductive for motor controller.



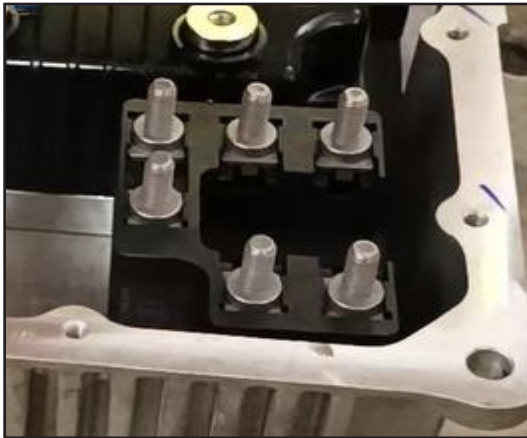
STEP 2 : Place the Curtis controller in Housing ECU box mounting lower and fix its hardware.



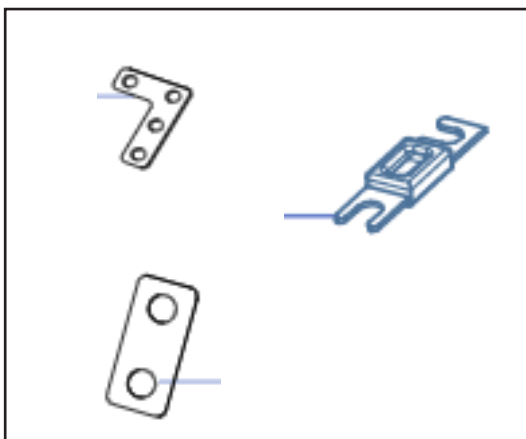
STEP 3 :Install the plate insulator mounting and fix its hardware



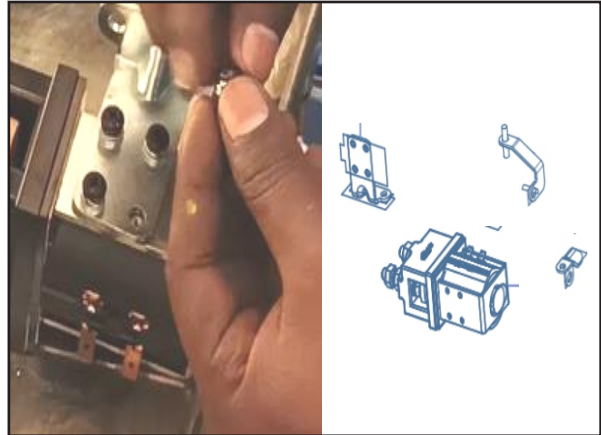
STEP 4 :Install the insulator Fuse mounting and fix its hardware



STEP 5 :Install the bracket PDU BUS bar & Fuse 355A Battery Cutoff and fix its hardware



STEP 6 :Install the bracket Contactor mounting, BUSBAR contactor to fuse & BUSBAR contactor to controller on contactor main assembly SW200 and fix its hardware



STEP 7 :Install assembled contactor main assembly SW200 and fix its hardware



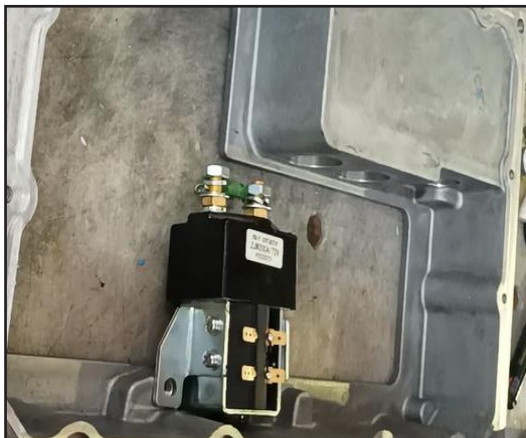
STEP 8 :Apply Lacquer on the hardware inside E Box



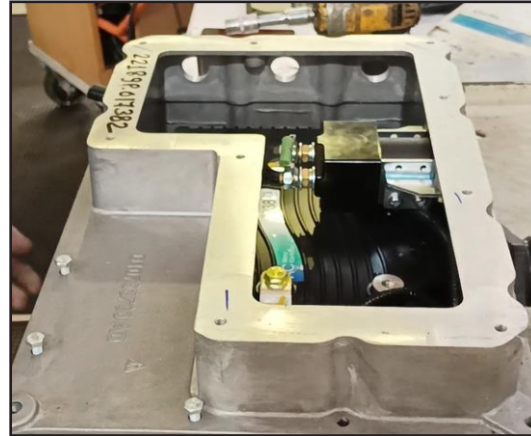
STEP 9 :Install Harness assembly electronic control



STEP 10 : Install the bracket hydraulic contactor mounting LH 7 RH on Contactor assembly hydraulic and then assembly the Contactor assembly hydraulic on housing box mounting upper



STEP 11 : Install the housing box mounting upper after applying Loctite 5060 on the mating hardware surface of housing box mounting upper & Housing ECU box mounting lower & fix its 12



STEP 12 : Install the orange connector back on housing box mounting upper and install there connection inside of E-box and install there hardware.



STEP 13 : Fix the Harness assembly electronic control with help of Bonded seal and flange screw and ensure Torque- 5~7 N-m.



4.2.4. Assembly of ECU in tractor:

Please follow reverse procedure of removal of ECU from tractor for assembly.

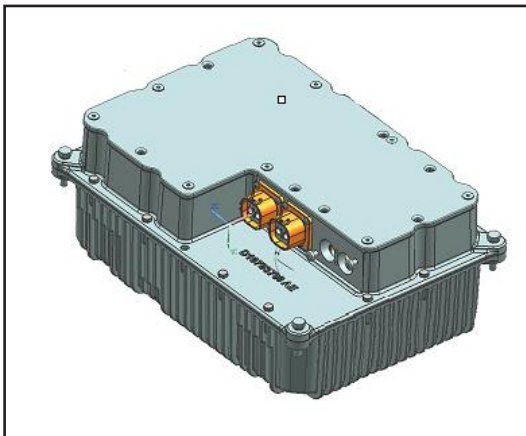
NOTE : Kindly make sure to use loctite 5060 in place of gasket during top cover mounting plate assembly.



4.3. Following are the part of E-Box.

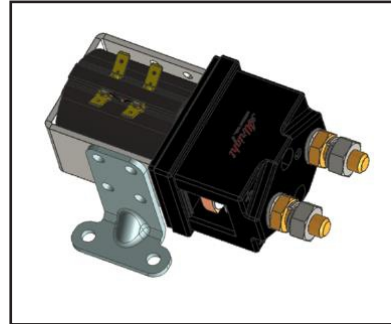
4.3.1 E- Box housing.

E Box is main unit of tractor which main motor and supplies voltages to various component



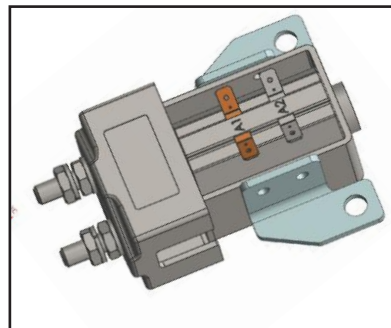
4.3.2 Main Motor Contactor.

Main Motor Contactor is an electrical device which is used for switching an electrical circuit on or off for main motor



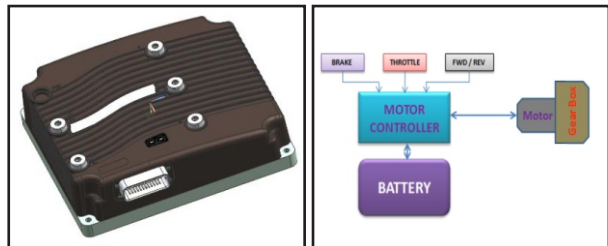
4.3.3 Hydraulic motor contactor.

Hydraulic motor contactor is an electrical device which is used for switching an electrical circuit on or off for main motor.



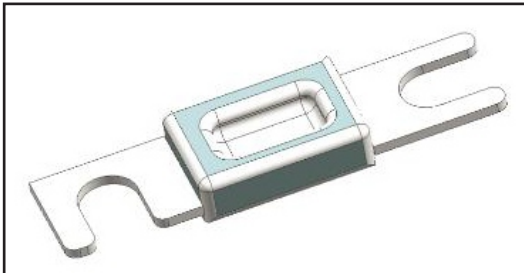
4.3.4 Main Motor Controller

Motor controller is a combination of power electronics and embedded micro- computing elements which makes efficient conversion of energy stored in batteries of an electrical vehicle to generate motion.



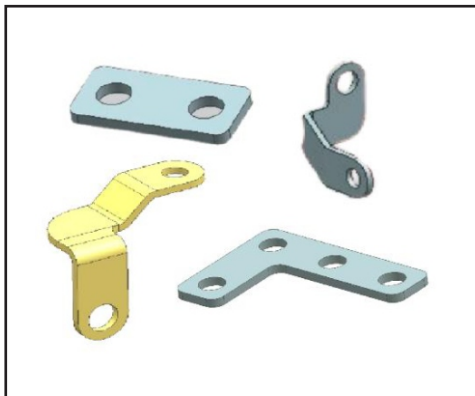
4.3.5 Fuse 350A

The primary use of an electric fuse is to protect electrical equipment from excessive current and to prevent short circuits or mismatched loads.

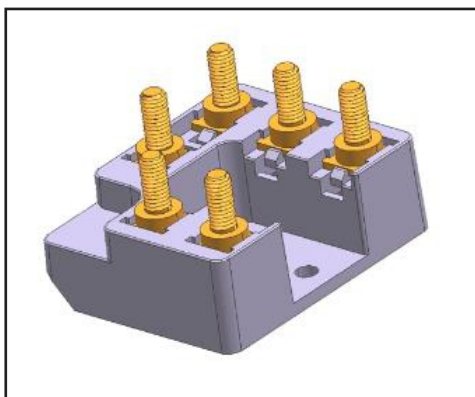


4.3.6. Busbar plates

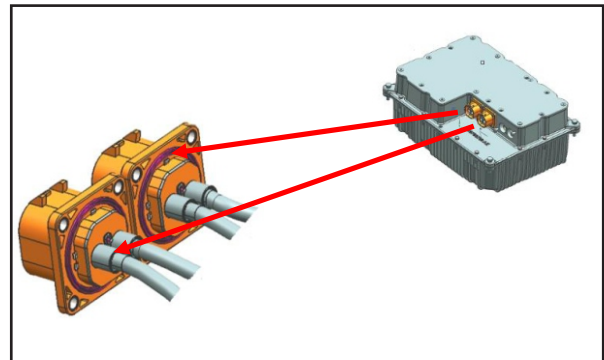
A busbar is an electrical junction used for collecting electric power from the incoming feeders and distributes them to the outgoing feeders.



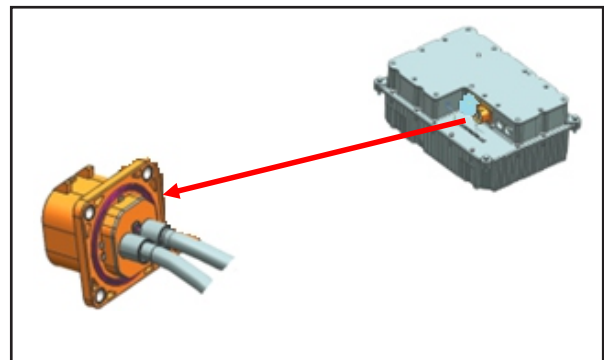
4.3.7. Insulator fuse mounting.



4.3.8. Connectors for Charger and hydraulic controller(FT25G Only)



4.3.9 Connectors for Charger in FT25G HST model In HST model hydraulic motor not present, so another socket is not available with HST E-Box)



4.3.10 Diagnostic for Motor Controller

WIRE COLOUR CODING:

WIRE COLOUR		
Colour Code	Description	
B	Black	
G	Green	
GR	Grey	
L	Blue	
O	Orange	
P	Pink	
R	Red	
V	Violet	
W	White	
Y	Yellow	
BR	Brown	
SK	Sky Blue	
LG	Light Green	

ERROR CODE BASED TROUBLESHOOTING DIAGNOSTICS

Diagnostics information can be obtained in either of two ways: By observing the fault codes issued by the Status LED's See Table for a summary of LED display formats. The pair of LED's built into the controller (red & yellow) produce flash codes displaying the currently set faults in a repeating cycle. Each code consists of two digits. The red LED flashes once to indicate that the first digit of the code will follow, the yellow LED then flashes the appropriate number of times for the first digit. The red LED flashes twice to indicate that the second digit of the code will follow, the yellow LED flashes the appropriate number of times for the second digit.

Example: Battery Under voltage (code 23).

The controller's two LED's will display this repeating pattern:



The numerical codes used by the yellow LED are listed in trouble shooting chart, which also lists possible fault, causes, describes conditions for reset & clear each fault.

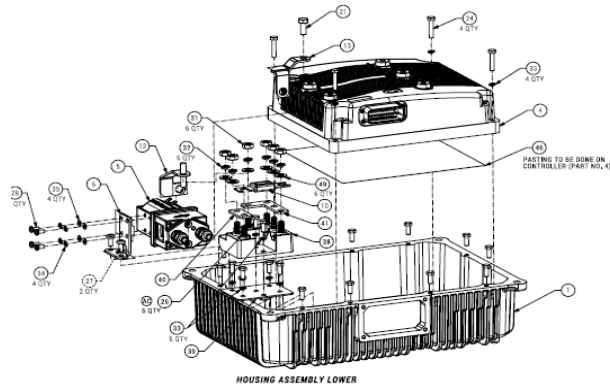
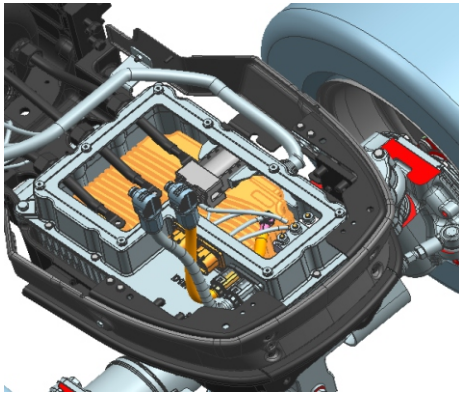
Summary of LED display formats The two LED's have four different display modes, indicating the type of information they are providing.

TYPES OF LED DISPLAY	
DISPLAY	STATUS
Neither LED illuminated	Controller is not powered on, or Vehicle has dead battery, or severe damage.
Yellow	LED flashing Controller is operating normally
Yellow and red LED's both on solid	Controller is in Flash program mode.
Red LED on solid	Watchdog failure or no software loaded. Cycle KSI to restart, and if necessary load software.
Red LED and yellow LED flashing alternately	Controller has detected a fault. 2 -digit code flashed by yellow LED Identifies the specific fault; one or two flashes by red LED indicate whether first or second code digit will follow

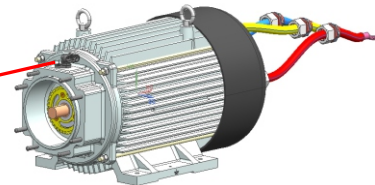
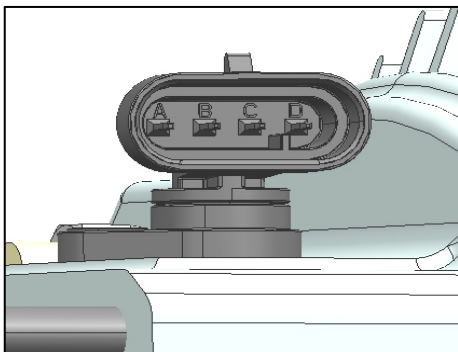
Error Code 12: Controller Over Current

Normal Operations	The controller gives input to the motor according to the reference from the throttle pot
ERROR CODE Detecting Conditions	If the controller draws more than the set current limit. Or if any short in U, V and W motor terminals.
Probable Cause	<ol style="list-style-type: none"> 1. External short of phase U, V, or W motor connections. 2. Motor parameters are mistuned 3. Controller defective. 4. Speed encoder noise problems.
Lamp status ERROR CODE	Malfunction tell-tale lamp will blink
Reaction	Motor Shutdown & Vehicle Will not move
Healing Conditions	Rectify fault

Component Location:

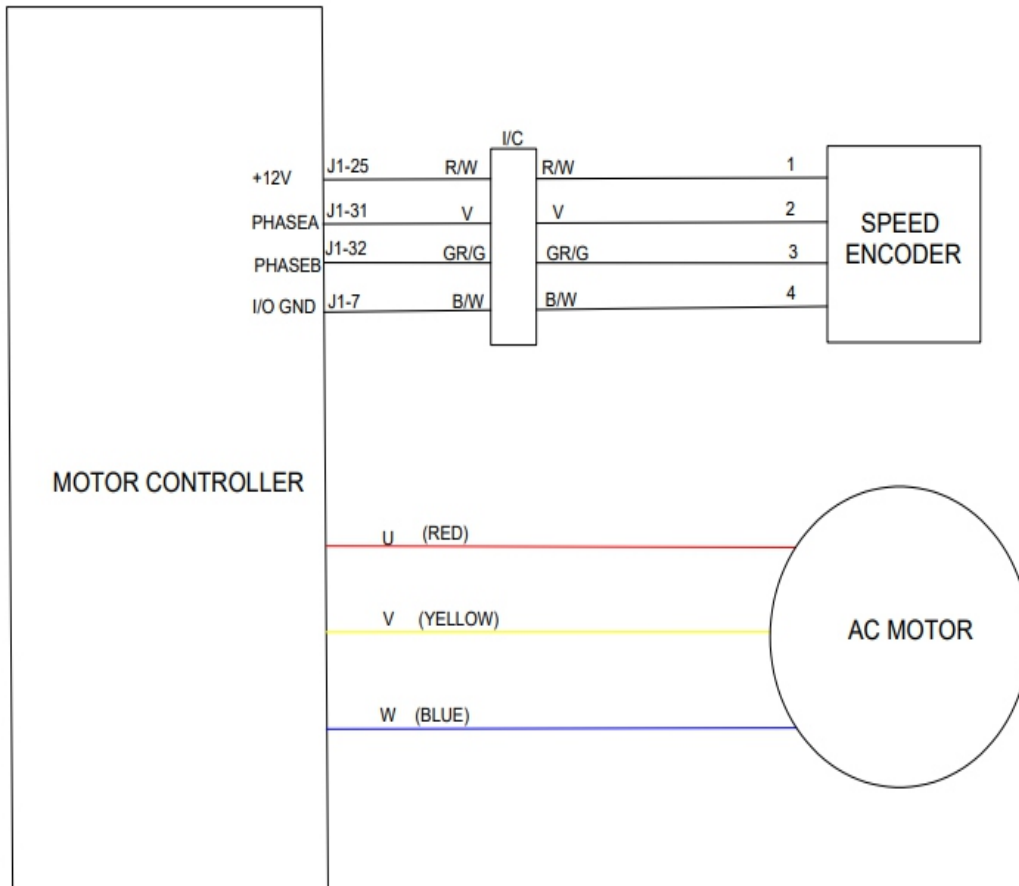


Motor Controller

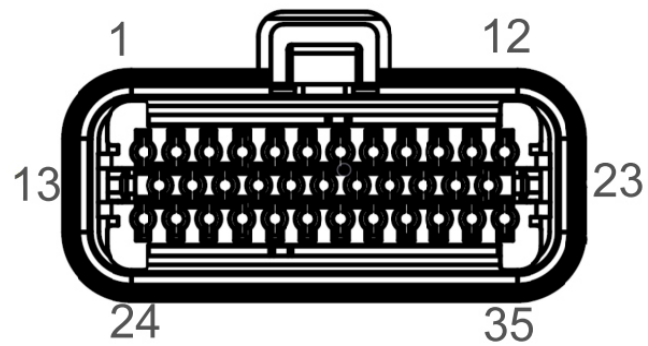


SENSOR ASSEMBLY CONNECTOR DETAILS	
PIN No	DESCRIPTION
A	GROUND
B	CHANNEL A
C	CHANNEL B
D	SUPPLY 5V

Motor and Speed Encoder



Connector View



Step 1: Connect Diagnostic tool and note down the ERROR CODE. If ERROR CODE is present, go to step 2.

YES	NO
STEP 2	Clear the ERROR COD

Step 2: Turn OFF the IGN and Check the resistance between R-Y, Y-B and B-R it should be <9 mili ohms.

YES	NO
STEP 3	Replace Motor

Step 3: Turn OFF the IGN and Check the Insulation between R-G, Y-G and B-G (here G refers to Ground) at Voltage 500 Volts.

YES	NO
STEP 4	Replace Motor

Step 4: Disconnect IC Pigtail of Speed Encoder (which is going to motor) and then turn ON IGN Check the Voltage Between 1 and 4 (On the connector which is going towards Motor controller) it should be 12 Volts.

YES	NO
STEP 5	Check for wiring Damage, Rectify it and then check for Tractor working.

Step 5: Check for dirtiness on encoder and also check for the frequency between pin 2 and pin 3 of speed encoder while rotating the gear wheel of motor. There should be some value and it will increase as the rotating speed increases

YES	NO
STEP 6	Replace Speed Encoder

Step 6: Replace Motor Controller

Error Code 13: Current Sensor Fault

Normal Operations throttle pot	The controller gives input to the motor according to the input from the
ERROR CODE Detecting Conditions	If the controller draws more than the set current limit or No current
Probable Cause	1.Leakage to vehicle frame from phase U, V, or W (short in motor stator). 2.Controller defective. 3.Internal HW fault 4.Current sensor may be faulty
Lamp status ERROR CODE	Malfunction tell-tale lamp will blink
Reaction	Motor Shutdown & Vehicle Will not move
Healing Conditions	Rectify fault

Step 1: Connect Diagnostic tool and note down the ERROR CODE. If ERROR CODE is present, go to step 2

YES	NO
STEP 2	Clear the ERROR CODE

Step 2: Turn OFF the IGN and Check the resistance between R-Y, Y-B and B-R it should be < 9 mili ohms

YES	NO
STEP 3	Replace Motor

Step 3: Turn OFF the IGN and Check the Insulation between R-G, Y-G and B-G (here G refers to Ground) at Voltage 500 Volts.

YES	NO
STEP 5	Check for wiring Damage, Rectify it and then check for Tractor working.

Step 5: Replace controller

Error Code 15: Controller Severe Under temp

Normal Operations	Normally Motor controller works at zero to 55°C If the controller draws more than the set current limit or No current
ERROR CODE Detecting Conditions	If the Temperature of the controller is less than -10°C in diagnostics
Probable Cause	Controller is operating in an extreme environment(low temp.)
Lamp status	Malfunction tell-tale lamp will blink
ERROR CODE Reaction	Motor Shutdown & Vehicle Will not move
Healing Conditions	Rectify fault

Step 1: Connect Diagnostic tool and note down the ERROR CODE. If ERROR CODE is present, go to step 2.

YES	NO
STEP 2	Clear the ERROR CODE

Step 2: Check for Motor Controller Temp is < -10°C

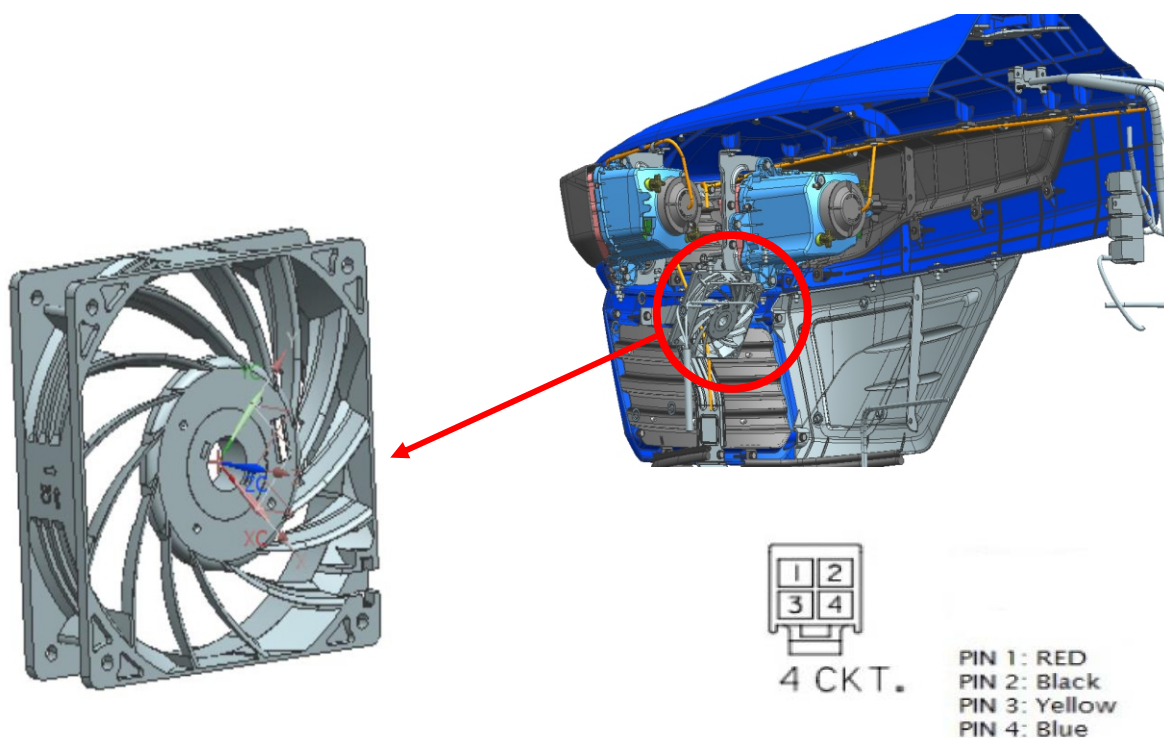
YES	NO
STEP 3	1. Park the Tractor in warm Place. 2. Clear the ERROR CODE and verify

Step 3: Check for Motor Controller Temp reads irregular (i.e., Motor Controller temp=-166°C?)

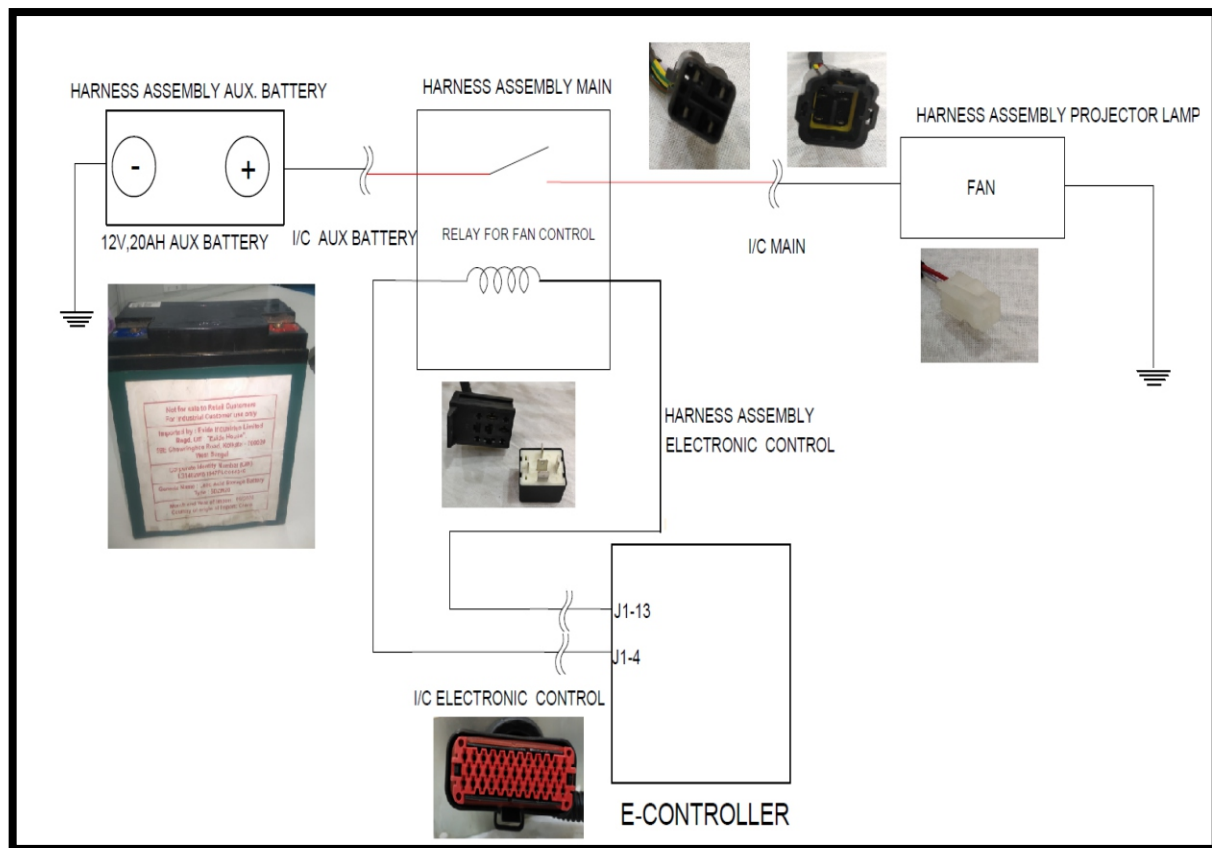
YES	NO
1. Replace Motor Controller. 2. Clear the ERROR CODE and verify	

Error Code 16: Controller Severe Over temp

Normal Operations	Normally Motor controller works at zero to 75°C
ERROR CODE Detecting Conditions	If the Temperature of the controller is more than 75°C in diagnostics
Probable cause	<ol style="list-style-type: none"> 1. See temperature of Motor Controller on cluster Temperature. It may be running in red zone 2. Controller is operating in an extreme environment. 3. Excessive continuous load on vehicle. 4. Improper mounting of controller. 5. Inverter cooling fan failure or obstructed.
Lamp status	Malfunction tell -tale Lamp will blink
ERROR CODE Reaction	Motor Shutdown & Vehicle Will not move
Healing Conditions	Rectify fault



Wiring Layout:



Connector View

Description	Connector PIC	Connector Number	No. of Pins	Function
Harness Assembly Auxiliary Battery		C-315 2PLMNY=1 NOS	2 pin	To interconnect with Dashboard wiring harness
Harness Assembly Auxiliary Battery		C-315 2PLMNY=1 NOS	2 pin	To interconnect with Dashboard wiring harness
Harness Assembly Instrument Panel		C-315 2PLFNY= 1Nos.	1 PINS	To interconnect with Aux Battery
Harness Assembly Instrument Panel		CONN- 423102000103- 1Nos. BLACK C-315 2PLMNY= 1Nos.	2 PINS	To interconnect with Aux Battery
Harness Assembly Instrument Panel		CONN- 420916030303- 01NOS BLACK C-90 WP16MPNY CONNECTOR	16 PINS	To interconnect with Harness assembly main
Harness Assembly Instrument Panel		CONN- 422508930003- 01NOS BLACK C-250 8PMNY	8 PINS	To interconnect with wiring harness Main
Harness Assembly Main		CONN- 420916035403- 01NOS BLACK C-090 WP16PFPNY	16 PINS	To interconnect with Instrument panel wiring harness with Harness Assembly Main
Harness Assembly Main		CONN- 422508035003- 01NOS BLACK C-250 8PFPNY(FD)	8 PINS	To interconnect with Instrument panel wiring harness with Harness Assembly Main
MINI INTERLOCK RELAY FAN RELAY		TT PRB-6 TTPL TB- 6.4FP=4NOS. (BASE - 429905095015- BLACK)	5 PINS	To connect relay assembly to provide power to FAN
Harness Assembly Main		C-90 WP4MNY-B	4 pin	To interconnect with Harness Assembly Main
Harness Assembly Projector Lamp		C-90WP4PM-B CONNECTOR	4 PINS	To connect with Front Indication Lamp LH
Fan		39012041 (Molex conn.)	4 pin	To connect controller fan

Step 1: Connect Diagnostic tool and note down the ERROR CODE. If ERROR CODE is present, go to step 2.

YES	NO
STEP 2	Clear the ERROR CODE

Step 2: Check for Motor Controller Temp On Instrument Cluster (Is it in RED zone).

YES	NO
Cool Down the TEMP.	STEP3

Step 3: Check for System Current in Instrument Cluster for continuous load (i.e., System current should be in 15-20A at NO Load Condition)

YES	NO
Cool Down the TEMP.	STEP 4

Step 4: Check Inverter cooling fan failure or obstructed.
FAN ON?

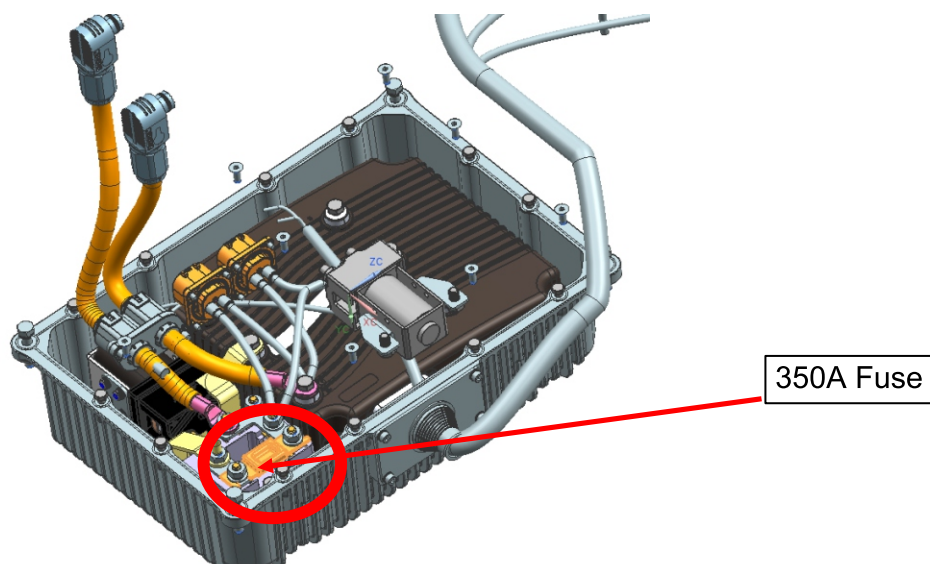
YES	NO
Check Motor connector looseness if found okay Replace Motor Controller	Step 5

Step 5: Check Voltage of FAN at Pin 1 and Pin 2 of FAN Connector when temp is more than 60°C, it should be 12 volts.

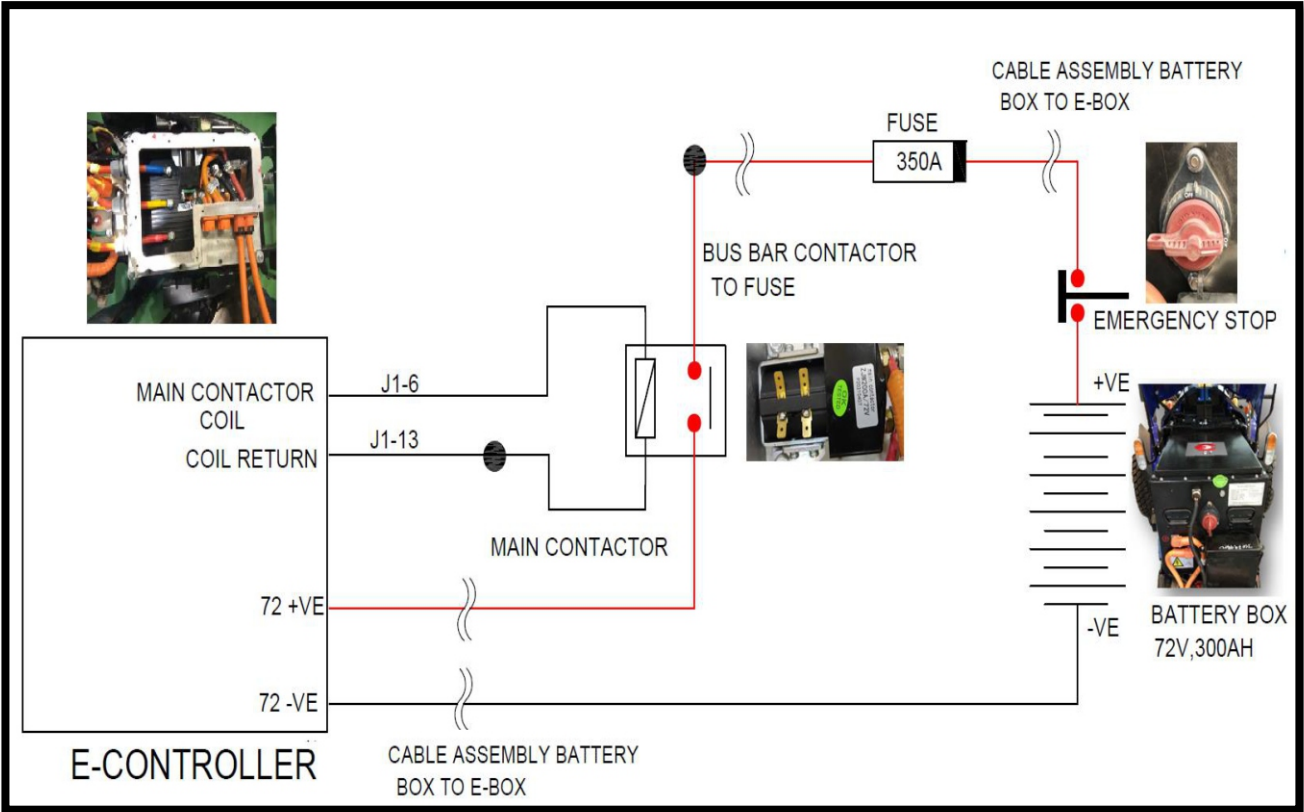
YES	NO
Replace FAN	Check for wiring Damage, Rectify it and then check for Tractor working.

Error Code 17: Severe B+ Under voltage


Normal Operations	Normally Motor Controller will operate on 72 volts DC power supply.
ERROR CODE Detecting Conditions	If the input voltage to MOTOR CONTROLLER is less than 62 Volts, SOC should not be Zero.
Probable cause	<ol style="list-style-type: none"> 1. Battery parameters are misadjusted. 2. Non -controller system drain on battery. 3. Battery resistance too high. 4. Battery disconnected while driving. 5. Blown B+ fuse or main contactor did not close. 6. System voltage low - battery or wiring /PDU fault
Lamp status	Malfunction tell -tale lamp will blink
ERROR CODE Reaction	Motor Shutdown & Vehicle Will not move
Healing Conditions	Rectify fault

Component Location:

Wiring Layout:



Connector View

Description	connector PIC	Connector Number	No. of Pins	Function
MAIN CONNECTOR COIL		TB-6.4FP (DIMPLE)= 2NOS. CAP-FMC= 2NOS.	2 PINS	To connect with Main contactor coil

Step 1: Connect Diagnostic tool and note down the ERROR CODE. If ERROR CODE is present, go to step 2.

YES	NO
STEP 2	Clear the ERROR CODE

Step 2: Check for Battery Parameter in Menu and check for under voltage value should be 70% (i.e., >62 Volts)

YES	NO
STEP 3	Charge the Battery pack and check

Step 3: Check for Motor Controller Fuse B+ of 350 A in E-Box for Blown OFF? (If in STEP 2 you find 0 Volts then check step 3 otherwise move to step 4)

Ok.

YES	NO
STEP 5	Check and rectify and charge the battery pack and then check.

Step 5: Replace BMS

Error Code 18: Severe B+ Over voltage

Normal Operations	Normally Motor Controller will operate on 72 volts DC power supply.
ERROR CODE Detecting Conditions	If the Regen Current generate more causing pack voltage more than 84 volts
Probable cause	1. Battery parameters are misadjusted. 2. Battery resistance too high for given regen current. 3. Battery disconnected while regen braking. 4. Contactor rapid opening or charger fault
Lamp status	Malfunction tell-tale lamp will blink
ERROR CODE Reaction	Motor Shutdown & Vehicle Will not move
Healing Conditions	Rectify fault

Step 1: Connect Diagnostic tool and note down the ERROR CODE. If ERROR CODE is present, go to step 2.

YES	NO
STEP 2	Clear the ERROR CODE


Step 2: Connect Diagnostic tool and check the following value

YES	NO
Clear the ERROR CODE and Check if persist Replace Motor Controller	Replace BMS

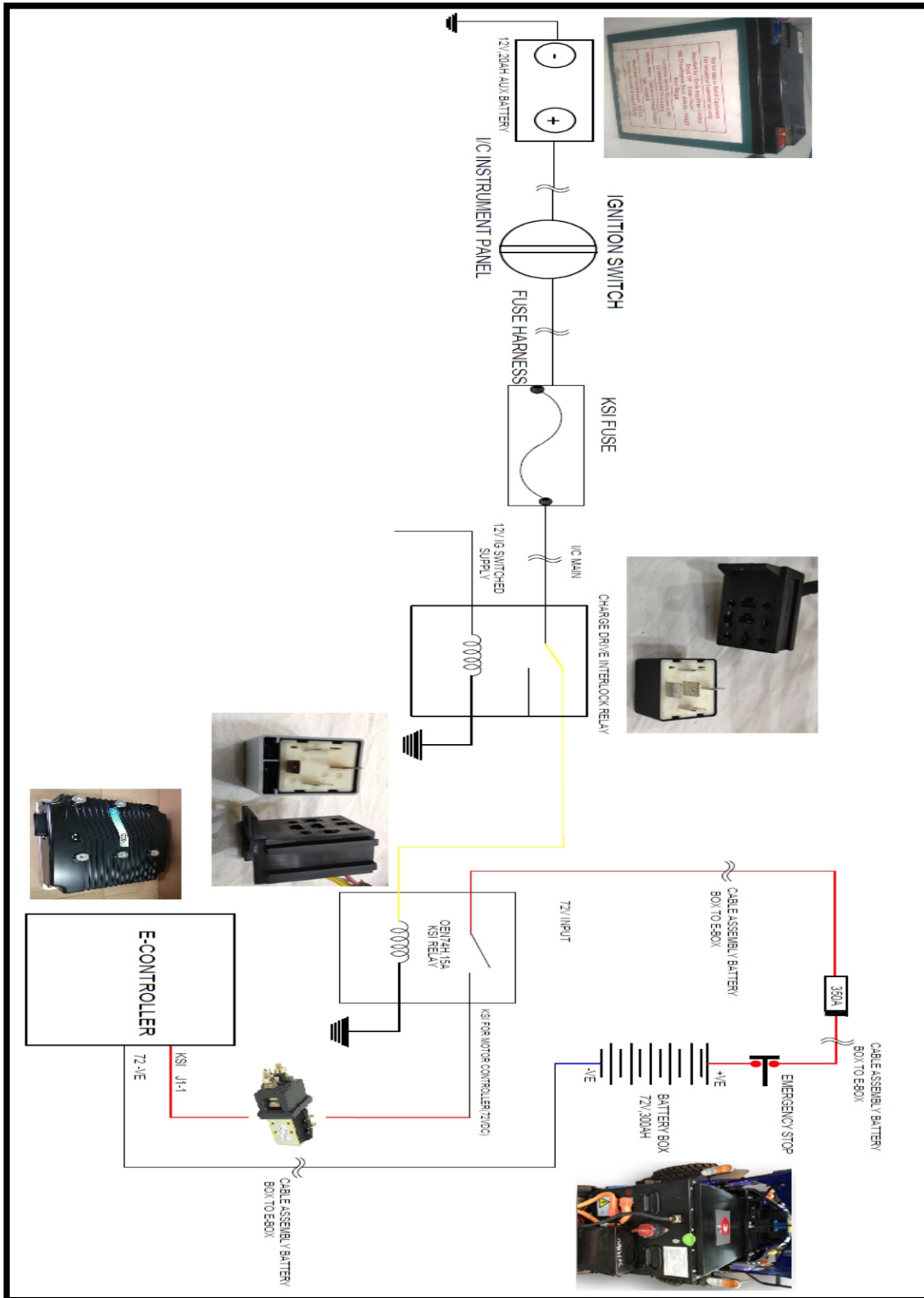
Error Code 18: Severe KSI Over voltage

Normal Operations	Normally Motor Controller will operate on 72 volts DC power supply.
ERROR CODE Detecting Conditions	If KSI voltage is more than 84 Volts
Probable cause	Incorrect (to high) battery-voltage applied to KSI (pin 1)
Lamp status	Malfunction tell-tale lamp will blink
ERROR CODE Reaction	Motor Shutdown & Vehicle Will not move
Healing Conditions	Rectify fault













Connector View

Description	connector PIC	Connector Number	No. of Pins	Function
MAIN CONNECTOR COIL		TB-6.4FP (DIMPLE)= 2NOS. CAP-FMC= 2NOS.	2 PINS	To connect with Main contactor coil

Wiring Layout:



Connector View

Description	Connector PIC	Connector Number	No. of Pins	Function
Harness Assembly Auxiliary Battery		C-315 2PLMNY=1 NOS	2 pin	To interconnect with Dashboard wiring harness
Harness Assembly Auxiliary Battery		C-315 2PLMNY=1 NOS	2 pin	To interconnect with Dashboard wiring harness
Harness Assembly Instrument Panel		C-315 2PLFNY= 1Nos.	1 PINS	To interconnect with Aux Battery
Harness Assembly Instrument Panel		CONN-423102000103-1Nos. BLACK C-315 2PLMNY= 1Nos.	2 PINS	To interconnect with Aux Battery
Harness Assembly Instrument Panel		CONN-420916030303- 01NOS BLACK C-90 WP16MPNY CONNECTOR	16 PINS	To interconnect with Harness assembly main
Harness Assembly Instrument Panel		CONN-422508930003- 01NOS BLACK C-250 8PMNY	8 PINS	To interconnect with wiring harness Main
Harness Assembly Main		CONN-420916035403- 01NOS BLACK C-090 WP16PFPNY	16 PINS	To interconnect with Instrument panel wiring harness with Harness Assembly Main
Harness Assembly Main		CONN-422508035003- 01NOS BLACK C-250 8PFPNY(FD)	8 PINS	To interconnect with Instrument panel wiring harness with Harness Assembly Main
RELAY1863000015(MINI RELAY CHARGE DRIVE INTERLOCK RELAY)		TT PRB-6 TTPL TB-6.4FP=4NOS. (BASE -429905095015- BLACK)	5 PINS	To connect relay for disconnecting KSI signal to controller during charging
I/C CONTROLLER		CONN-420916030303 BLACK C-090 WP16PMPNY	16 PINS	To interconnect with wiring Harness Dashboard.
CONTROLLER		CONN-4299350650 BLACK	35 PINS	To connect with Main E-controller
MAIN CONNECTOR COIL		TB-6.4FP(DIMPLE)= 2NOS.CAP-FMC= 2NOS.	2 pins	To connect with Main contactor coil

Step 1: Connect Diagnostic tool and note down the ERROR CODE. If ERROR CODE is present, go to step 2.

YES	NO
STEP 2	Clear the ERROR CODE

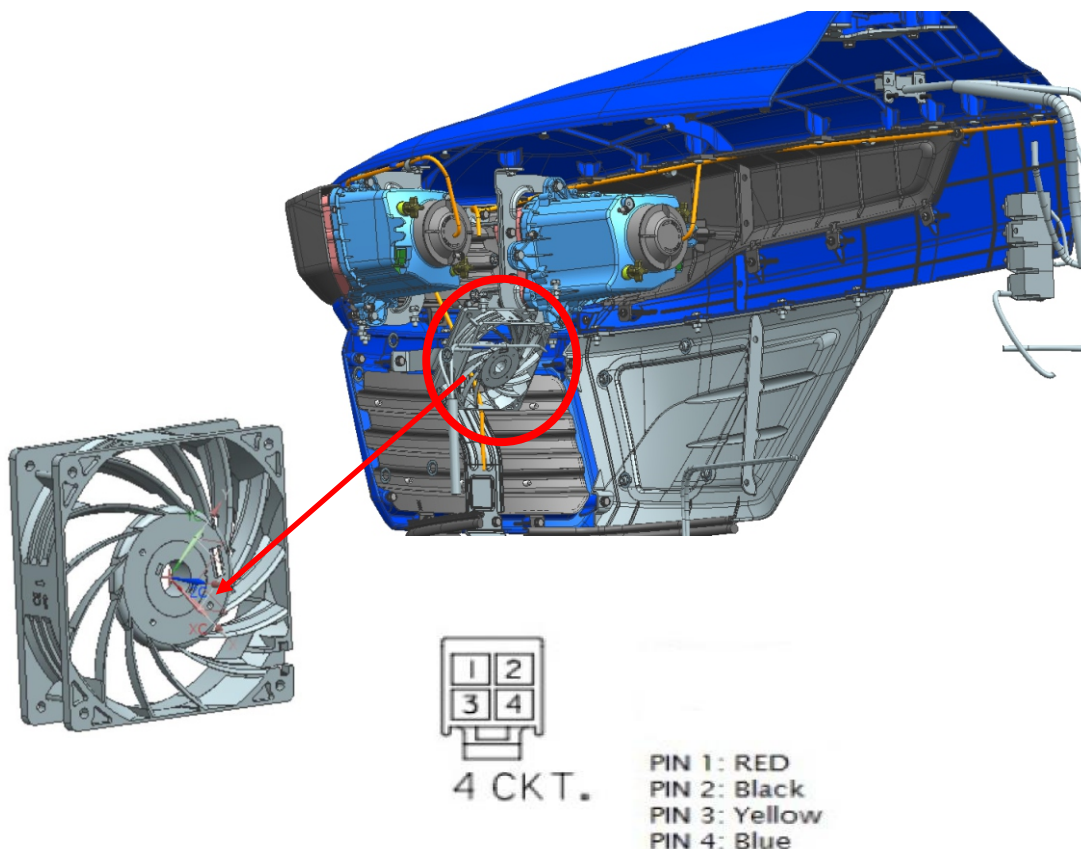
Step 2: Connect Diagnostic tool and check the following value 1. Battery Capacitor Voltage <84 Volts

YES	NO
Clear the ERROR CODE and Check if persist Replace Motor Controller	Replace BMS

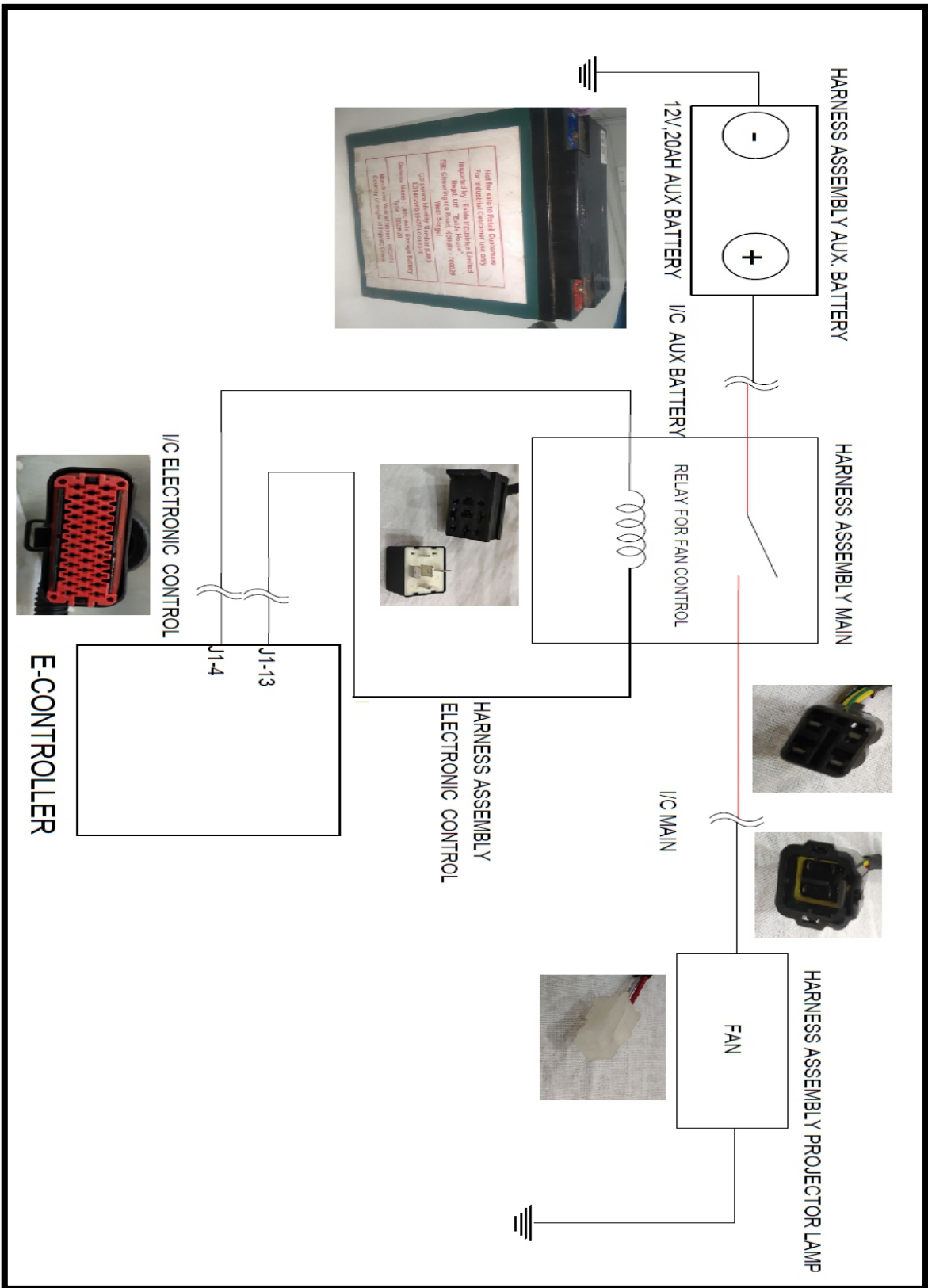
Error Code 22: Controller Over Temp Cutback

Normal Operations	Controller will work till its temperature reaches 60°C
ERROR CODE Detecting Conditions	If the temperature of the controller reaches more than the set value.
Probable cause	<ol style="list-style-type: none"> 1. See temperature of Controller on cluster Temperature. It may be running in red zone 2. Controller is operating in an extreme environment. 3. Excessive load on vehicle. 4. Improper mounting of controller. 5. Inverter cooling fan failure or obstructed.
Lamp status	Malfunction tell -tale lamp will blink
ERROR CODE Reaction	Motor Shutdown & Vehicle Will not move
Healing Conditions	Rectify fault

Component Location:



Wiring Layout:



Connector View

Description	Connector PIC	Connector Number	No. of Pins	Function
Harness Assembly Auxiliary Battery		C-315 2PLMNY=1 NOS	2 pin	To interconnect with Dashboard wiring harness
Harness Assembly Auxiliary Battery		C-315 2PLMNY=1 NOS	2 pin	To interconnect with Dashboard wiring harness
Harness Assembly Instrument Panel		C-315 2PLFNY= 1Nos.	1 PINS	To interconnect with Aux Battery
Harness Assembly Instrument Panel		CONN- 423102000103- 1Nos. BLACK C-315 2PLMNY= 1Nos.	2 PINS	To interconnect with Aux Battery
Harness Assembly Instrument Panel		CONN- 420916030303- 01NOS BLACK C-90 WP16MPNY CONNECTOR	16 PINS	To interconnect with Harness assembly main
Harness Assembly Instrument Panel		CONN- 422508930003- 01NOS BLACK C-250 8PMNY	8 PINS	To interconnect with wiring harness Main
Harness Assembly Main		CONN- 420916035403- 01NOS BLACK C-090 WP16PFPNY	16 PINS	To interconnect with Instrument panel wiring harness with Harness Assembly Main
Harness Assembly Main		CONN- 422508035003- 01NOS BLACK C-250 8PFNY(FD)	8 PINS	To interconnect with Instrument panel wiring harness with Harness Assembly Main
MINI INTERLOCK RELAY FAN RELAY		TT PRB-6 TTPL TB- 6.4FP=4NOS. (BASE - 429905095015- BLACK)	5 PINS	To connect relay assembly to provide power to FAN
Harness Assembly Main		C-90 WP4MNY-B	4 pin	To interconnect with Harness Assembly Main
Harness Assembly Projector Lamp		C-90WP4PM-B CONNECTOR	4 PINS	To connect with Front Indication Lamp LH
Fan		39012041 (Molex conn.)	4 pin	To connect controller fan

Step 1: Connect Diagnostic tool and note down the ERROR CODE. If ERROR CODE is present, go to step 2.

YES	NO
STEP 2	Clear the ERROR CODE

Step 2: Check for System Current in Instrument Cluster for continuous load (i.e., System current should be in 15-20A at NO Load Condition)

Check for parking brake engage in drive.

Is Parking Brake Engaged while Driving?

YES	NO
1. Advice the customer. 2. Clear the ERROR CODE and verify	Step 3

Step 3: Check for Controller temperature during drive.

Is Controller temp > 60°C

YES	NO
Step 4	Clear the ERROR CODE and verify

Step 4: Check Inverter cooling fan failure or obstructed.

FAN ON?

YES	NO
Replace Motor Controller	Step 4

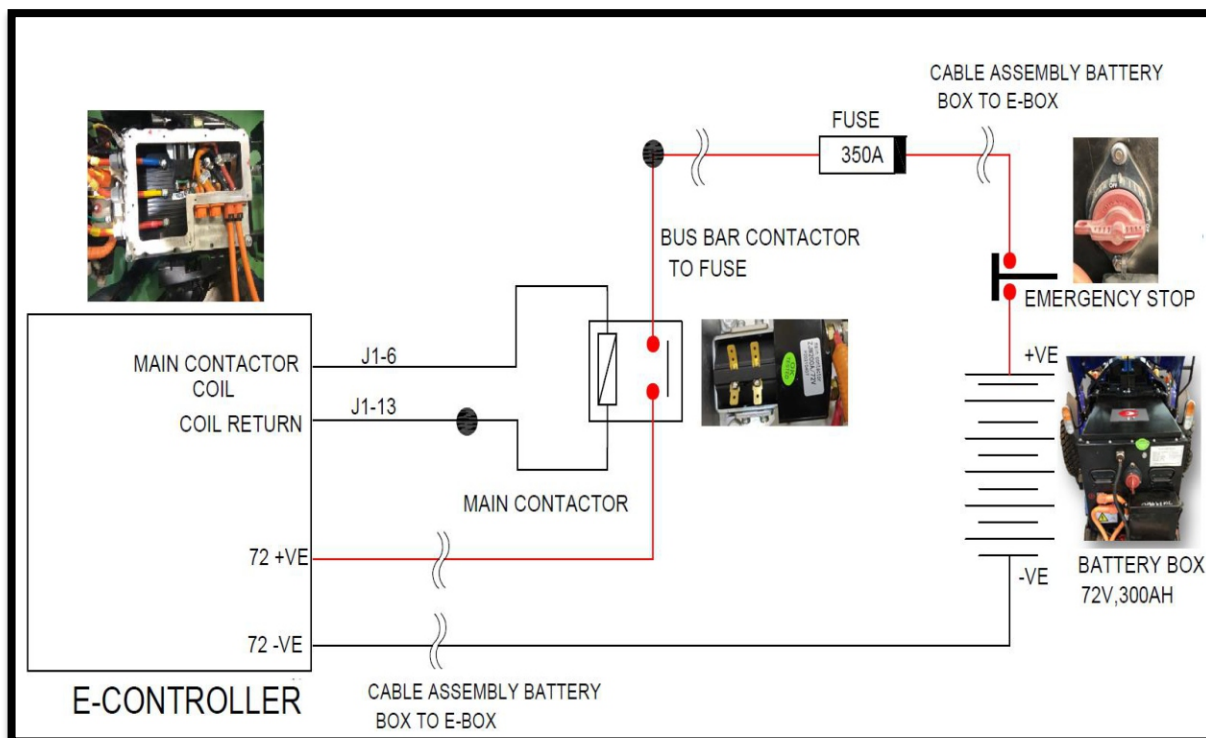
Step 5: Check Voltage of FAN at Pin 1 and Pin 2 of FAN Connector when temp is more than 60°C, it should be 12 volts.

YES	NO
Replace FAN	Check for wiring Damage, Rectify it and then check for Tractor working.


Error Code 23: B+ Under voltage Cutback

Normal Operations	Normally Motor Controller will operate on 72 volts DC power supply.
ERROR CODE Detecting Conditions	If the input voltage to MOTOR CONTROLLER is less than 62 Volts, SOC should not be less than 15 %
Probable cause	<ol style="list-style-type: none"> 1. Battery parameters are misadjusted. 2. Non-controller system drain on battery. 3. Battery resistance too high. 4. Battery disconnected while driving. 5. Blown B+ fuse or main contactor did not close. 6. System voltage low - battery or wiring /PDU fault
Lamp status	Malfunction tell-tale lamp will blink
ERROR CODE Reaction	Motor Shutdown & Vehicle Will not move
Healing Conditions	Rectify fault

Wiring Layout:



Connector View

Description	connector PIC	Connector Number	No. of Pins	Function
MAIN CONNECTOR COIL		TB-6.4FP (DIMPLE)= 2NOS. CAP-FMC= 2NOS.	2 PINS	To connect with Main contactor coil

YES	NO
STEP 2	Clear the ERROR CODE

Step 2: Check for Battery Parameter in Menu and check for under voltage value should be 70% (i.e., >62 Volts)

YES	NO
STEP	3 Charge the Battery pack and check

Step 3: Check for Motor Controller Fuse B+ of 350 A in E-Box for Blown OFF? (If in STEP 2 you find 0 Volts then check step 3 otherwise move to step 4)

OK

YES	NO
STEP 4	Replace Fuse

Step 4: Check for Battery Terminal Connector which is connected between motor controller and Battery Pack for looseness and for proper fitting.

OK

YES	NO
STEP 5	Check and rectify and charge the battery pack and then check.

Step 5: Replace BMS

Error Code 24: B+ Over Voltage Cutback

Normal Operations	Normally Motor Controller will operate on 72 volts DC power supply.
ERROR CODE Detecting Conditions	If the Regen Current produced more causing pack voltage more than 84 volts
Probable Cause	1. Battery parameters are misadjusted. 2. Battery resistance too high for given regen current. 3. Battery disconnected while regen braking. 4. Contactor rapid opening or charger fault
Lamp status ERROR CODE	Malfunction tell-tale lamp will blink
Reaction	Motor Shutdown & Vehicle Will not move
Healing Conditions	Rectify fault

Step 1: Connect Diagnostic tool and note down the ERROR CODE. If ERROR CODE is present, go to step 2.

YES	NO
STEP 2	Clear the ERROR CODE

Step 2: Connect Diagnostic tool and check the following value

1. Battery Capacitor Voltage <84 Volts (in live parameter)

YES	NO
Clear the ERROR CODE and Check if persist Replace Motor Controller	STEP 3

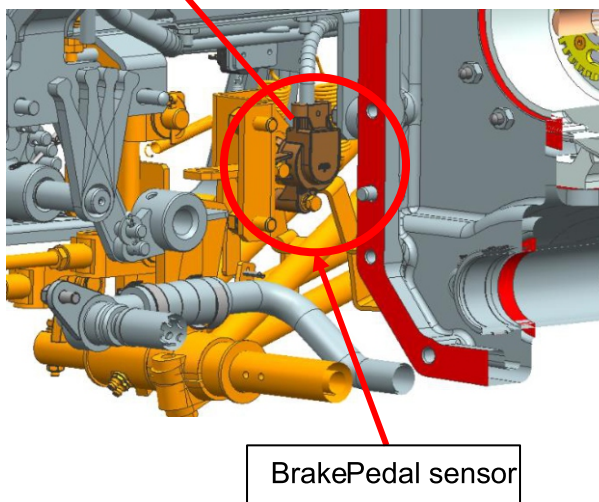
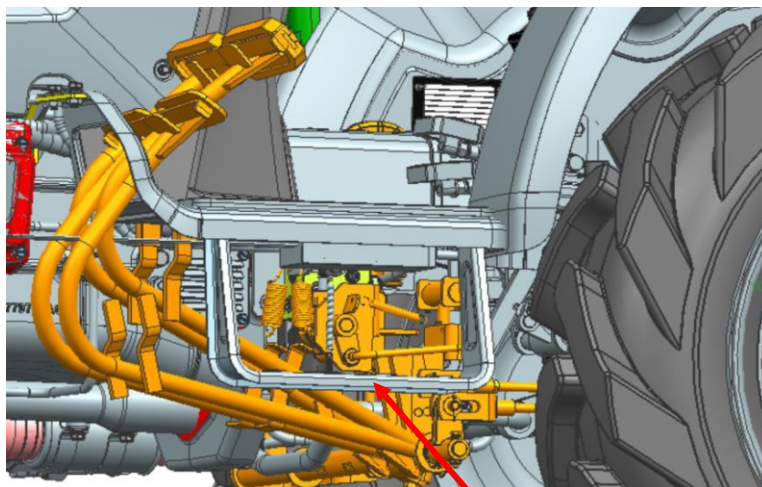
Step 3: Check for Battery Terminal Connector which is connected between motor controller and Battery Pack for looseness and for proper fitting.

OK?

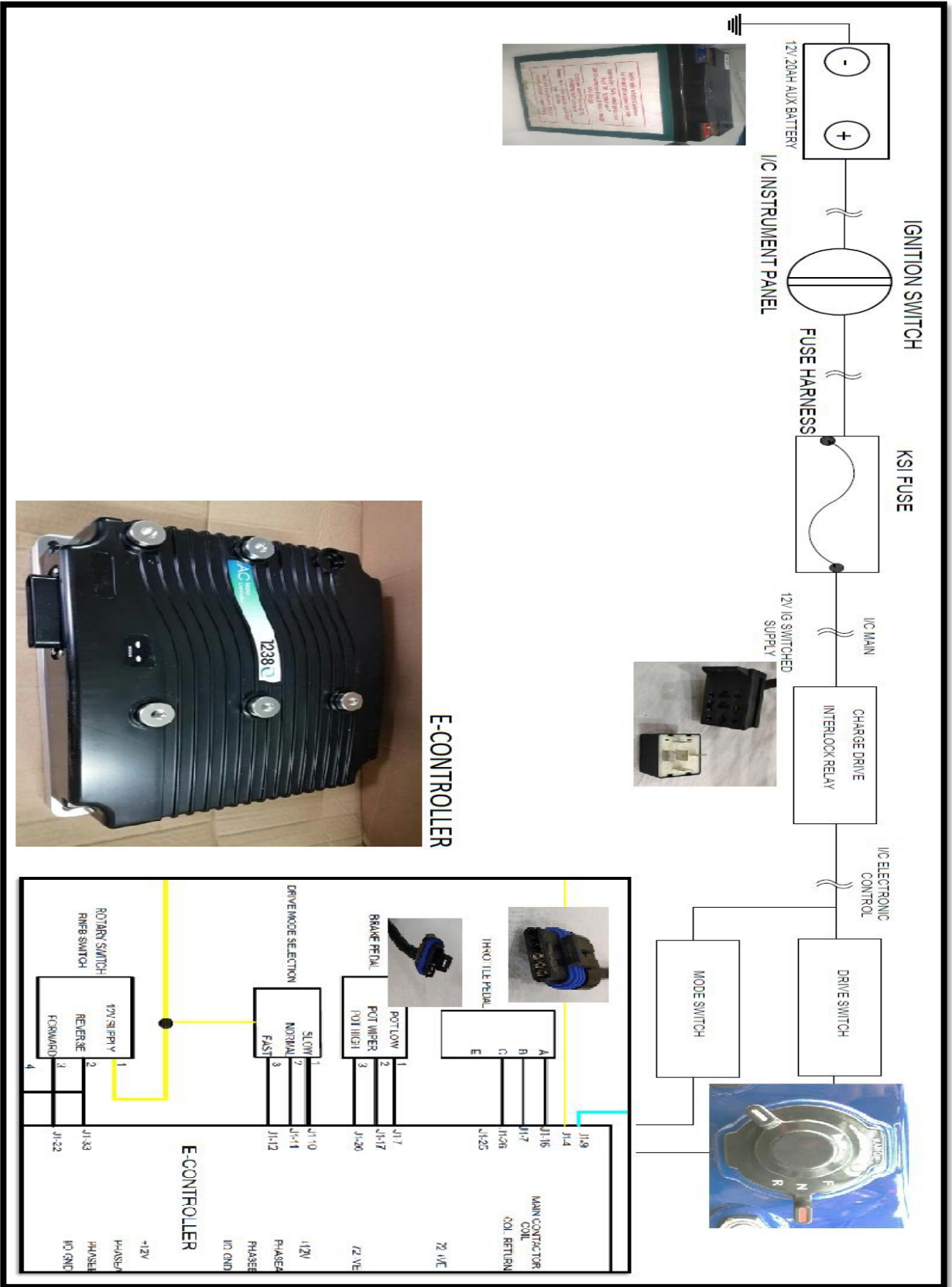
YES	NO
Replace Motor Controller	Replace BMS

Error Code 25: Supply Failure






Normal Operations	Normally Motor Controller will operate on 72 volts DC power supply.
ERROR CODE Detecting Conditions	If External load impedance on the +5V supply (pin 26) is too low.
Probable Cause	1. External load impedance on the +5V supply (pin 26) is too low. 2. See Monitor menu » outputs: 5 Volts and Ext Supply Current.
Lamp status	Malfunction tell-tale lamp will blink
ERROR CODE Reaction	Motor Shutdown & Vehicle Will not move
Healing Conditions	Rectify fault



Wiring Layout:



Connector View

Description	Connector PIC	Connector Number	No. of Pins	Function
Harness Assembly Auxiliary Battery		C-315 2PLMNY=1 NOS	2 pin	To interconnect with Dashboard wiring harness
Harness Assembly Auxiliary Battery		C-315 2PLMNY=1 NOS	2 pin	To interconnect with Dashboard wiring harness
Harness Assembly Instrument Panel		C-315 2PLFNY= 1Nos.	1 PINS	To interconnect with Aux Battery
Harness Assembly Instrument Panel		CONN-423102000103-1Nos. BLACK C-315 2PLMNY= 1Nos.	2 PINS	To interconnect with Aux Battery
Harness Assembly Instrument Panel		CONN-420916030303-01NOS BLACK C-90 WP16MPNY CONNECTOR	16 PINS	To interconnect with Harness assembly main
Harness Assembly Instrument Panel		CONN-422508930003-01NOS BLACK C-250 8PMNY	8 PINS	To interconnect with wiring harness Main
Harness Assembly Main		CONN-420916035403-01NOS BLACK C-090 WP16PFPNY	16 PINS	To interconnect with Instrument panel wiring harness with Harness Assembly Main
Harness Assembly Main		CONN-422508035003-01NOS BLACK C-250 8PFNY(FD)	8 PINS	To interconnect with Instrument panel wiring harness with Harness Assembly Main
RELAY1863000015(MINI RELAY CHARGE DRIVE INTERLOCK RELAY)		TT PRB-6 TTPL TB-6.4FP=4NOS. (BASE -429905095015-BLACK)	5 PINS	To connect relay for disconnecting KSI signal to controller during charging
I/C CONTROLLER		CONN-420916030303 BLACK C-090 WP16PMPNY	16 PINS	To interconnect with wiring Harness Dashboard.
THROTTLE		12162261 C-150 WP6PFNY-B (DPES-PTS)	6 PINS	To connect with throttle assembly
REGEN BRAKING		12066317 6P FM BLK CON ASSY 150 SERIES DELPHI BRAKE	6 PINS	To connect with brake throttle
DRIVE SWITCH		C-090 WP4PFNY-B= 1NOS. TT-WP090F= 4NOS.	4 PINS	To connect with drive switch (Slow, Normal & Fast)
MODE SWITCH		C-090 WP3PFPBT-B= 1NOS.	3 PINS	To connect with Mode switch (FNR)

Step 1: Connect Diagnostic tool and note down the ERROR CODE. If ERROR CODE is present, go to step 2.

YES	NO
STEP 2	Clear the ERROR CODE and Verify

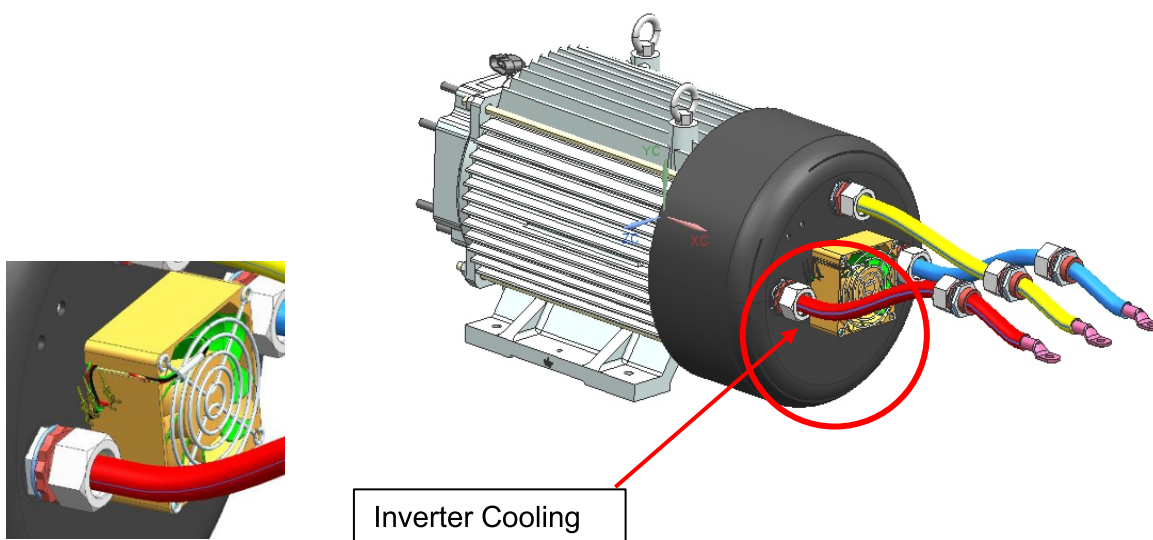
Step 2: check 5 volts supply at pin J1-7 and J1-26 of Motor Controller.
(This Voltage need to be checked from the back side of connector in connector connected condition)

Yes	No
Replace Motor Controller	Replace Motor Controller

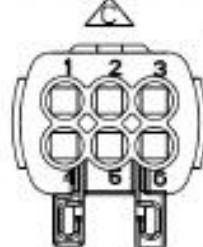
Error Code 28: Motor Temp Hot Cutback

Normal Operations	It will read the current temperature of the motor to the controller and if the temperature exceeds more than 125°C.
ERROR CODE Detecting Conditions	If the motor temperature sensor is reading more than 125°C then the error
Probable Cause	1. Motor temperature is at or above the programmed Temperature Hot setting, and the current is being cut back. 2. Motor high temp due to high load or poor cooling
Lamp status	Malfunction tell-tale lamp will blink
ERROR CODE Reaction	Motor Shutdown & Vehicle Will not move
Healing Conditions	Rectify fault

Component Location:

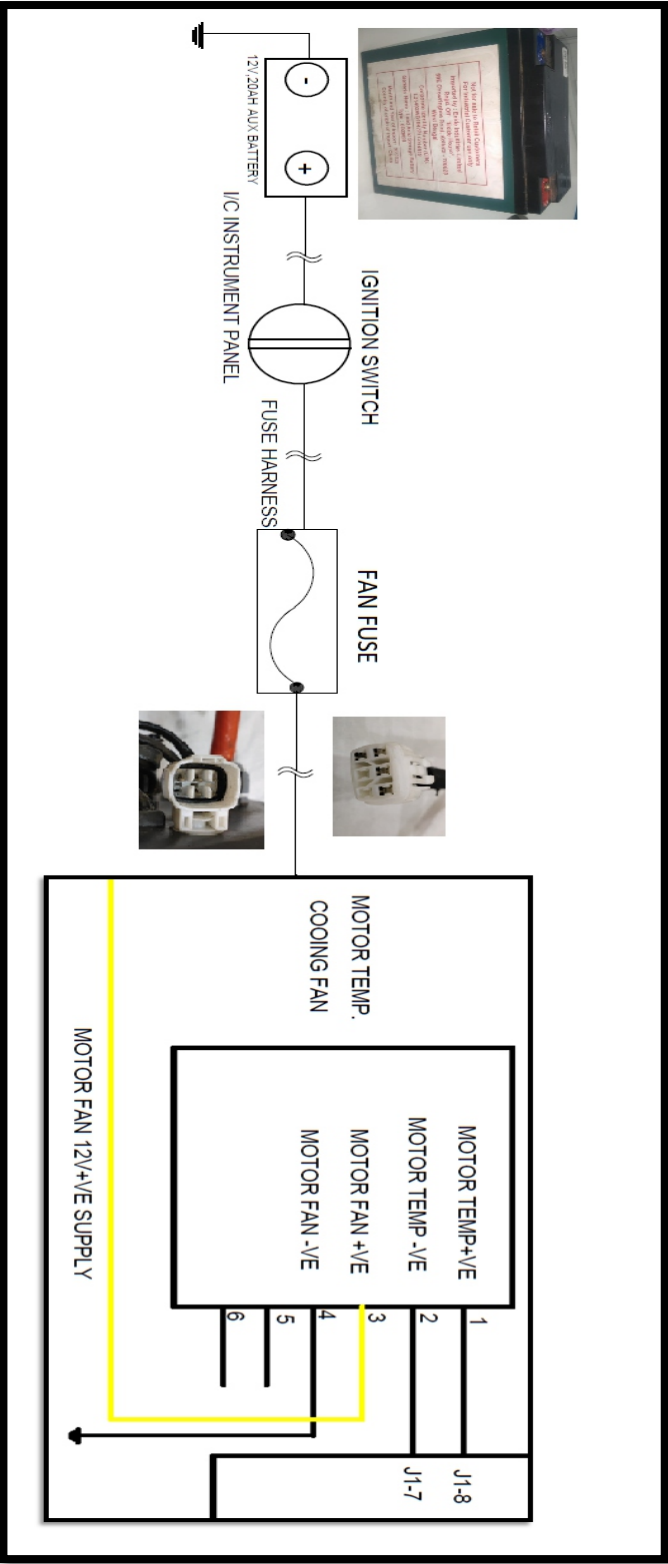


CONNECTOR CABLE DETAILS (VIEW FROM WIRE ENTRY SIDE)












LEADS	PIN No	DESCRIPTION	WIRE COLOR
TEMP LEADS	1	TEMP -VE	BLACK
	2	TEMP +VE	YELLOW
FAN LEADS	3	FAN +VE	RED
	4	FAN -VE	BROWN
	5	DUMMY	--
	6	DUMMY	--

Wiring Layout



Connector View

Description	Connector PIC	Connector Number	No. of Pins	Function
Harness Assembly Auxiliary Battery		C-315 2PLMNY=1 NOS	2 pin	To interconnect with Dashboard wiring harness
Harness Assembly Auxiliary Battery		C-315 2PLMNY=1 NOS	2 pin	To interconnect with Dashboard wiring harness
Harness Assembly Instrument Panel		C-315 2PLFNY= 1Nos.	1 PINS	To interconnect with Aux Battery
Harness Assembly Instrument Panel		CONN-423102000103-1Nos. BLACK C-315 2PLMNY= 1Nos.	2 PINS	To interconnect with Aux Battery
Harness Assembly Instrument Panel		CONN-420916030303-01NOS BLACK C-90 WP16MPNY CONNECTOR	16 PINS	To interconnect with Harness assembly main
Harness Assembly Instrument Panel		CONN-422508930003-01NOS BLACK C-250 8PMNY	8 PINS	To interconnect with wiring harness Main
Harness Assembly Main		CONN-420916035403-01NOS BLACK C-090 WP16PFPNY	16 PINS	To interconnect with Instrument panel wiring harness with Harness Assembly Main
Harness Assembly Main		CONN-422508035003-01NOS BLACK C-250 8PFNY(FD)	8 PINS	To interconnect with Instrument panel wiring harness with Harness Assembly Main
I/C CONTROLLER		CONN-420916030303 BLACK C-090 WP16PMPNY	16 PINS	To interconnect with wiring Harness Dashboard.
MOTOR FAN & TEMP		C-090 WP6PFPBT-W CONN-6FW090FHCLG (BESEMAK FEMALE CONNETOR)	6 PINS	To connect with Motor Fan and Temperature sensor

Step 1: Connect Diagnostic tool and note down the ERROR CODE. If ERROR CODE is present, go to step 2.

YES	NO
STEP 2	Clear the ERROR CODE

Step 2: Check for FAN for Working.

Yes	No
Check for the excessive Load on Vehicle and is vehicle driving in Parking brake engage condition.	STEP 3

Step 3: Check for FAN for the looseness in wire or in thimble of Motor Fan Connector.

Yes	No
Correct it and rectify and check	STEP 4

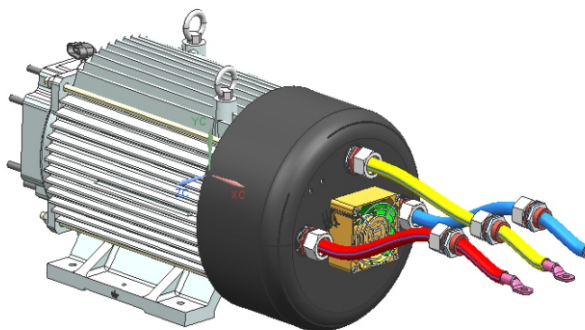
Step 4: Check Voltage Between Pin3 of Motor fan connector and Ground.
It should be 12 volts.

Yes	No
Replace Fan	Check wiring and rectify

Error Code 28: Motor Temp Hot Cutback

Normal Operations	s It will read the current temperature of the motor to the controller and if the temperature exceeds more than 125°C.
ERROR CODE Detecting Conditions	If the motor temperature sensor is reading more than 125°C then the error
Probable Cause	1. Motor temperature is at or above the programmed Temperature Hot setting, and the current is being cut back. 2. Motor high temp due to high load or poor cooling
Lamp status	Malfunction tell-tale lamp will blink
ERROR CODE Reaction	Motor Shutdown & Vehicle Will not move
Healing Conditions	Rectify fault

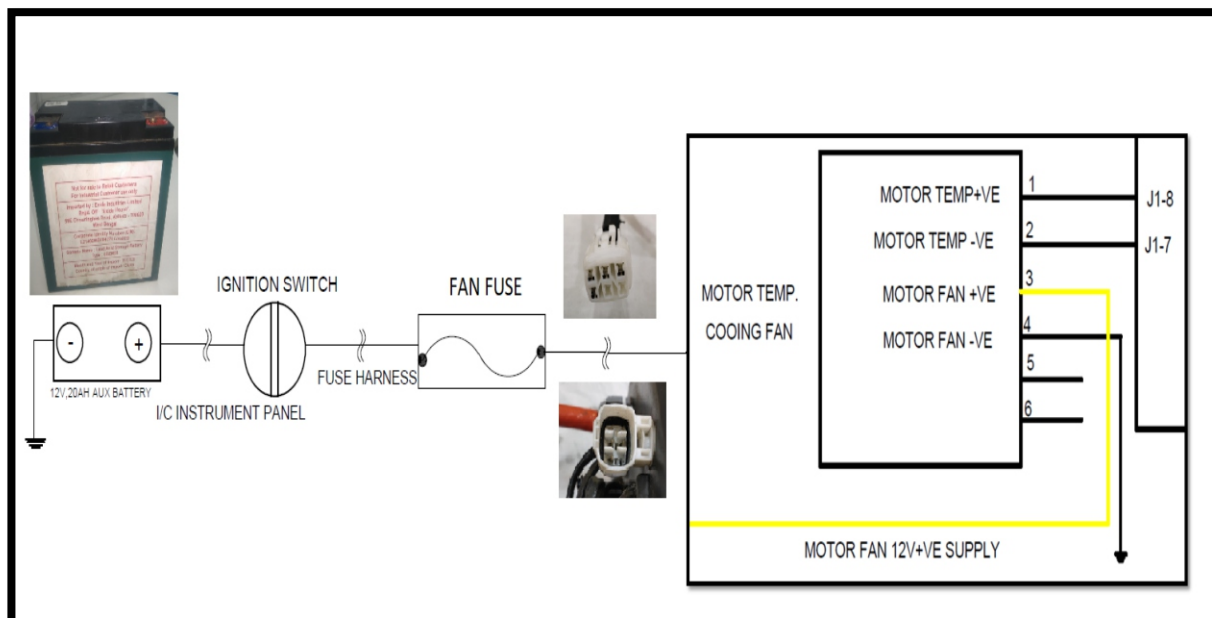
Component Location:






CONNECTOR CABLE DETAILS (VIEW FROM WIRE ENTRY SIDE)

LEADS	PIN No	DESCRIPTION	WIRE COLOR
TEMP LEADS	1	TEMP -VE	BLACK
	2	TEMP +VE	YELLOW
FAN LEADS	3	FAN +VE	RED
	4	FAN -VE	BROWN
	5	DUMMY	--
	6	DUMMY	--

Wiring Layout



Connector View

Description	Connector PIC	Connector Number	No. of Pins	Function
Harness Assembly Auxiliary Battery		C-315 2PLMNY=1 NOS	2 pin	To interconnect with Dashboard wiring harness
Harness Assembly Auxiliary Battery		C-315 2PLMNY=1 NOS	2 pin	To interconnect with Dashboard wiring harness
Harness Assembly Instrument Panel		C-315 2PLFNY= 1Nos.	1 PINS	To interconnect with Aux Battery
Harness Assembly Instrument Panel		CONN-423102000103-1Nos. BLACK C-315 2PLMNY= 1Nos.	2 PINS	To interconnect with Aux Battery
Harness Assembly Instrument Panel		CONN-420916030303-01NOS BLACK C-90 WP16MPNY CONNECTOR	16 PINS	To interconnect with Harness assembly main
Harness Assembly Instrument Panel		CONN-422508930003-01NOS BLACK C-250 8PMNY	8 PINS	To interconnect with wiring harness Main
Harness Assembly Main		CONN-420916035403-01NOS BLACK C-090 WP16PFPNY	16 PINS	To interconnect with Instrument panel wiring harness with Harness Assembly Main
Harness Assembly Main		CONN-422508035003-01NOS BLACK C-250 8PFPNY(FD)	8 PINS	To interconnect with Instrument panel wiring harness with Harness Assembly Main
I/C CONTROLLER		CONN-420916030303 BLACK C-090 WP16PMPNY	16 PINS	To interconnect with wiring Harness Dashboard.
MOTOR FAN & TEMP		C-090 WP6PFPBT-W CONN-6FW090FHCLG (BESEMAK FEMALE CONNETOR)	6 PINS	To connect with Motor Fan and Temperature sensor

Step 1: Connect Diagnostic tool and note down the ERROR CODE. If ERROR CODE is present, go to step 2.

YES	NO
STEP 2	Clear the ERROR CODE

Step 2: Check for the looseness in wire or in thimble of Motor Temperature Sensor Connector.

Yes	No
Correct it and rectify and check	STEP 3

Step 3: Check the Resistance between MT+ (Pin1) and GND2 (Pin2) of Motor Temperature Sensor Connector on Motor Side.

It should be 1Kohm.

Yes	No
STEP 4	Replace Motor

Step 4: After Reconnecting Motor Temperature Sensor Connector Check the Voltage Between Pin1 and Pin2 of Motor Temperature Sensor Connector.

Value Should Varies between 0-10 volts According to ambient Temperature

(This Voltage need to be checked from the back side of connector in connector connected condition)

Yes	No
Step 5	Replace Motor

Yes	No
Step 5	Replace Motor

Step 5: Check the continuity Between following:

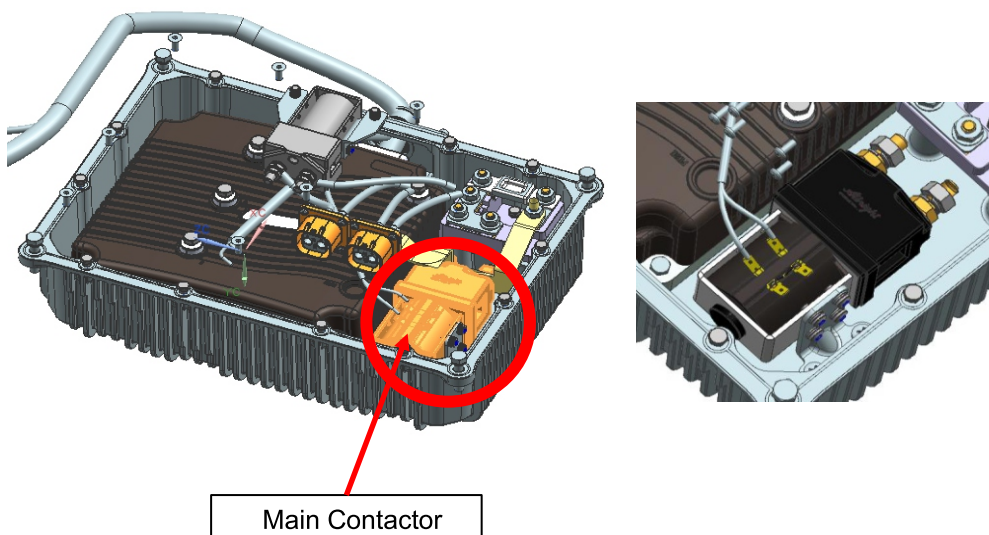
1. Pin 1 of Motor Temperature Sensor Connector and Pin 8 of Motor Controller Connector.
2. Pin 2 of Motor Temperature Sensor Connector and Pin 7 of Motor Controller Connector.

Yes	No
Replace Motor Controller	Check wiring and Rectify


Error Code 31: Coil1 Driver Open/Short

Normal Operations	Main Contactor provide the supply from Battery Pack to Motor Controller
ERROR CODE Detecting Conditions	Any short circuit in motor Controller or in Main Contractor
Probable Cause	1 Open or short on driver load. 2. Dirty connector pins. 3. Bad crimps or faulty wiring.
Lamp status	Malfunction tell-tale lamp will blink
ERROR CODE Reaction	Motor Shutdown & Vehicle Will not move
Healing Conditions	Rectify fault

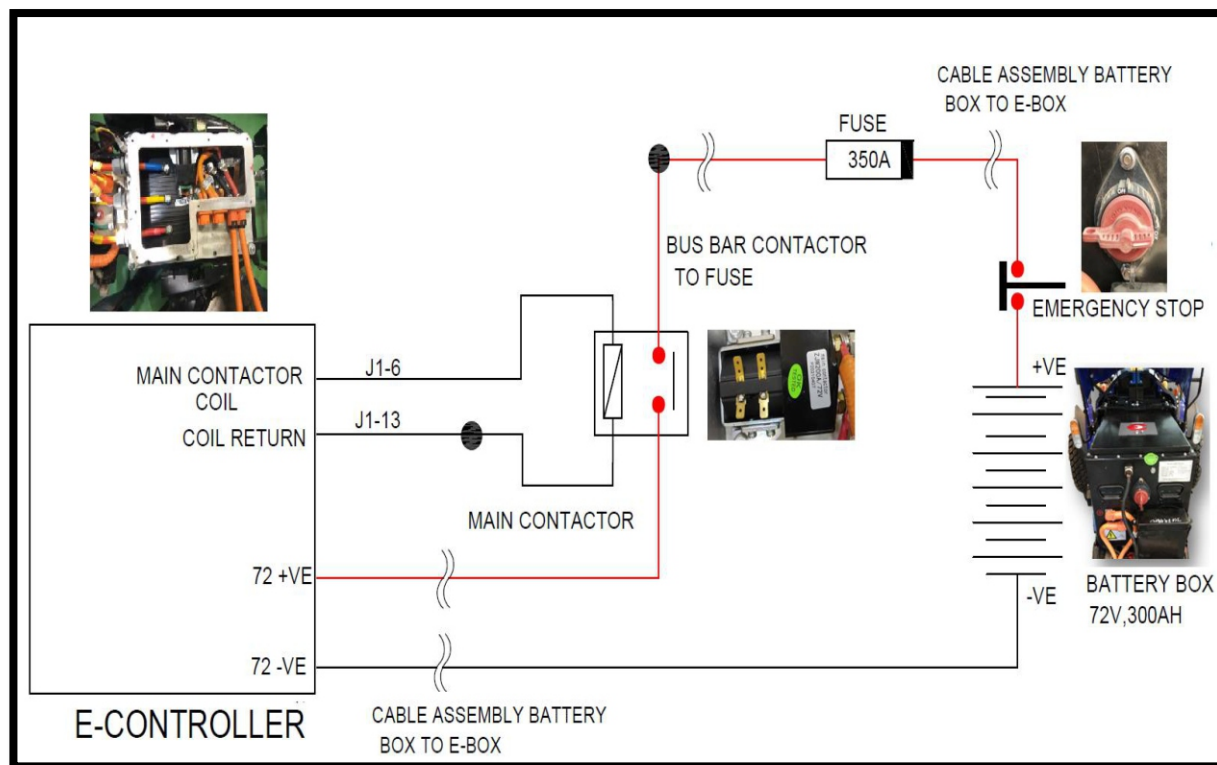
Component Location:



Connector View

Description	connector PIC	Connector Number	No. of Pins	Function
MAIN CONNECTOR COIL		TB-6.4FP (DIMPLE)= 2NOS. CAP-FMC= 2NOS.	2 PINS	To connect with Main contactor coil

Wiring Layout



Step 1: Connect Diagnostic tool and note down the ERROR CODE. If ERROR CODE is present, go to step 2.

YES	NO
STEP 2	Clear the ERROR CODE .

Step 2: Check the setting in Drive Menu

Main Enable- ON

YES	NO
STEP 3	Write the same and Check again

Step 3: Check the Resistance of Main Contactor Coil between Pin J1-6 and Pin J1-13 of Motor Controller Connector.

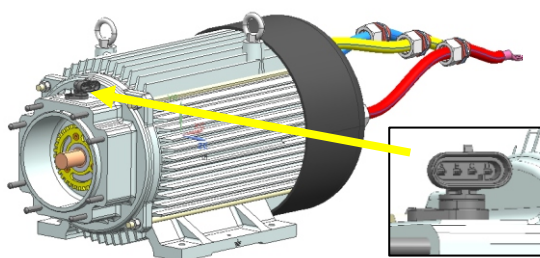
It should be 150 ohms.

YES	NO
Replace Motor Controller	Replace Contactor and check

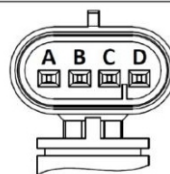
Error Code 36: Encoder Fault

Normal Operations	Encoder provides Motor RPM Feedback to Motor Controller
ERROR CODE Detecting Conditions	If the Speed Encoder input data Malfunctions
Probable Cause	1. Motor encoder failure. 2. Bad crimps or faulty wiring
Lamp status	Malfunction tell-tale lamp will blink
ERROR CODE Reaction	Motor Shutdown & Vehicle Will not move
Healing Conditions	Rectify fault

Component Location:

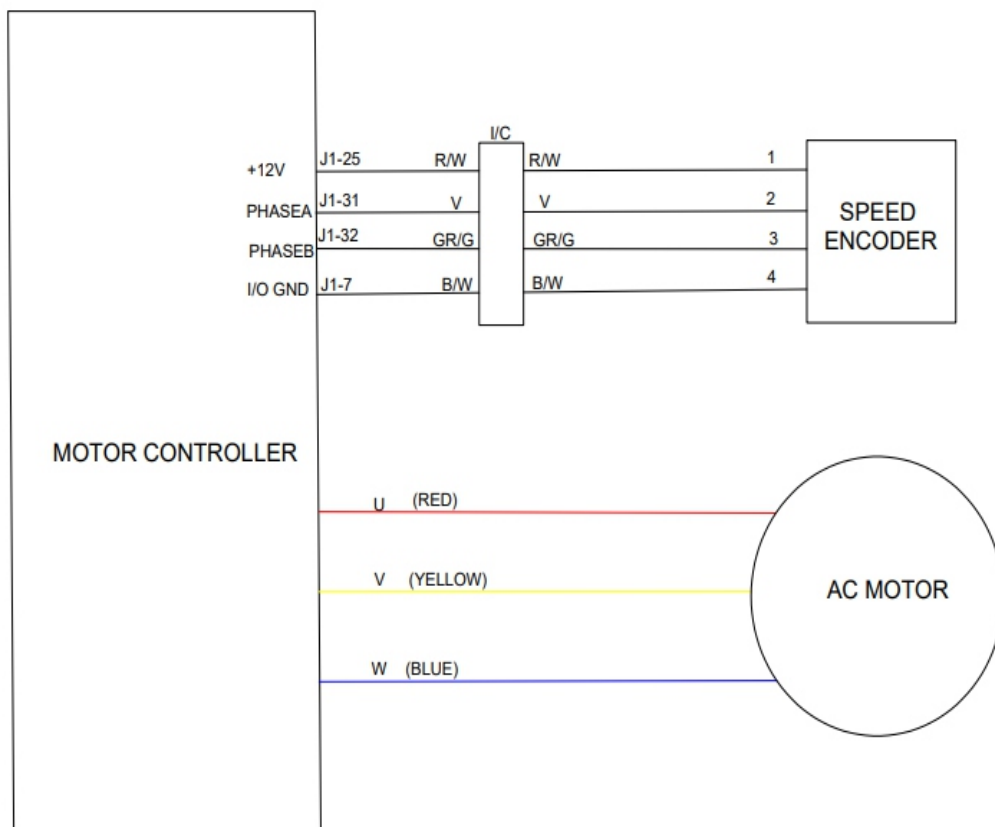


SENSOR ASSEMBLY CONNECTOR DETAILS



PIN No	DESCRIPTION
A	GROUND
B	CHANNEL A
C	CHANNEL B
D	SUPPLY 5V

Wiring dig



Step 1: Connect Diagnostic tool and note down the ERROR CODE. If ERROR CODE is present, go to step 2.

YES	NO
STEP 2	Clear the ERROR CODE

Step 2: Disconnect IC Pigtail (which is going to motor) and then turn ON IGN Check the Voltage Between 1 and 4 (On the connector which is going towards Motor controller) it should be 12 Volts

YES	NO
STEP 2	Check for wiring Damage, Rectify it and then check for Tractor working.

Step 3: Check for dirtiness on encoder and also check for the frequency between pin 2 and pin 3 of speed encoder while rotating the gear wheel of motor.
There should be some value and it will increase as the rotating speed increases.

YES	NO
STEP 4	Replace Speed Encoder

Step 4: Replace Motor Controller

Error Code 36: Sin/Cos Sensor Fault

Normal Operations	Encoder provides Motor RPM Feedback to Motor Controller
ERROR CODE Detecting Conditions	If the Speed Encoder input data Malfunctions
Probable Cause	1. Motor encoder failure. 2. Bad crimps or faulty wiring
Lamp status	Malfunction tell-tale lamp will blink
ERROR CODE Reaction	Motor Shutdown & Vehicle Will not move
Healing Conditions	Rectify fault

Step 1: Connect Diagnostic tool and note down the ERROR CODE. If ERROR CODE is present, go to step 2

YES	NO
STEP 2	Clear the ERROR CODE

Step 2: Disconnect IC Pigtail (which is going to motor) and then turn ON IGN Check the Voltage Between 1 and 4 (On the connector which is going towards Motor controller) it should be 12 Volts

YES	NO
STEP 3	Check for wiring Damage, Rectify it and then check for Tractor working.

Step 3: Check for dirtiness on encoder and also check for the frequency between pin 2 and pin 3 of speed encoder while rotating the gear wheel of motor.

There should be some value and it will increase as the rotating speed increases

YES	NO
STEP 4	Replace Speed Encoder

Step 4: Replace Motor Controller

Error Code 37: Motor Open

Normal Operations	Provide forward and reverse movement to the vehicle as per user selection.
ERROR CODE Detecting Conditions	If the motor is short/open.
Probable Cause	1. Motor phase is open. 2. Bad crimps or faulty wiring
Lamp status	Malfunction tell-tale lamp will blink
ERROR CODE Reaction	Motor Shutdown & Vehicle Will not move
Healing Conditions	Rectify fault

Step 1: Connect Diagnostic tool and note down the ERROR CODE. If ERROR CODE is present, go to step 2.

YES	NO
STEP 2	Clear the ERROR CODE

Step 2: Turn OFF the IGN and Check the resistance between R-Y, Y-B and B-R it should be <9 mili ohms.

YES	NO
STEP 3	Check for wiring and crimping of Terminals of RYB and rectify

Step 3: Turn OFF the IGN and Check the Insulation between R-G, Y-G and B-G (here G refers to Ground) at Voltage 500 volts.

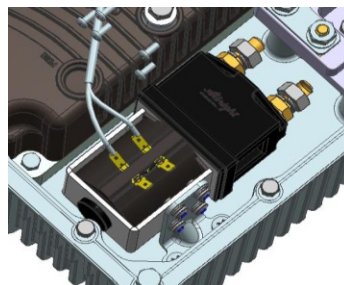
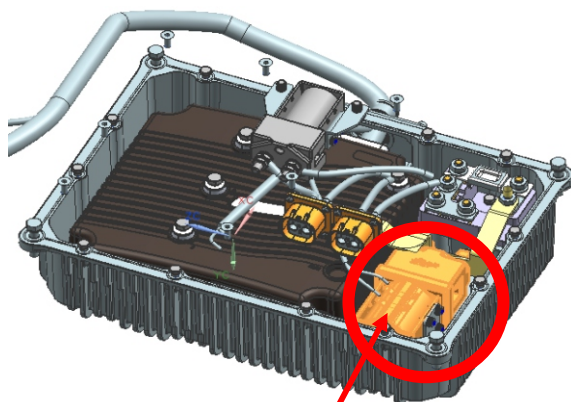
YES	NO
STEP 4	Replace Motor

Step 4: : Replace Motor Controller

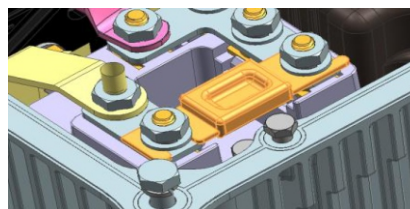
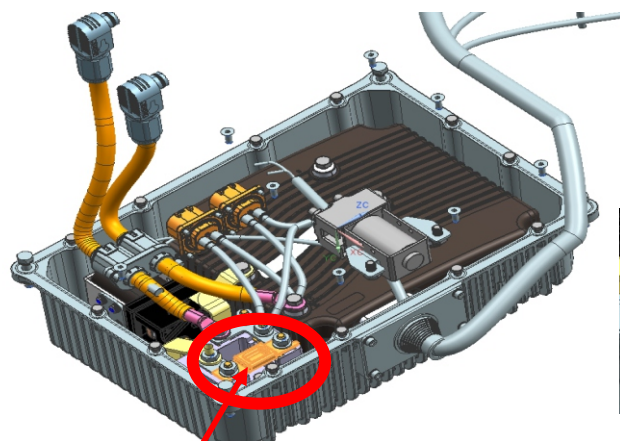
Error Code 38: Main Contactor Welded

Normal Operations	When vehicle is authenticated MOTOR CONTROLLER provides ground signal to contactor coil
ERROR CODE Detecting Conditions	Contactor not switching off after IGN Turn OFF
Probable Cause	<ol style="list-style-type: none"> 1. Main contactor tips are welded closed. 2. Motor phase U or V is disconnected or open. 3. An alternate voltage path (such as an external precharge resistor) is providing a current to the capacitor bank (B+ connection terminal).
Lamp status	Malfunction tell-tale lamp will blink
ERROR CODE Reaction	Motor Shutdown & Vehicle Will not move
Healing Conditions	Rectify fault

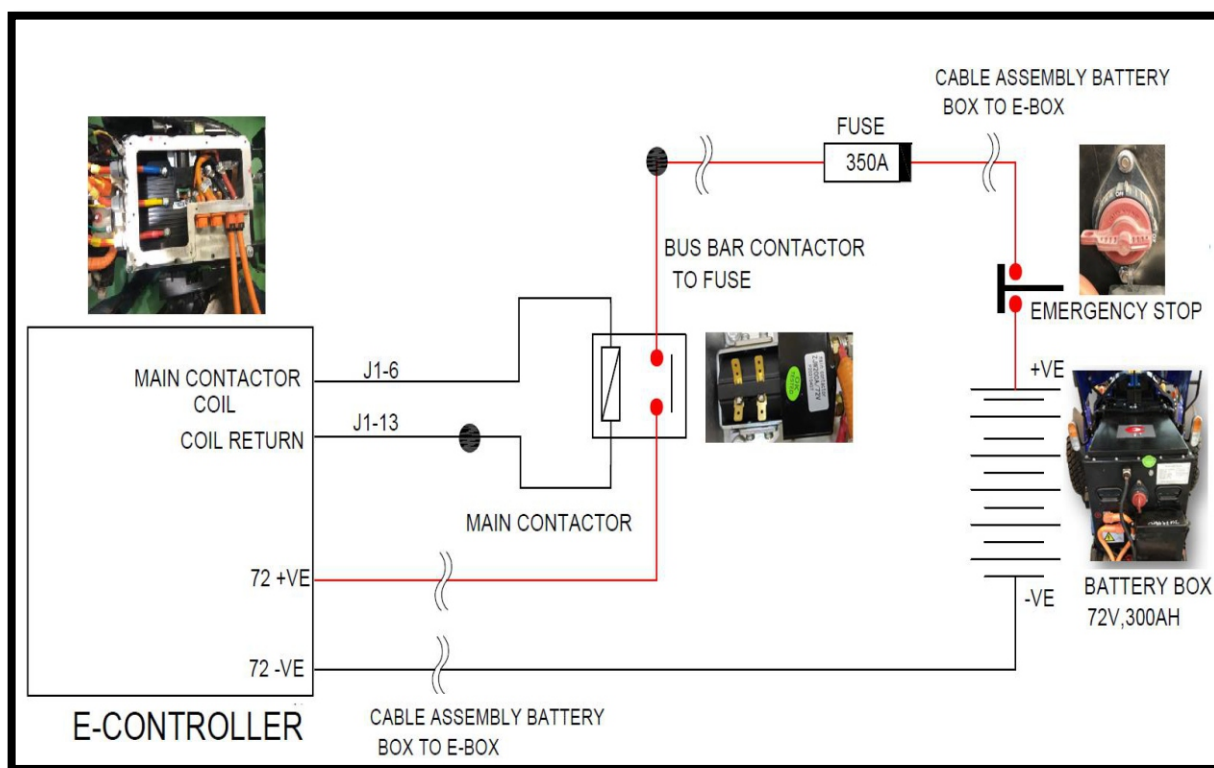
Component Location




Main Contactor



350A Fuse

Wiring Layout:**Connector View**

Description	connector PIC	Connector Number	No. of Pins	Function
MAIN CONNECTOR COIL		TB-6.4FP (DIMPLE)= 2NOS. CAP-FMC= 2NOS.	2 PINS	To connect with Main contactor coil

Step 1: Connect Diagnostic tool and note down the ERROR CODE. If ERROR CODE is present, go to step 2.

YES	NO
STEP 2	Clear the ERROR CODE

Step 3: Check the Resistance between Pin J1-6 and Pin J1-13 of Motor Controller.

It should be 150 ohms.

YES	NO
STEP 3	Replace Contactor and check

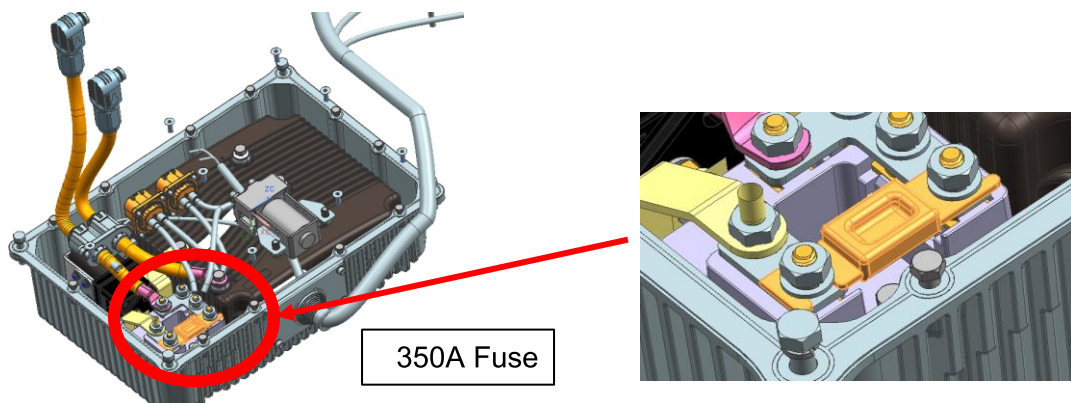
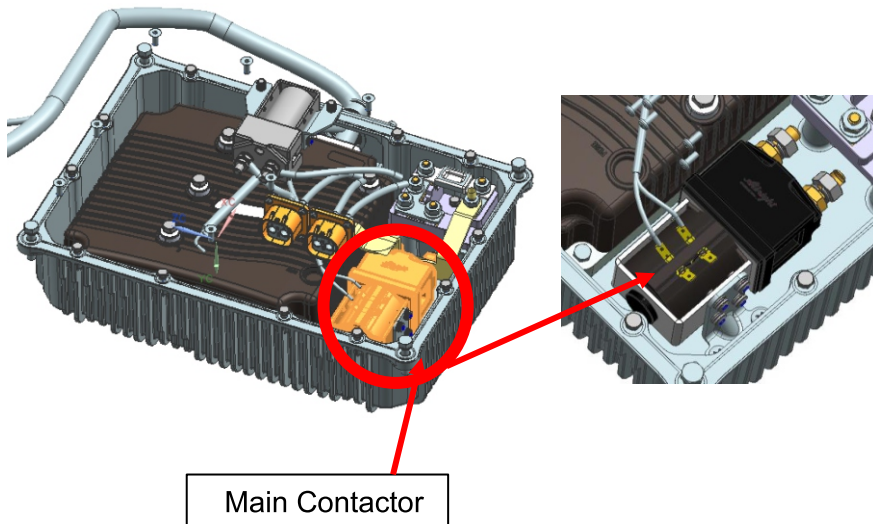
Step 3: Check the continuity Between Terminals of Main Contactor.

YES	NO
Replace Main Contactor	Replace Motor Controller

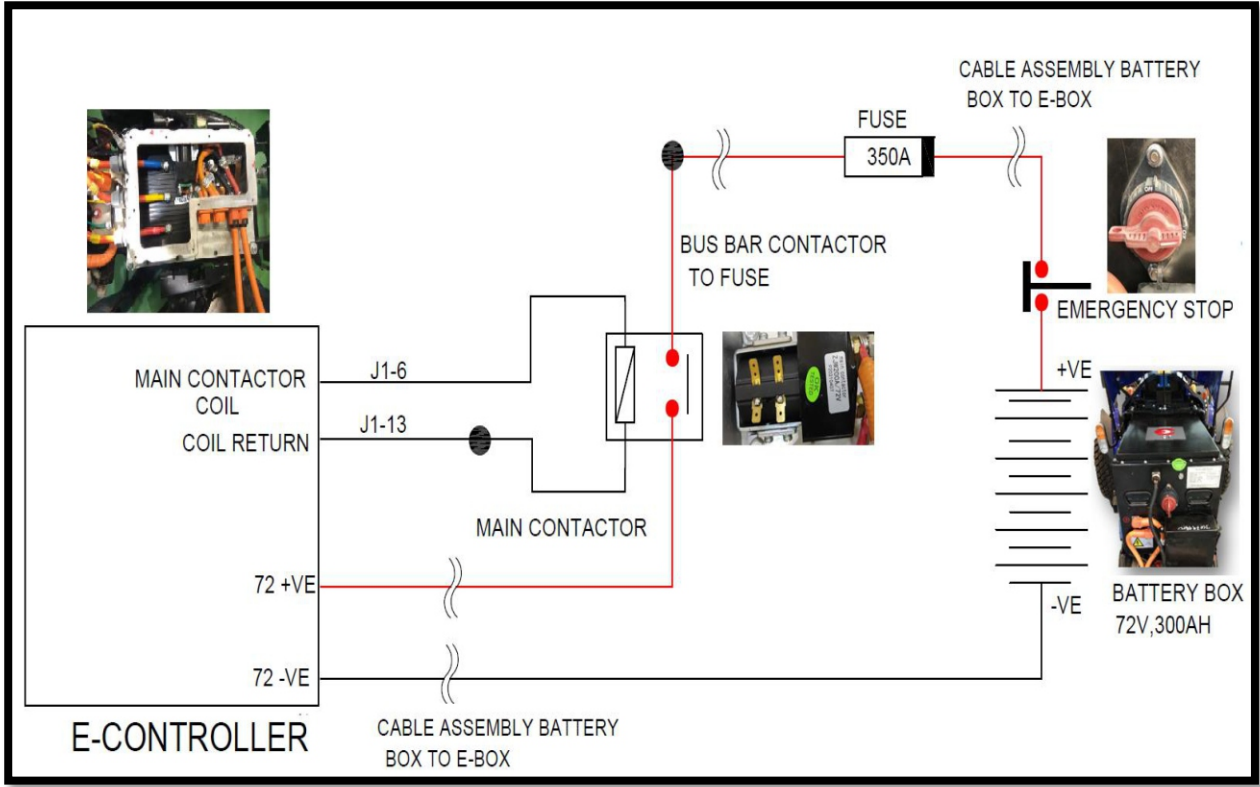
Error Code 39: Main Contactor Did Not Close

Normal Operations	When vehicle is authenticated MOTOR CONTROLLER provides ground signal to contactor coil.
ERROR CODE Detecting Conditions	Contactor not switching off after IGN Turn OFF
Probable Cause	<ol style="list-style-type: none"> 1. Main contactor coil is not getting adequate supply 2. Main contactor tips are oxidized, burned, or not making good contact. 3. External load on capacitor bank (B+ connection terminal) that prevents capacitor bank from charging. 4. Blown B+ fuse
Lamp status	Malfunction tell-tale lamp will blink
ERROR CODE Reaction	Motor Shutdown & Vehicle Will not move
Healing Conditions	Rectify fault


Component Location:



Wiring Layout:



Connector View

Description	connector PIC	Connector Number	No. of Pins	Function
MAIN CONNECTOR COIL		TB-6.4FP (DIMPLE)= 2NOS. CAP-FMC= 2NOS.	2 PINS	To connect with Main contactor coil

Step 1: Connect Diagnostic tool and note down the ERROR CODE. If ERROR CODE is present, go to step 2.

YES	NO
STEP 2	Clear the ERROR CODE

Step 2: Check for the Main Fuse in B+ (350amps)
B+ Fuse=Blown?

YES	NO
Check for the Cause and Replace the Main Fuse.	STEP 3

Step 3: Check the Continuity Between Pin 30 of KSI Relay and Battery +ve Terminal of Main Fuse
(Present in E- Box

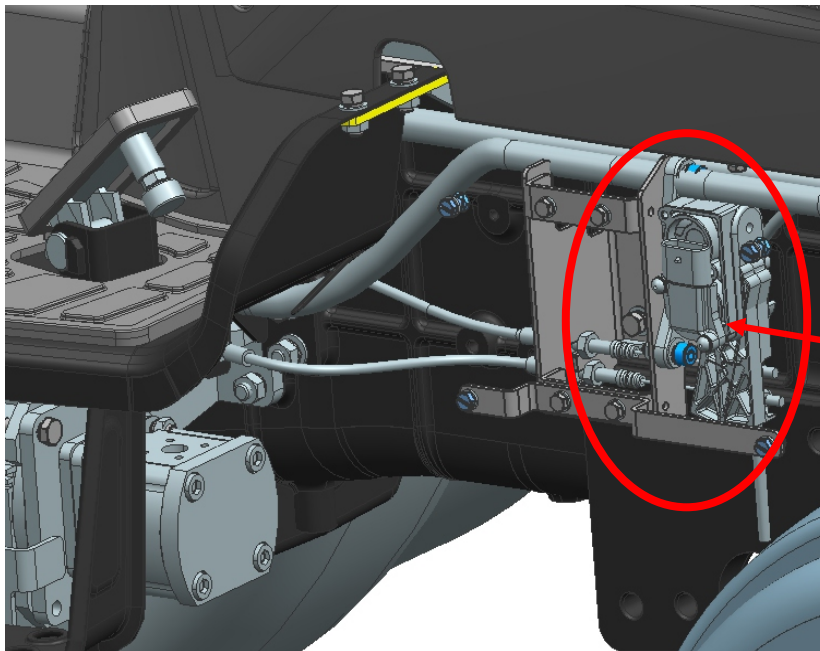
YES	NO
STEP 4	Check Wiring and Rectify

Step 4: Check the Voltages at the thimble of Main Contactor.
It should be 72 Volts

YES	NO
Replace the main contractor.	Replace Main Controller

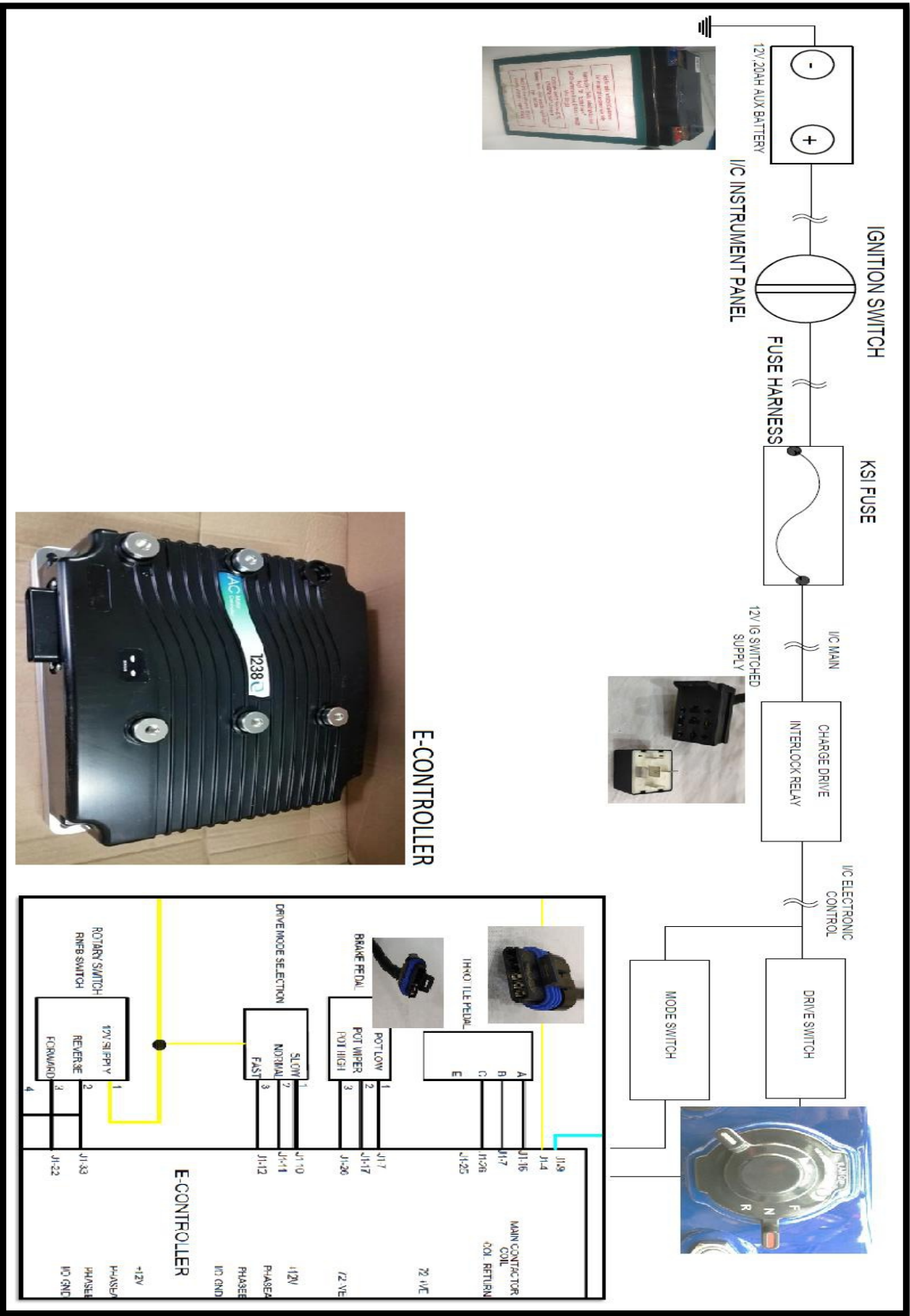
Error Code 41: Throttle Wiper High

Normal Operations	Pot should read the value less than the set value in the MOTOR CONTROLLER while Pedal is pressed fully
ERROR CODE Detecting Conditions	if the pot reading more than set value in MOTOR CONTROLLER
Probable Cause	1. Throttle pot wiper voltage too high. 2. Defective Throttle Pot.
Lamp status	Malfunction tell-tale lamp will blink
ERROR CODE Reaction	Motor Shutdown & Vehicle Will not move
Healing Conditions	Rectify fault


Component Location:

Throttle sensor

Wiring Layout:



Connector View

Description	Connector PIC	Connector Number	No. of Pins	Function
Harness Assembly Auxiliary Battery		C-315 2PLMNY=1 NOS	2 pin	To interconnect with Dashboard wiring harness
Harness Assembly Auxiliary Battery		C-315 2PLMNY=1 NOS	2 pin	To interconnect with Dashboard wiring harness
Harness Assembly Instrument Panel		C-315 2PLFNY= 1Nos.	1 PINS	To interconnect with Aux Battery
Harness Assembly Instrument Panel		CONN-423102000103-1Nos. BLACK C-315 2PLMNY= 1Nos.	2 PINS	To interconnect with Aux Battery
Harness Assembly Instrument Panel		CONN-420916030303-01NOS BLACK C-90 WP16MPNY CONNECTOR	16 PINS	To interconnect with Harness assembly main
Harness Assembly Instrument Panel		CONN-422508930003-01NOS BLACK C-250 8PMNY	8 PINS	To interconnect with wiring harness Main
Harness Assembly Main		CONN-420916035403-01NOS BLACK C-090 WP16PFPNY	16 PINS	To interconnect with Instrument panel wiring harness with Harness Assembly Main
Harness Assembly Main		CONN-422508035003-01NOS BLACK C-250 8PFNY(FD)	8 PINS	To interconnect with Instrument panel wiring harness with Harness Assembly Main
RELAY1863000015(MINI RELAY CHARGE DRIVE INTERLOCK RELAY)		TT PRB-6 TTPL TB-6.4FP=4NOS. (BASE -429905095015-BLACK)	5 PINS	To connect relay for disconnecting KSI signal to controller during charging
I/C CONTROLLER		CONN-420916030303 BLACK C-090 WP16PMPNY	16 PINS	To interconnect with wiring Harness Dashboard.
THROTTLE		12162261 C-150 WP6PFNY-B (DPES-PTS)	6 PINS	To connect with throttle assembly
REGEN BRAKING		12066317 6P FM BLK CON ASSY 150 SERIES DELPHI BRAKE	6 PINS	To connect with brake throttle
DRIVE SWITCH		C-090 WP4PFNY-B= 1NOS. TT-WP090F= 4NOS.	4 PINS	To connect with drive switch (Slow, Normal & Fast)
MODE SWITCH		C-090 WP3PFPBT-B= 1NOS.	3 PINS	To connect with Mode switch (FNR)

Step 1: Connect Diagnostic tool and note down the ERROR CODE. If ERROR CODE is present, go to step 2.

YES	NO
STEP 2	Clear the ERROR CODE

Step 2: Check the continuity Between

- Pin A of throttle pedal sensor and Pin J1-16 of Motor Controller.
- Pin B of throttle pedal sensor and Pin J1-7 of Motor Controller.
- Pin C of throttle pedal sensor and Pin J1-26 of Motor Controller.
- Pin E of throttle pedal sensor and Pin J1-25 of Motor Controller.

YES	NO
STEP 3	Check Wiring and Rectify

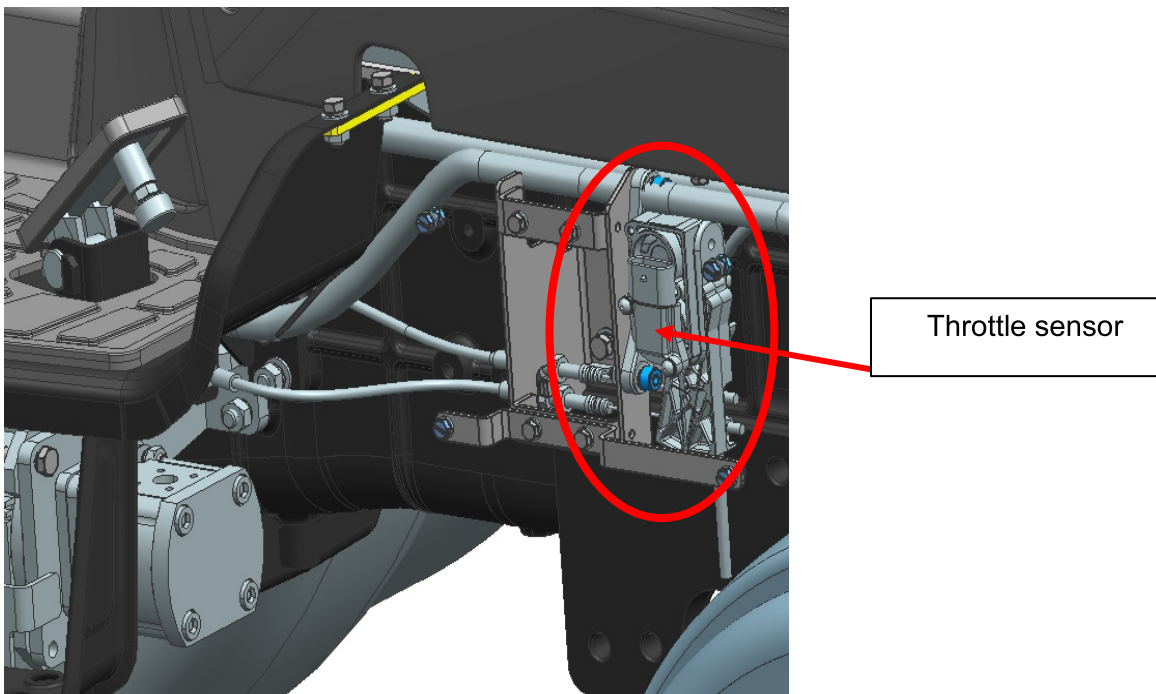
Step 2: Check Voltage Between Pin J1-7 and Pin J1-26 it should varies between 0-5 Volts as per the Throttle Pedal Movement.

(This Voltage need to be checked from the back side of connector)

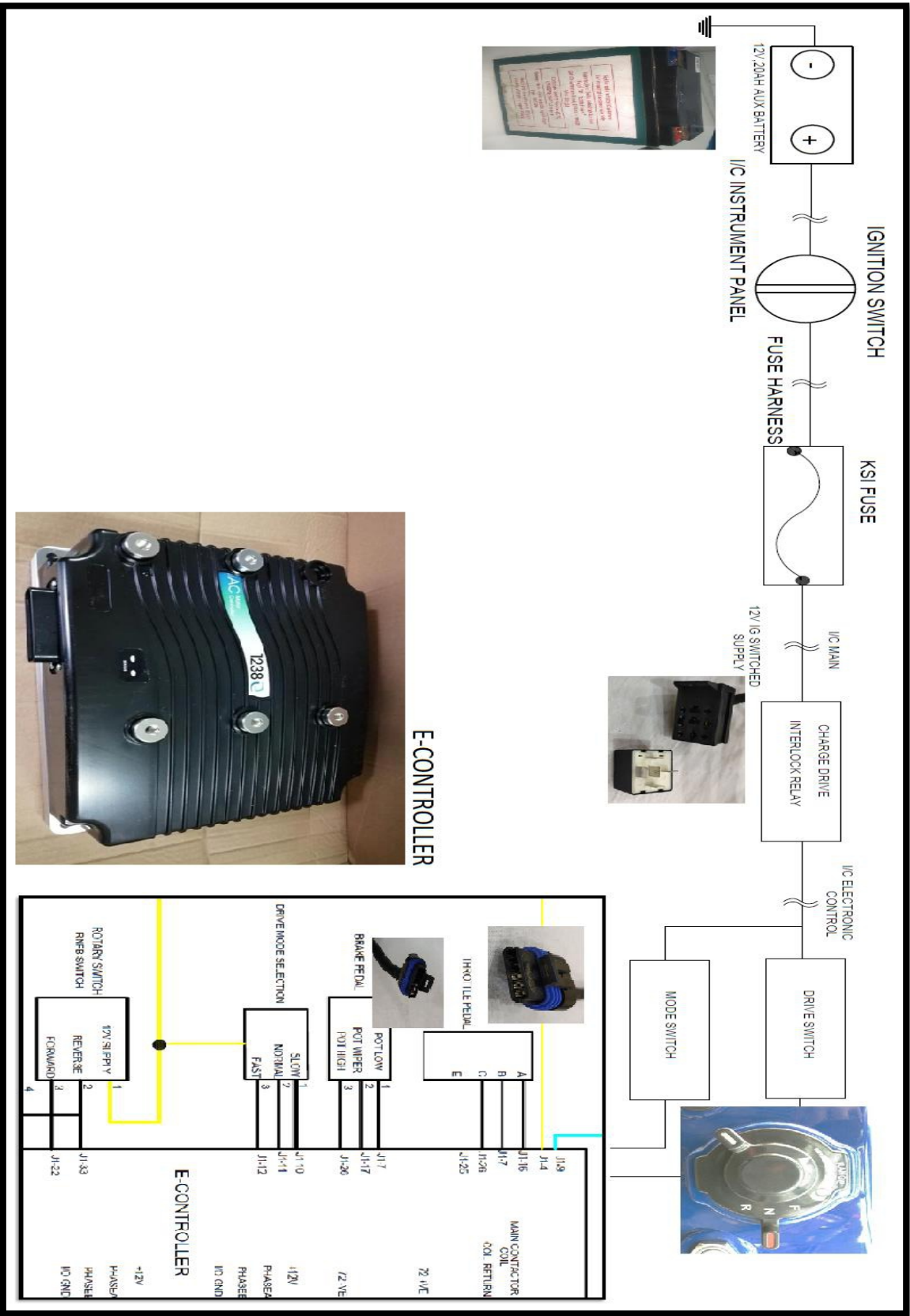
YES	NO
Replace Controller	Replace Throttle

Error Code 42: Throttle Wiper Low

Normal Operations	Pot should read the value less than the set value in the MOTOR CONTROLLER while Pedal is pressed fully
ERROR CODE Detecting Conditions	if the pot reading more than set value in MOTOR CONTROLLER
Probable Cause	1. Throttle pot wiper voltage too high. 2. Defective Throttle Pot.
Lamp status	Malfunction tell-tale lamp will blink
ERROR CODE Reaction	Motor Shutdown & Vehicle Will not move
Healing Conditions	Rectify fault

Component Location:

Wiring Layout:



Connector View

Description	Connector PIC	Connector Number	No. of Pins	Function
Harness Assembly Auxiliary Battery		C-315 2PLMNY=1 NOS	2 pin	To interconnect with Dashboard wiring harness
Harness Assembly Auxiliary Battery		C-315 2PLMNY=1 NOS	2 pin	To interconnect with Dashboard wiring harness
Harness Assembly Instrument Panel		C-315 2PLFNY= 1Nos.	1 PINS	To interconnect with Aux Battery
Harness Assembly Instrument Panel		CONN-423102000103-1Nos. BLACK C-315 2PLMNY= 1Nos.	2 PINS	To interconnect with Aux Battery
Harness Assembly Instrument Panel		CONN-420916030303-01NOS BLACK C-90 WP16MPNY CONNECTOR	16 PINS	To interconnect with Harness assembly main
Harness Assembly Instrument Panel		CONN-422508930003-01NOS BLACK C-250 8PMNY	8 PINS	To interconnect with wiring harness Main
Harness Assembly Main		CONN-420916035403-01NOS BLACK C-090 WP16PFPNY	16 PINS	To interconnect with Instrument panel wiring harness with Harness Assembly Main
Harness Assembly Main		CONN-422508035003-01NOS BLACK C-250 8PFNY(FD)	8 PINS	To interconnect with Instrument panel wiring harness with Harness Assembly Main
RELAY1863000015(MINI RELAY CHARGE DRIVE INTERLOCK RELAY)		TT PRB-6 TTPL TB-6.4FP=4NOS. (BASE -429905095015-BLACK)	5 PINS	To connect relay for disconnecting KSI signal to controller during charging
I/C CONTROLLER		CONN-420916030303 BLACK C-090 WP16PMPNY	16 PINS	To interconnect with wiring Harness Dashboard.
THROTTLE		12162261 C-150 WP6PFNY-B (DPES-PTS)	6 PINS	To connect with throttle assembly
REGEN BRAKING		12066317 6P FM BLK CON ASSY 150 SERIES DELPHI BRAKE	6 PINS	To connect with brake throttle
DRIVE SWITCH		C-090 WP4PFNY-B=1NOS. TT-WP090F= 4NOS.	4 PINS	To connect with drive switch (Slow, Normal & Fast)
MODE SWITCH		C-090 WP3PFPBT-B=1NOS.	3 PINS	To connect with Mode switch (FNR)

Step 1: Connect Diagnostic tool and note down the ERROR CODE. If ERROR CODE is present, go to step 2.

YES	NO
STEP 2	Clear the ERROR CODE

Step 2: Check the continuity Between

- Pin A of throttle pedal sensor and Pin J1-16 of Motor Controller.
- Pin B of throttle pedal sensor and Pin J1-7 of Motor Controller.
- Pin C of throttle pedal sensor and Pin J1-26 of Motor Controller.
- Pin E of throttle pedal sensor and Pin J1-25 of Motor Controller.

YES	NO
STEP 3	Check Wiring and Rectify

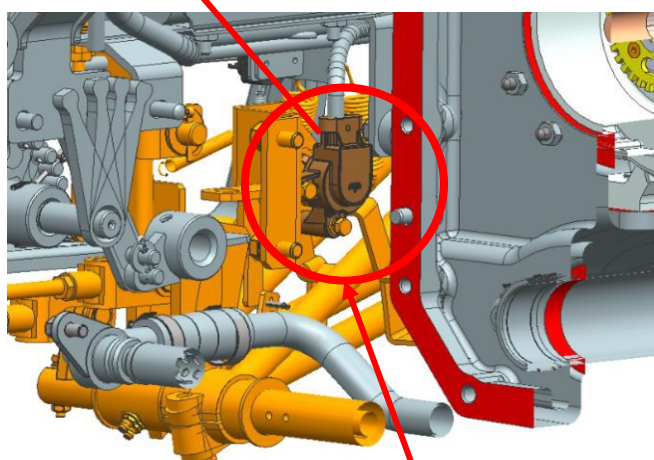
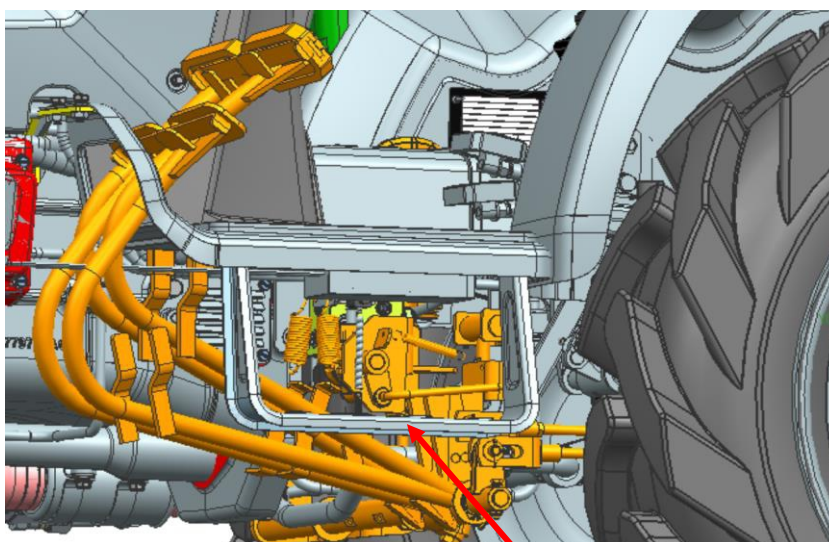
Step 2: Check Voltage Between Pin J1-7 and Pin J1-26 it should varies between 0-5 Volts as per the Throttle Pedal Movement.

(This Voltage need to be checked from the back side of connector)

YES	NO
Replace Controller	Replace Throttle

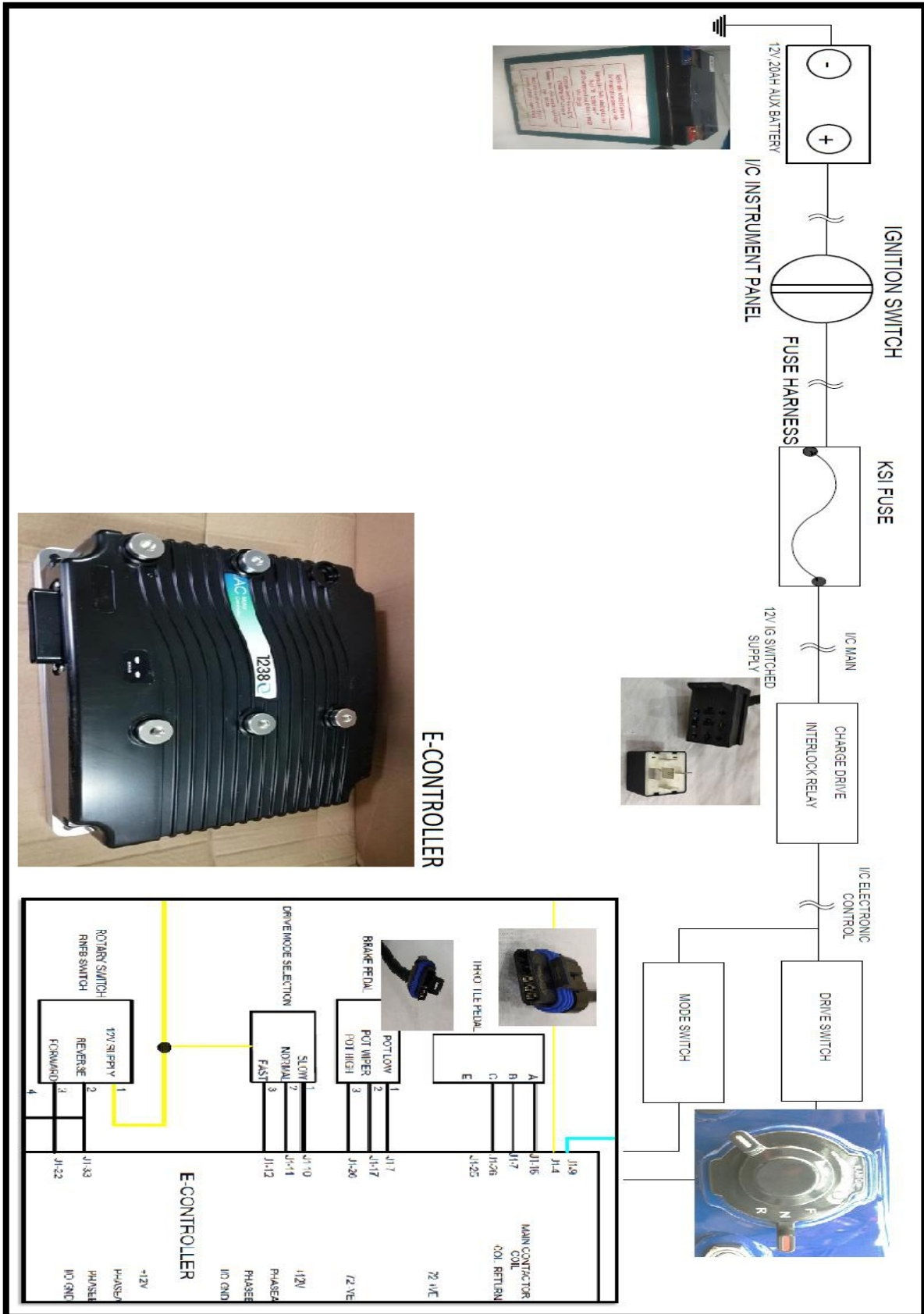
Error Code 43: Pot2 Wiper High

Normal Operations	Pot should read the value less than the set value in the MOTOR CONTROLLER while Brake Pedal is pressed fully
ERROR CODE Detecting Conditions	The measured value of the brake pot 0 to 5 volts. And if the actual pot reading is more than the set value
Probable Cause	1 Potentiometer may get damage 2. Potentiometer is not getting 5V supply from controller 3. Controller is not getting Wiper (Output) from controller
Lamp status	Malfunction tell-tale lamp will blink
ERROR CODE Reaction	Motor Shutdown & Vehicle Will not move
Healing Conditions	Rectify fault

Component Location:

Brake Pedal sensor

Wiring Layout:



Connector View

Description	Connector PIC	Connector Number	No. of Pins	Function
Harness Assembly Auxiliary Battery		C-315 2PLMNY=1 NOS	2 pin	To interconnect with Dashboard wiring harness
Harness Assembly Auxiliary Battery		C-315 2PLMNY=1 NOS	2 pin	To interconnect with Dashboard wiring harness
Harness Assembly Instrument Panel		C-315 2PLFNY= 1Nos.	1 PINS	To interconnect with Aux Battery
Harness Assembly Instrument Panel		CONN-423102000103-1Nos. BLACK C-315 2PLMNY= 1Nos.	2 PINS	To interconnect with Aux Battery
Harness Assembly Instrument Panel		CONN-420916030303-01NOS BLACK C-90 WP16MPNY CONNECTOR	16 PINS	To interconnect with Harness assembly main
Harness Assembly Instrument Panel		CONN-422508930003-01NOS BLACK C-250 8PMNY	8 PINS	To interconnect with wiring harness Main
Harness Assembly Main		CONN-420916035403-01NOS BLACK C-090 WP16PFPNY	16 PINS	To interconnect with Instrument panel wiring harness with Harness Assembly Main
Harness Assembly Main		CONN-422508035003-01NOS BLACK C-250 8PFPNY(FD)	8 PINS	To interconnect with Instrument panel wiring harness with Harness Assembly Main
RELAY1863000015(MINI RELAY CHARGE DRIVE INTERLOCK RELAY)		TT PRB-6 TTPL TB-6.4FP=4NOS. (BASE -429905095015-BLACK)	5 PINS	To connect relay for disconnecting KSI signal to controller during charging
I/C CONTROLLER		CONN-420916030303 BLACK C-090 WP16PMPNY	16 PINS	To interconnect with wiring Harness Dashboard.
THROTTLE		12162261 C-150 WP6PFPNY-B (DPES-PTS)	6 PINS	To connect with throttle assembly
REGEN BRAKING		12066317 6P FM BLK CON ASSY 150 SERIES DELPHI BRAKE	6 PINS	To connect with brake throttle
DRIVE SWITCH		C-090 WP4PFPNY-B=1NOS. TT-WP090F= 4NOS.	4 PINS	To connect with drive switch (Slow, Normal & Fast)
MODE SWITCH		C-090 WP3PFPBT-B=1NOS.	3 PINS	To connect with Mode switch (FNR)

Step 1: Connect Diagnostic tool and note down the ERROR CODE. If ERROR CODE is present, go to step 2.

YES	NO
STEP 2	Clear the ERROR CODE

YES	NO
STEP 3	Check continuity Between Pin1 of Brake Pedal sensor connector and J1-7 of Motor controller Pin2 of Brake Pedal sensor connector and J1-17 of Motor controller Pin3 of Brake Pedal sensor connector and J1-26 of Motor controller If continuity Found Replace Motor Controller

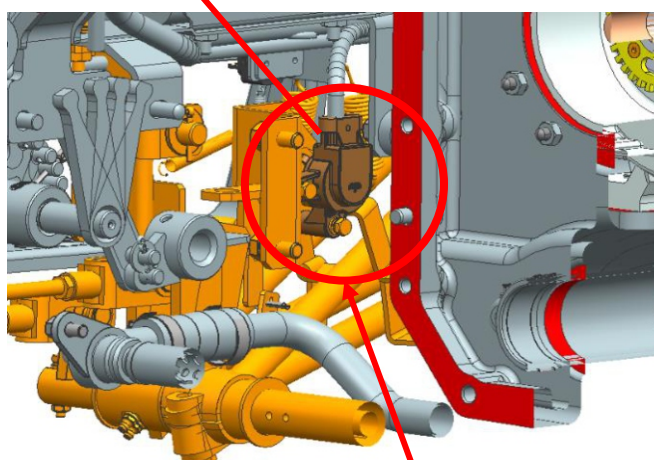
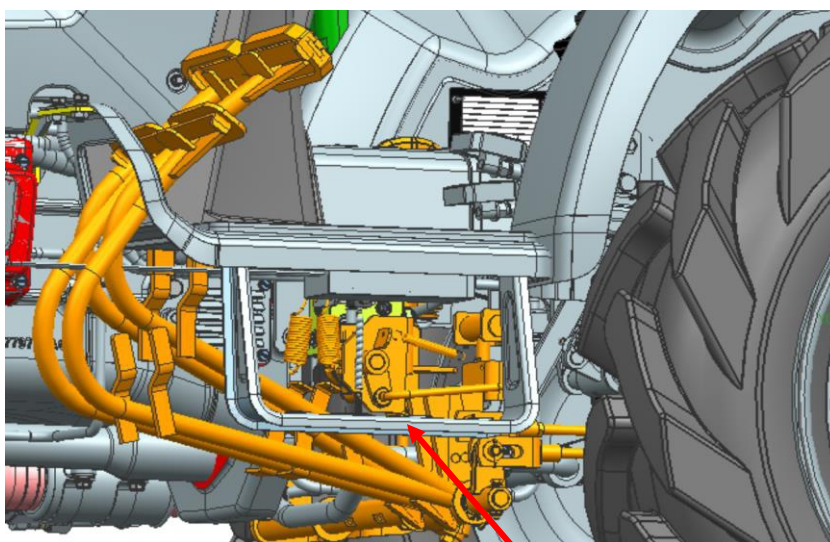
Step 3: Check Voltage Between Pin1 and Pin2 of Brake pedal connector, it should varies between 0-5 Volts as per the Brake Pedal Movement.

(This Voltage need to be checked from the back side of connector in connector connected condition)

YES	NO
Replace Motor Controller	Replace Brake Pedal throttle

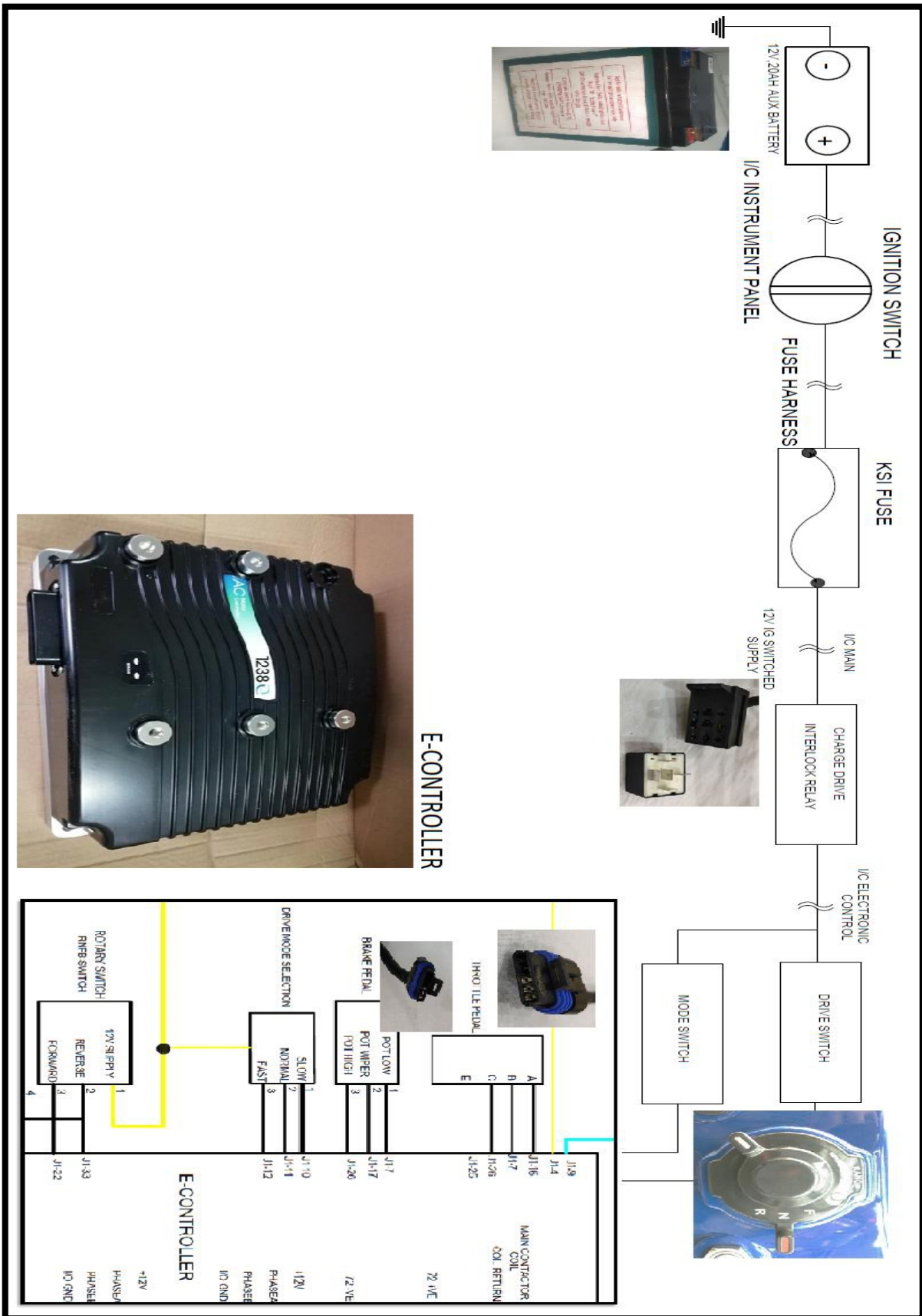
Error Code 43: Pot2 Wiper High

Normal Operations	Pot should read the value less than the set value in the MOTOR CONTROLLER while Pedal is pressed fully
ERROR CODE Detecting Conditions	The measured value of the brake pot 0 to 5 volts. And if the actual pot readings is more than the set value
Probable Cause	1 Potentiometer may get damage 2. Potentiometer is not getting 5V supply from controller 3. Controller is not getting Wiper (Output) from controller
Lamp status	Malfunction tell-tale lamp will blink
ERROR CODE Reaction	Motor Shutdown & Vehicle Will not move
Healing Conditions	Rectify fault

Component Location:

Brake Pedal sensor

Wiring Layout:



Connector View

Description	Connector PIC	Connector Number	No. of Pins	Function
Harness Assembly Auxiliary Battery		C-315 2PLMNY=1 NOS	2 pin	To interconnect with Dashboard wiring harness
Harness Assembly Auxiliary Battery		C-315 2PLMNY=1 NOS	2 pin	To interconnect with Dashboard wiring harness
Harness Assembly Instrument Panel		C-315 2PLFNY= 1Nos.	1 PINS	To interconnect with Aux Battery
Harness Assembly Instrument Panel		CONN-423102000103-1Nos. BLACK C-315 2PLMNY= 1Nos.	2 PINS	To interconnect with Aux Battery
Harness Assembly Instrument Panel		CONN-420916030303-01NOS BLACK C-90 WP16MPNY CONNECTOR	16 PINS	To interconnect with Harness assembly main
Harness Assembly Instrument Panel		CONN-422508930003-01NOS BLACK C-250 8PMNY	8 PINS	To interconnect with wiring harness Main
Harness Assembly Main		CONN-420916035403-01NOS BLACK C-090 WP16PFPNY	16 PINS	To interconnect with Instrument panel wiring harness with Harness Assembly Main
Harness Assembly Main		CONN-422508035003-01NOS BLACK C-250 8PFPNY(FD)	8 PINS	To interconnect with Instrument panel wiring harness with Harness Assembly Main
RELAY1863000015(MINI RELAY CHARGE DRIVE INTERLOCK RELAY)		TT PRB-6 TTPL TB-6.4FP=4NOS. (BASE -429905095015-BLACK)	5 PINS	To connect relay for disconnecting KSI signal to controller during charging
I/C CONTROLLER		CONN-420916030303 BLACK C-090 WP16PMPNY	16 PINS	To interconnect with wiring Harness Dashboard.
THROTTLE		12162261 C-150 WP6PFPNY-B (DPES-PTS)	6 PINS	To connect with throttle assembly
REGEN BRAKING		12066317 6P FM BLK CON ASSY 150 SERIES DELPHI BRAKE	6 PINS	To connect with brake throttle
DRIVE SWITCH		C-090 WP4PFPNY-B=1NOS. TT-WP090F= 4NOS.	4 PINS	To connect with drive switch (Slow, Normal & Fast)
MODE SWITCH		C-090 WP3PFPBT-B=1NOS.	3 PINS	To connect with Mode switch (FNR)

Step 1: : Connect Diagnostic tool and note down the ERROR CODE. If ERROR CODE is present, go to step 2.

YES	NO
STEP 2	Clear the ERROR CODE

YES	NO
STEP 3	Check continuity Between Pin1 of Brake Pedal connector and J1-7 of Motor controller Pin2 of Brake Pedal connector and J1-17 of Motor controller Pin3 of Brake Pedal connector and J1-26 of Motor controller If continuity Found Replace Motor Controller

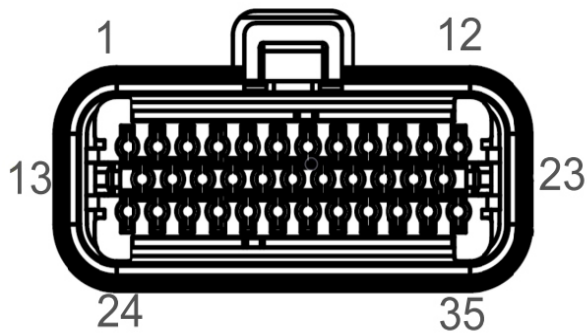
Step 3: Check Voltage between Pin1 and Pin2 of Brake pedal connector, it should varies between 0-5 Volts as per the Brake Pedal Movement.

(This Voltage need to be checked from the back side of connector in connector connected condition)

YES	NO
Replace Motor Controller	Replace Brake Pedal Throttle

Error Code 46: EEPROM Failure

Normal Operations	EEPROM is the internal memory in MOTOR CONTROLLER where all the processes are being stored
ERROR CODE Detecting Conditions	If MOTOR CONTROLLER lose its software/Corrupted VCL
Probable Cause	Failure to write to EEPROM memory
Lamp status	Malfunction tell-tale lamp will blink
ERROR CODE Reaction	Motor Shutdown & Vehicle Will not move
Healing Conditions	Rectify fault

Connector View**MOTOR CONTROLLER**

Step 1: Connect Diagnostic tool and note down the ERROR CODE. If ERROR CODE is present, go to step 2.

YES	NO
SETP 2	Clear the ERROR CODE

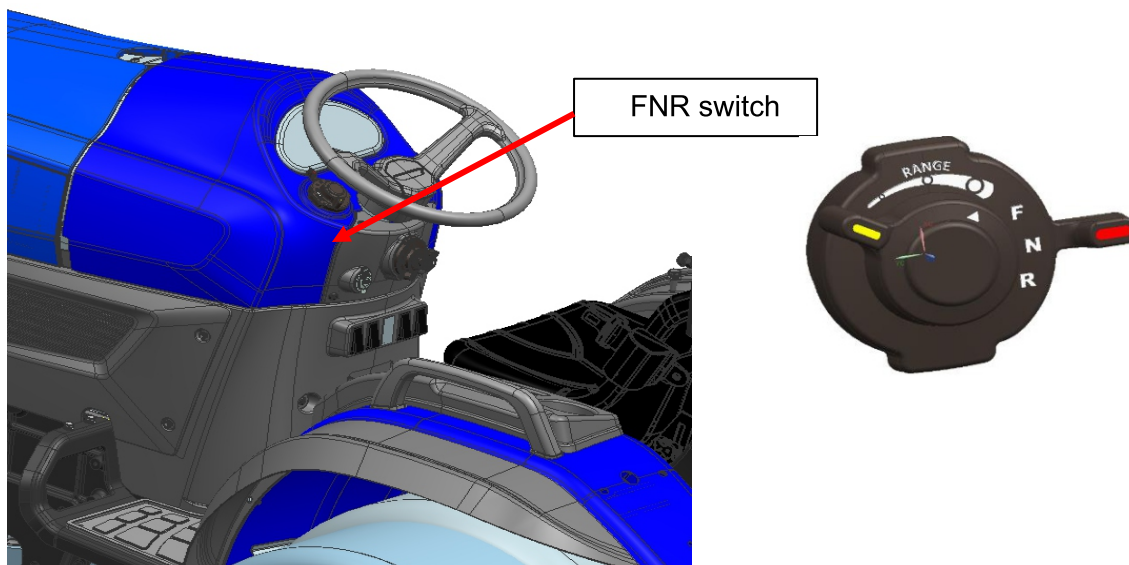
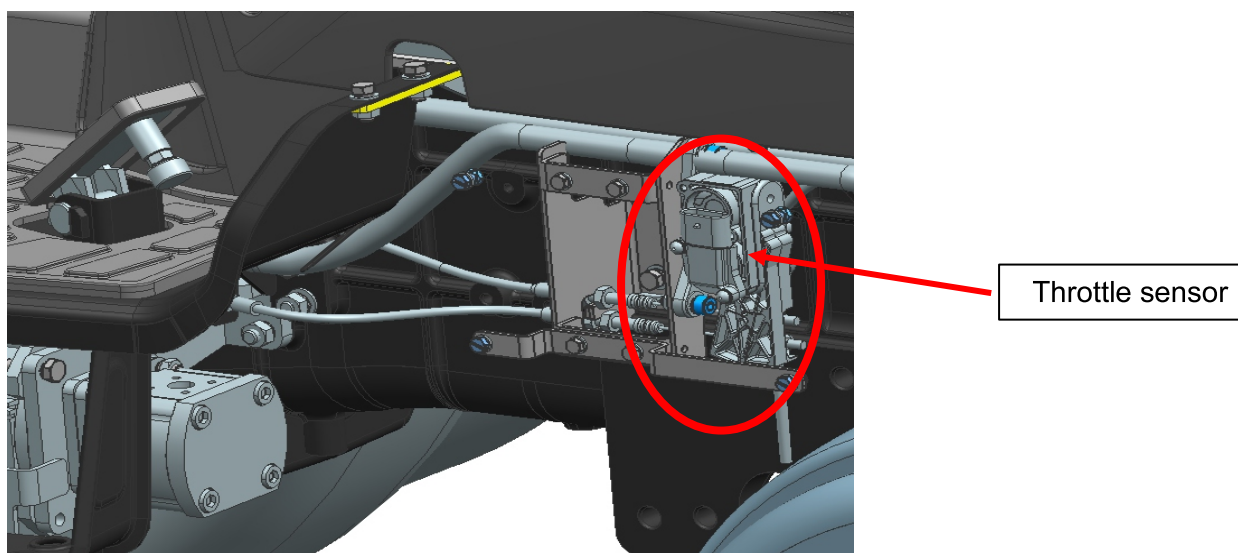
Step 2: Check for the Tractor movement.
Is the Tractor moving?

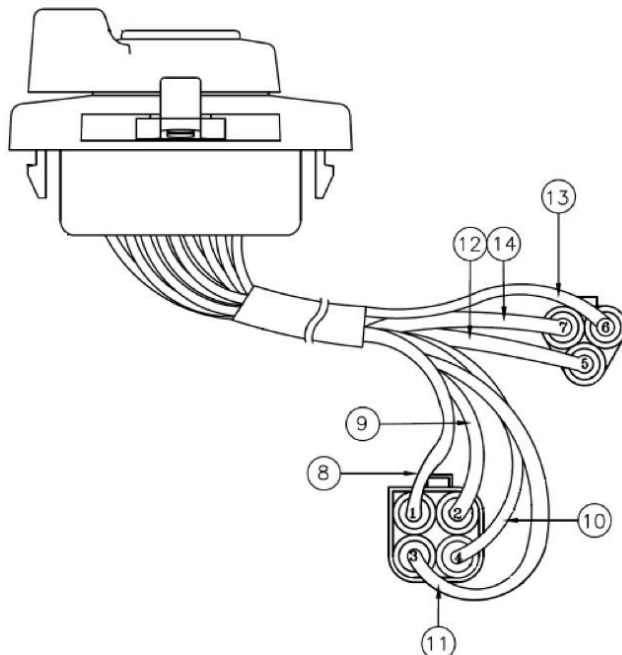
YES	NO
Clear the ERROR CODE and verify	Replace Motor Controller.

Error Code 47: HPD/Sequencing Fault

Normal Operations	FNR has to be in neutral and both pots should read within set value
ERROR CODE Detecting Conditions	HPD/sequence Fault In drive if gear is not in Neutral when Authentication success
Probable Cause	FNR may be engaged Throttle may be engaged
Lamp status	Malfunction tell-tale lamp will blink
ERROR CODE Reaction	Motor Shutdown & Vehicle Will not move
Healing Conditions	Rectify fault

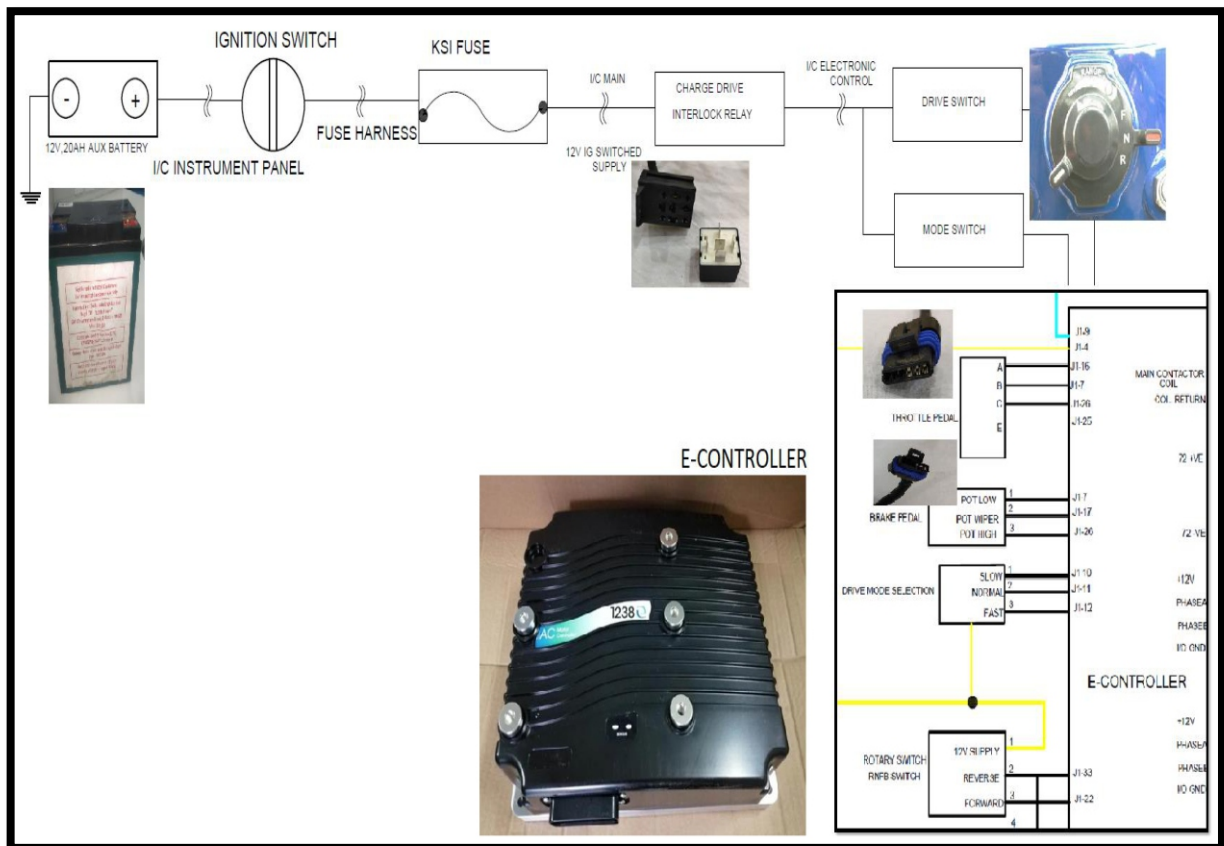
Component Location:




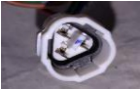


14	CABLE GREEN BLUE (7) F
13	CABLE GREEN BROWN (6) R
12	CABLE BLUE (5) BAT. N
11	CABLE RED WHITE (3) F
10	CABLE BROWN (4) BAT.
9	CABLE GREEN (2) S
8	CABLE BLUE YELLOW (1) N

Wiring Layout



Connector View

Description	Connector PIC	Connector Number	No. of Pins	Function
Harness Assembly Auxiliary Battery		C-315 2PLMNY=1 NOS	2 pin	To interconnect with Dashboard wiring harness
Harness Assembly Auxiliary Battery		C-315 2PLMNY=1 NOS	2 pin	To interconnect with Dashboard wiring harness
Harness Assembly Instrument Panel		C-315 2PLFNY= 1Nos.	1 PINS	To interconnect with Aux Battery
Harness Assembly Instrument Panel		CONN-423102000103-1Nos. BLACK C-315 2PLMNY= 1Nos.	2 PINS	To interconnect with Aux Battery
Harness Assembly Instrument Panel		CONN-420916030303-01NOS BLACK C-90 WP16MPNY CONNECTOR	16 PINS	To interconnect with Harness assembly main
Harness Assembly Instrument Panel		CONN-422508930003-01NOS BLACK C-250 8PMNY	8 PINS	To interconnect with wiring harness Main
Harness Assembly Main		CONN-420916035403-01NOS BLACK C-090 WP16PFPNY	16 PINS	To interconnect with Instrument panel wiring harness with Harness Assembly Main
Harness Assembly Main		CONN-422508035003-01NOS BLACK C-250 8PFNY(FD)	8 PINS	To interconnect with Instrument panel wiring harness with Harness Assembly Main
RELAY1863000015(MINI RELAY CHARGE DRIVE INTERLOCK RELAY)		TT PRB-6 TTPL TB-6.4FP=4NOS. (BASE -429905095015-BLACK)	5 PINS	To connect relay for disconnecting KSI signal to controller during charging
I/C CONTROLLER		CONN-420916030303 BLACK C-090 WP16PMPNY	16 PINS	To interconnect with wiring Harness Dashboard.
THROTTLE		12162261 C-150 WP6PFNY-B (DPES-PTS)	6 PINS	To connect with throttle assembly
REGEN BRAKING		12066317 6P FM BLK CON ASSY 150 SERIES DELPHI BRAKE	6 PINS	To connect with brake throttle
DRIVE SWITCH		C-090 WP4PFNY-B= 1NOS. TT-WP090F= 4NOS.	4 PINS	To connect with drive switch (Slow, Normal & Fast)
MODE SWITCH		C-090 WP3PFPBT-B= 1NOS.	3 PINS	To connect with Mode switch (FNR)

Step 1: Connect Diagnostic tool and note down the ERROR CODE. If ERROR CODE is present, go to step 2.

YES	NO
STEP 2	Clear the ERROR CODE

Step 2: Check the FNR Switch is in Neutral mode and Throttle Pedal Not Pressed.

YES	NO
STEP 2	Bring FNR Switch to neutral and release

Step 3: Check live parameter of motor controller for

- FNR Inputs for Neutral
- Throttle input for not pressed

YES	NO
STEP 4	Replace Motor Controller throttle pedal

Step 4: Check Voltage at FNR Switch between

- Pin 1 of FNR and Pin J1-7 of Motor controller it should be 12 volts in Neutral condition.
- Pin 2 of FNR and Pin J1-7 of Motor controller it should be 0 volts in Neutral condition.
- Pin 3 of FNR and Pin J1-7 of Motor controller it should be 0 volts in Neutral condition.

(This Voltage need to be checked from the back side of connector in connector connected condition)

YES	NO
STEP 5	Change FNR Switch

Step 5: Check Voltage between Pin A and Pin B of Throttle pot, it should be less than 1 volt at ideal condition

(This Voltage need to be checked from the back side of connector in connector connected condition)

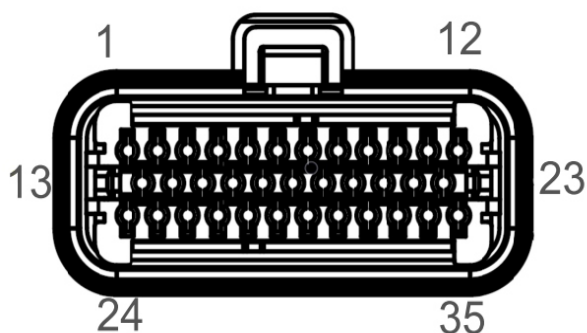
YES	NO
Replace Motor Controller	Replace Throttle Pedal

Error Code 49: Parameter Change Fault

Normal Operations	When vehicle is authenticated MOTOR CONTROLLER provides ground signal to contactor coil.
ERROR CODE Detecting Conditions	This is a safety fault caused by a change in certain parameter settings so that the vehicle will not operate until KSI is cycled.
Probable Cause	This is a safety fault caused by a change in certain parameter settings so that the vehicle will not operate until KSI is cycled
Lamp status	Malfunction tell-tale lamp will blink
ERROR CODE Reaction	Motor Shutdown & Vehicle Will not move
Healing Conditions	Rectify fault

Connector View

MOTOR CONTROLLER

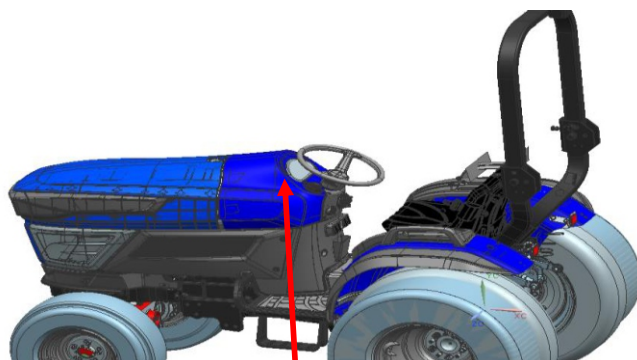


Step 1: Connect Diagnostic tool and note down the ERROR CODE. If ERROR CODE is present, go to step 2.

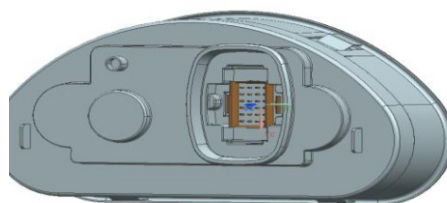
YES	NO
STEP 2	Clear the ERROR CODE

Step 2: Contact Escorts

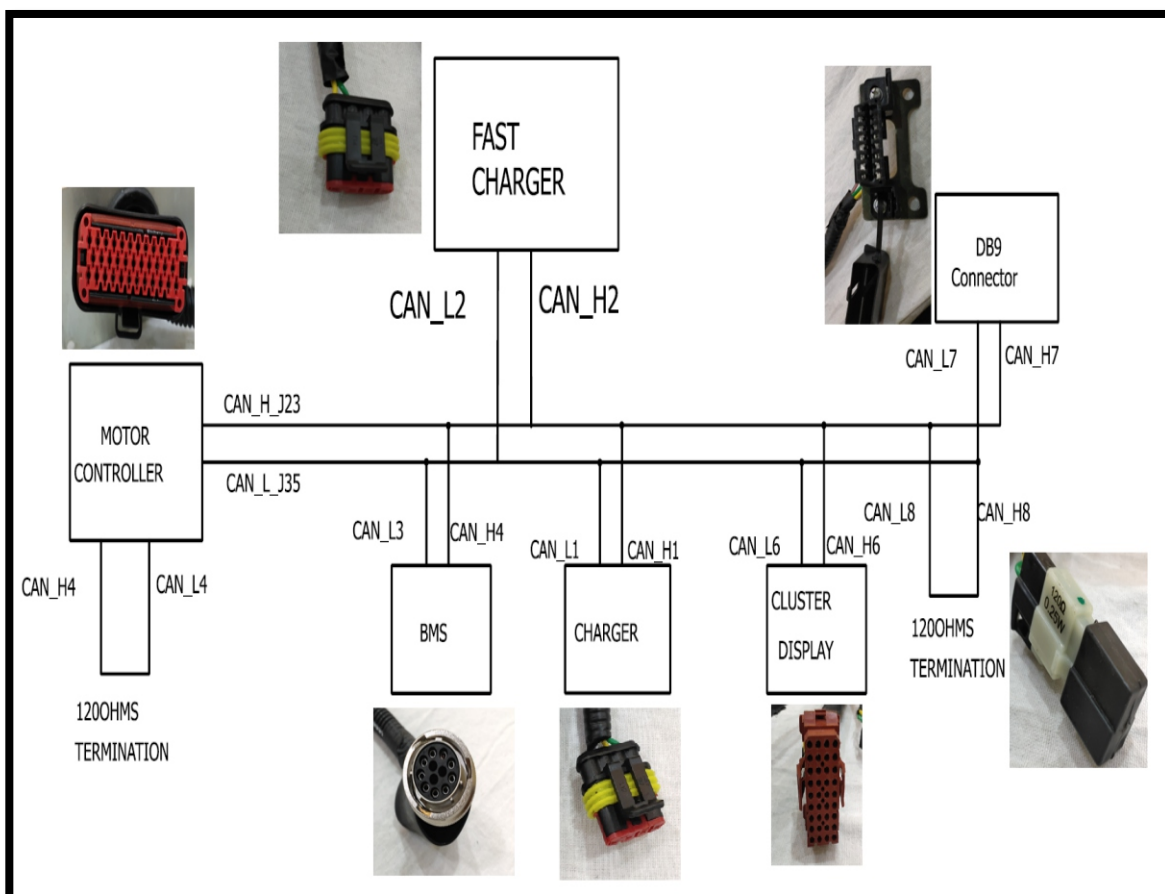
Error Code 72: PDO Timeout
Component Location:



Instrument cluster



Wiring Layout



Connector View

Description	Connector PIC	Connector Number	No. of Pins	Function
RESISTANCE ASSEMBLY (120 OHMS RESISTANCE)		C-250 2PFNY BLACK=1NOS.	2 PINS	To connect with resistance assembly ohms resistance
CLUSTER		1-0640526-0	36 PINS	To connect with Cluster assembly
DIAGNOSTIC CONNECTOR		4299169350 MINDA CONNECTOR	16 PINS	To connect with diagnostic connector
BMS CONNECTOR		RT061412SNHEC03	12 PINS	To connect with Main Battery BMS connector
CHARGER CONN.		C-060 WP4PFNY-B(AMP) CONN-4206040652-1Nos. BLACK	4 PINS	To connect Fast charger CAN Connector(3.3KW charger)
FAST CHARGER CONN.		TYCO CONNECTOR 282088-1	4 PINS	To connect Fast charger CAN Connector (6.6KW charger)
CONTROLLER		CONN-4299350650 BLACK	35 PINS	To connect with Main E-controller

Step 1: Connect Diagnostic tool and note down the ERROR CODE. If ERROR CODE is present, go to step 2.

YES	NO
STEP 2	Clear the ERROR CODE

Step 2: Check the resistance between Pin 6 and Pin 14 of Diagnostic Connector, it should be 60 ohms

YES	NO
Contact Escorts	STEP 3

Step 3: Check the resistance between external Terminal Resistor, it should be 120 ohms.

YES	NO
4	Replace Resistor

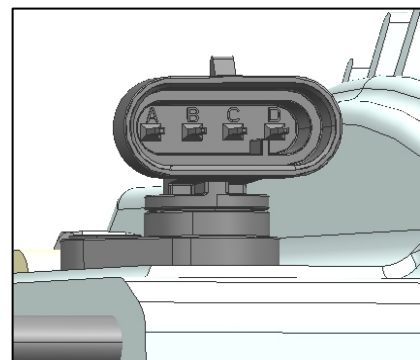
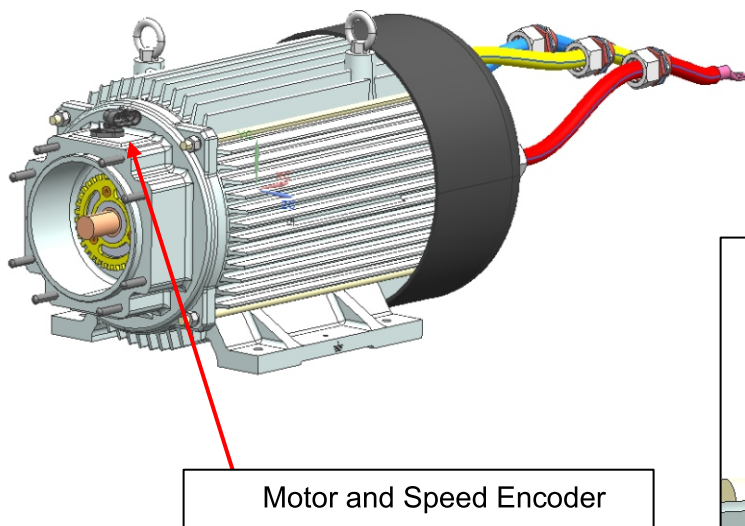
YES	NO
5	Replace Instrument Cluster

Step 4: Check the resistance between Pin J1-21 and Pin J1-34 on Motor controller, it should be 120 ohms.

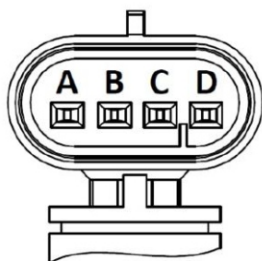
YES	NO
Check wiring and Rectify	Replace Controller

Error Code 73: Stall Detected

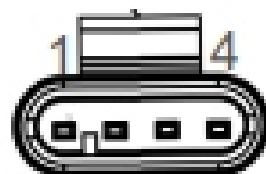
Normal Operations	Encoder provides Motor RPM Feedback to Motor Controller
ERROR CODE Detecting Conditions	If the Speed Encoder input data Malfunctions
Probable Cause	1. Motor encoder failure. 2. Bad crimps or faulty wiring.
Lamp status	Malfunction tell-tale lamp will blink
ERROR CODE Reaction	Motor Shutdown & Vehicle Will not move
Healing Conditions	Rectify fault



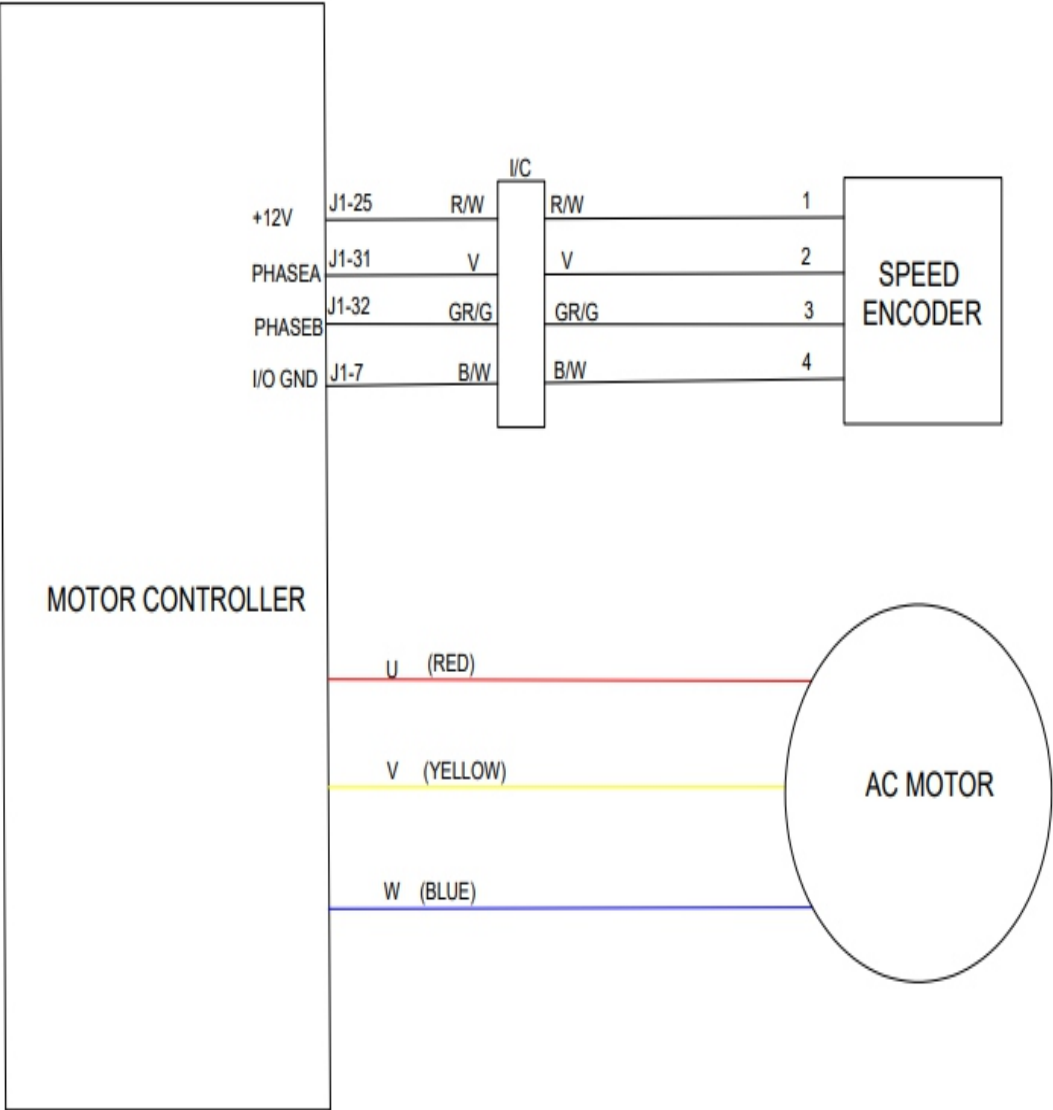
SENSOR ASSEMBLY CONNECTOR DETAILS



PIN No	DESCRIPTION
A	GROUND
B	CHANNEL A
C	CHANNEL B
D	SUPPLY 5V



Wiring Layout:



Connector View



Step 1: Connect Diagnostic tool and note down the ERROR CODE. If ERROR CODE is present, go to step 2.

YES	NO
STEP 2	Clear the ERROR CODE

Step 2: Disconnect IC Pigtail (which is going to motor) and then turn ON IGN Check the Voltage Between 1 and 4 (On the connector which is going towards Motor controller) it should be 12 Volts

YES	NO
STEP 3	Check for wiring Damage, Rectify it and then check for Tractor working.

Step 3: Check for dirtiness on encoder and also check for the frequency between pin 2 and pin 3 of speed encoder while rotating the gear wheel of motor.

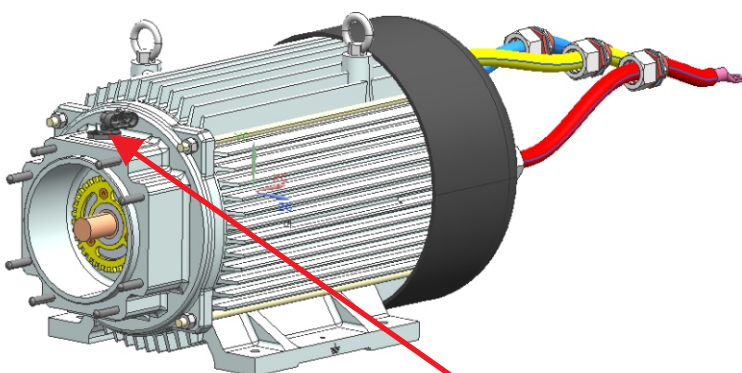
There should be some value and it will increase as the rotating speed increases.

YES	NO
STEP 4	Replace Speed Encoder

Step 4: Replace Motor Controller

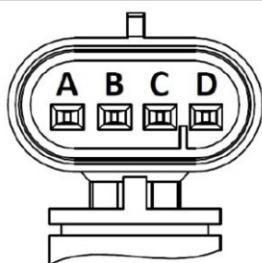
Error Code 88: Encoder Pulse Count Fault

Normal Operations	Encoder provides Motor RPM Feedback to Motor Controller
ERROR CODE Detecting Conditions	If the Speed Encoder input data Malfunctions
Probable Cause	1. Motor encoder failure. 2. Bad crimps or faulty wiring.
Lamp status	Malfunction tell-tale lamp will blink
ERROR CODE Reaction	Motor Shutdown & Vehicle Will not move
Healing Conditions	Rectify fault

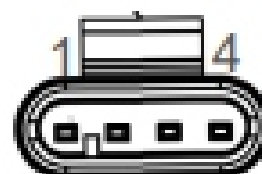


Motor and Speed Encoder

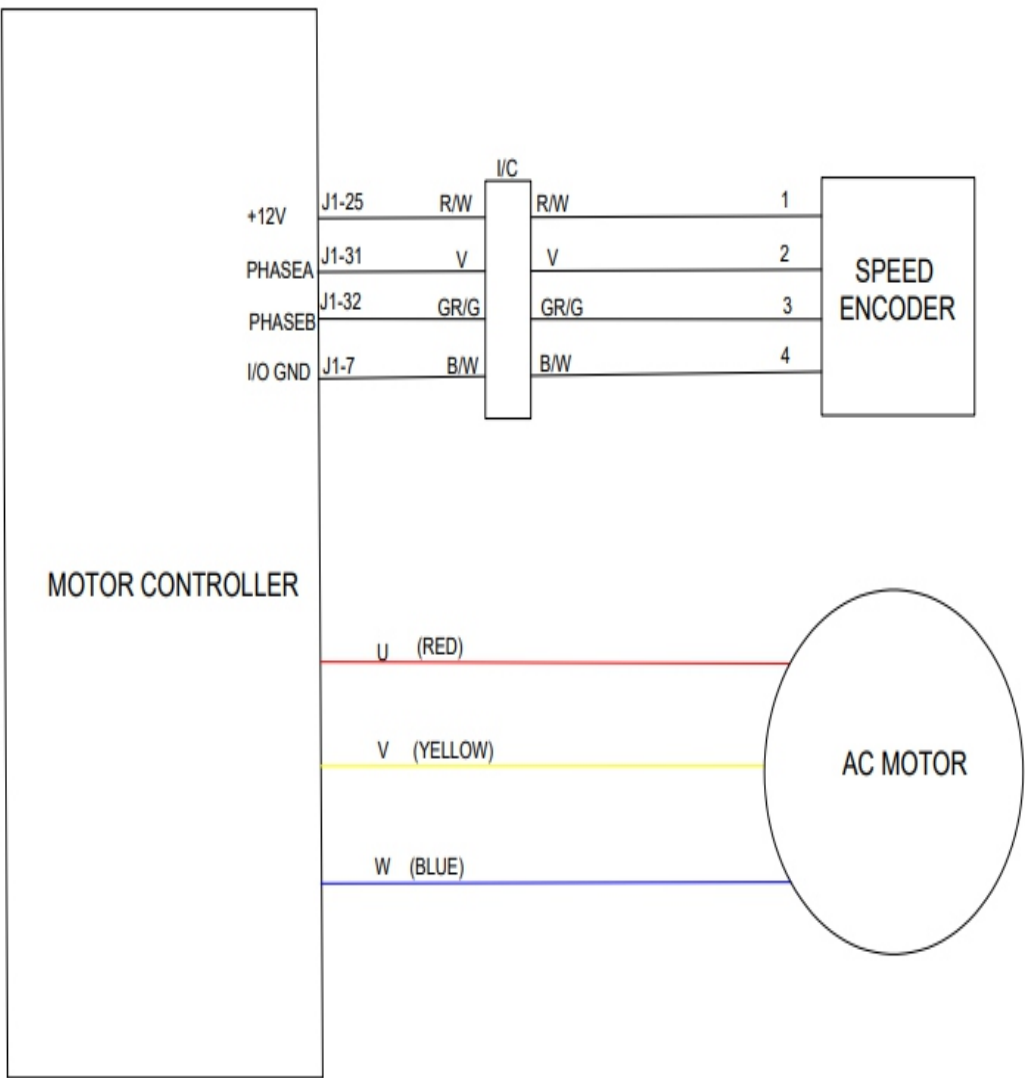
SENSOR ASSEMBLY CONNECTOR DETAILS



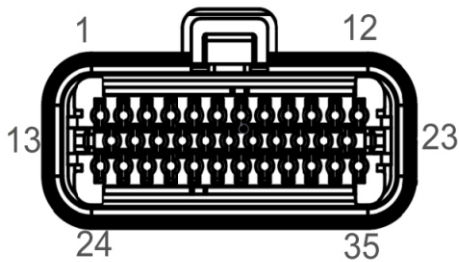
PIN No	DESCRIPTION
A	GROUND
B	CHANNEL A
C	CHANNEL B
D	SUPPLY 5V



Wiring Layout:



Connector View



Step 1: Connect Diagnostic tool and note down the ERROR CODE. If ERROR CODE is present, go to step 2.

YES	NO
STEP 2	Clear the ERROR CODE

Step 2: Disconnect IC Pigtail (which is going to motor) and then turn ON IGN Check the Voltage Between 1 and 4 (On the connector which is going towards Motor controller) it should be 12 Volts.

YES	NO
STEP 3	Check for wiring Damage, Rectify it and then check for Tractor working.

Step 3: : Check for dirtiness on encoder and also check for the frequency between pin 2 and pin 3 of speed encoder while rotating the gear wheel of motor.

There should be some value and it will increase as the rotating speed increases.

YES	NO
STEP 4	Replace Speed Encoder

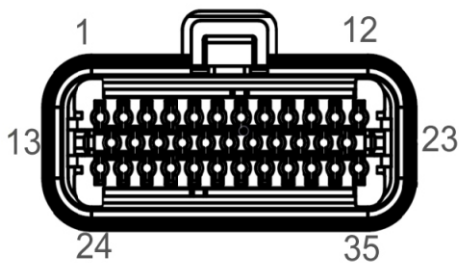
Step 4: Replace Motor Controller

Error Code 99: Parameter Change Fault

Normal Operations	When vehicle is authenticated MOTOR CONTROLLER provides ground signal to contactor coil.
ERROR CODE Detecting Conditions	This is a safety fault caused by a change in certain parameter settings so that the vehicle will not operate until KSI is cycled.
Probable Cause	<ol style="list-style-type: none"> 1. Dual drive enabled on only one controller. 2. Incorrect position feedback type chosen for motor technology in use. 3. Dual drive is enabled in torque mode
Lamp status	Malfunction tell-tale lamp will blink
ERROR CODE Reaction	Motor Shutdown & Vehicle Will not move
Healing Conditions	Rectify fault

Connector View

MOTOR CONTROLLER



Step 1: Connect Diagnostic tool and note down the ERROR CODE. If ERROR CODE is present, go to step 2.

YES	NO
STEP 2	Clear the ERROR CODE

Step 2: Contact Escorts

Step 3: Check for dirtiness on encoder and also check for the frequency between pin 2 and pin 3 of speed encoder while rotating the gear wheel of motor.

There should be some value and it will increase as the rotating speed increases.

YES	NO
STEP 4	Replace Speed Encoder

Step 4: Replace Motor Controller

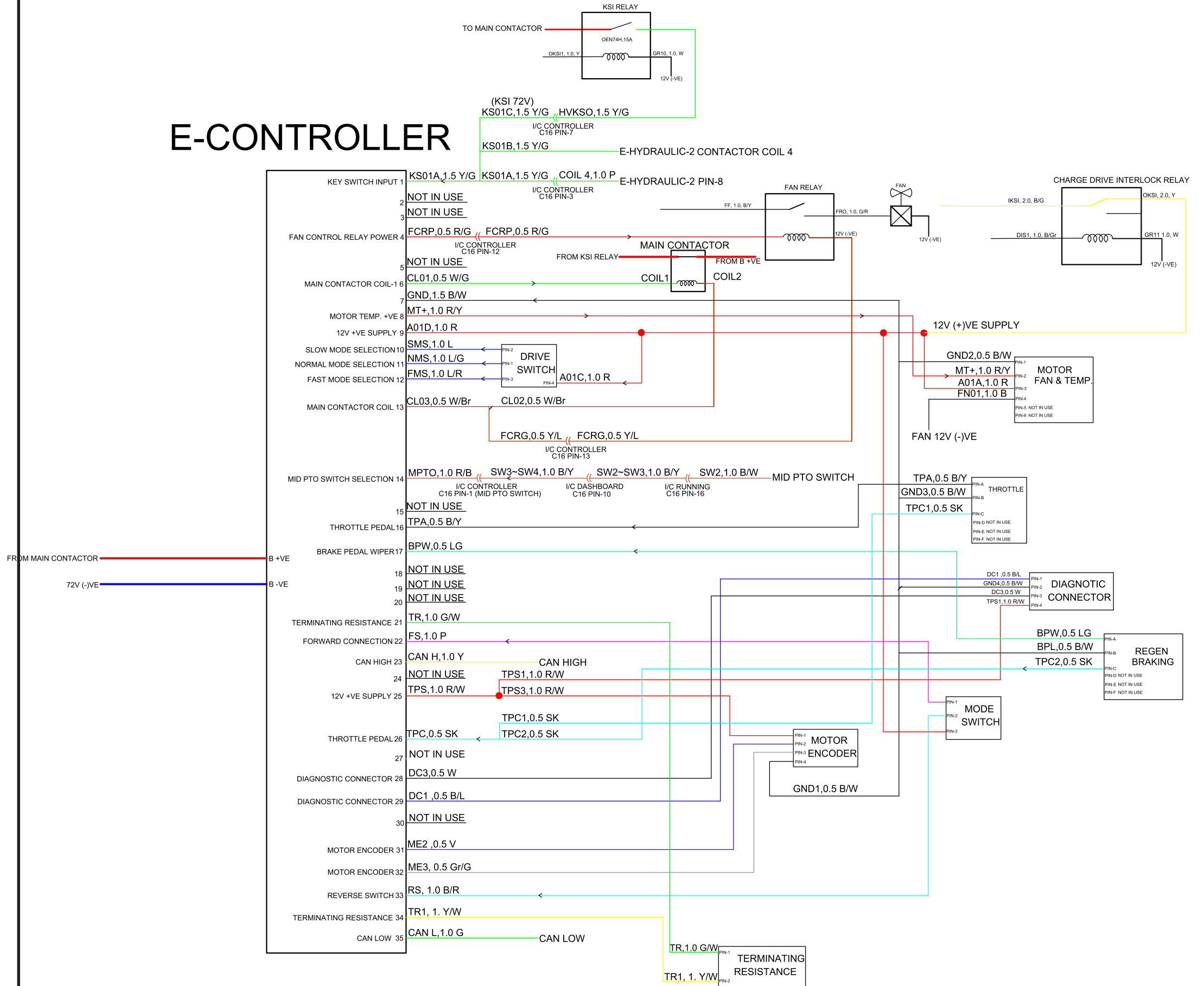
SCHEMATICS

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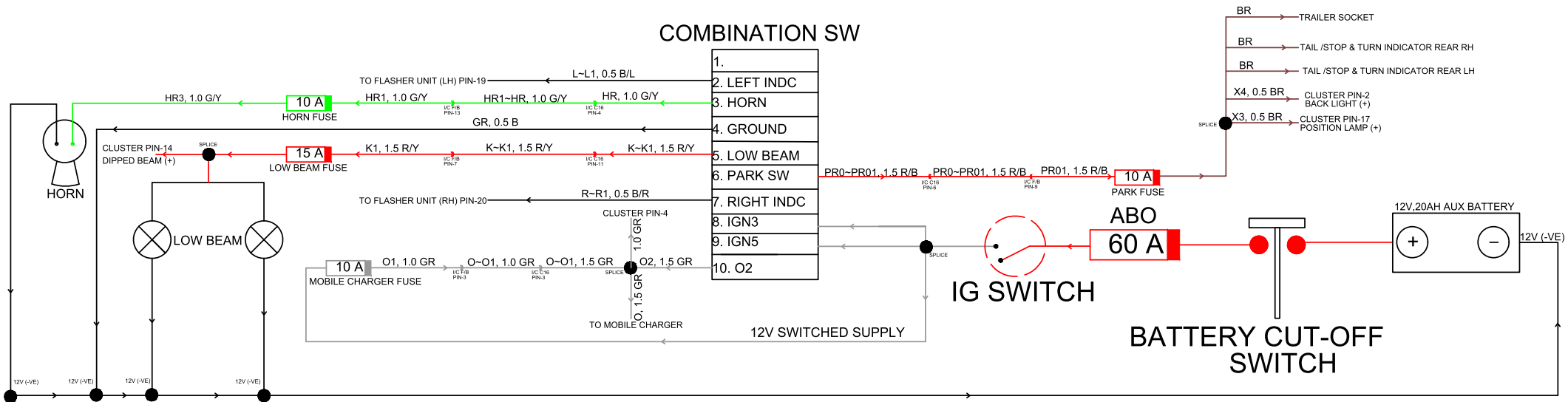
5. SCHEMATIC DIAGRAM OF E-CONTROLLER

E-CONTROLLER



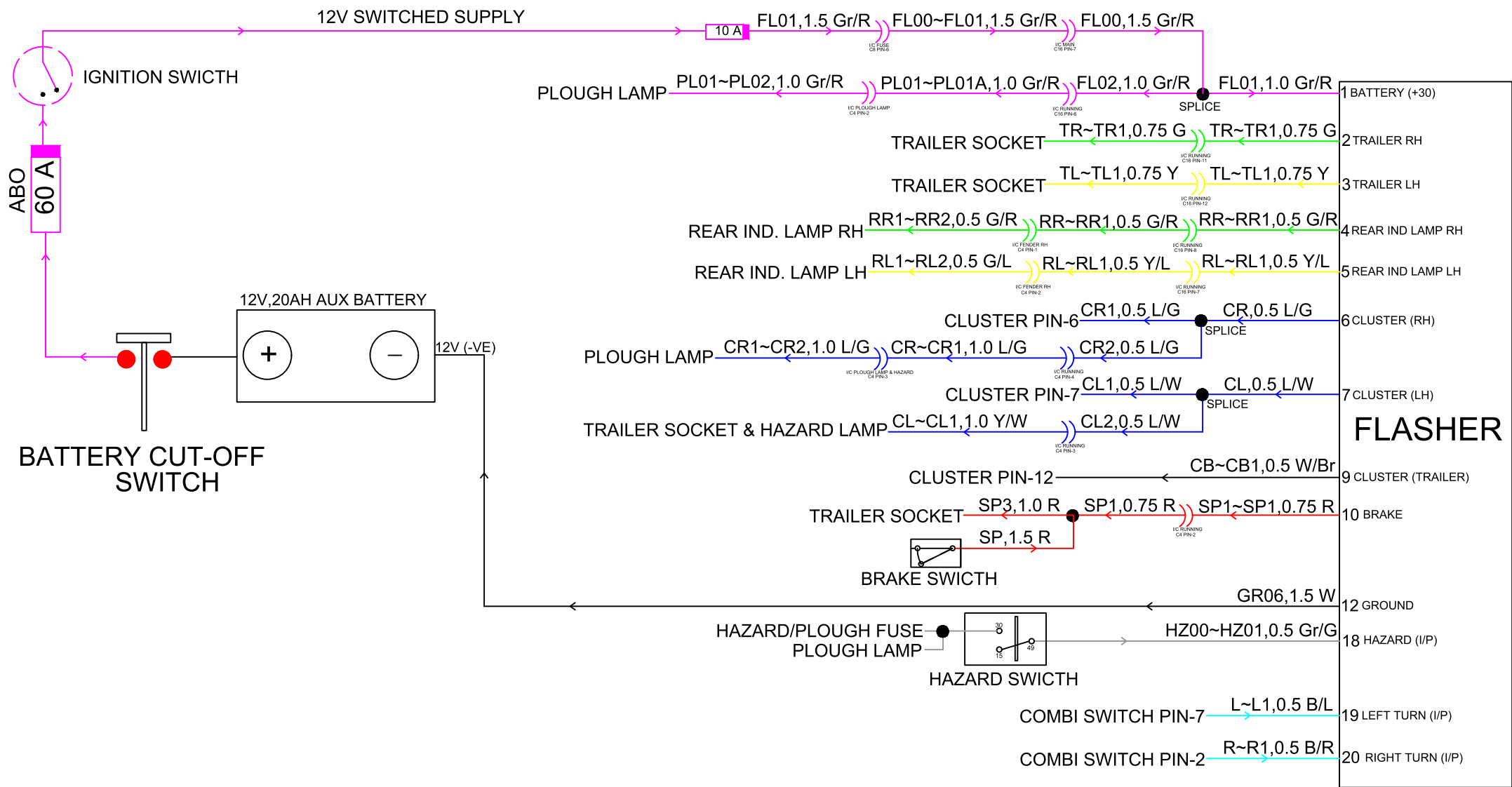
DIMENSION	DEVIATION

5.1. SCHEMATIC DIAGRAM OF COMBI SWITCH



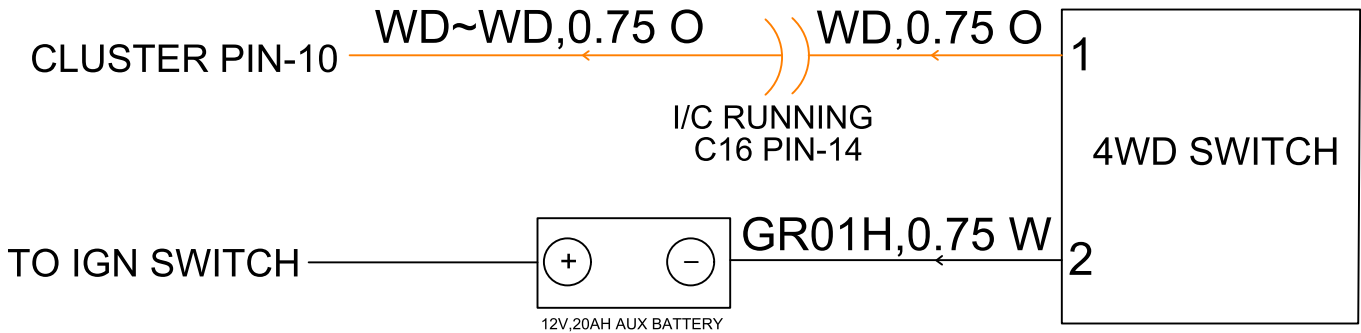
DIMENSION	DEVIATION

5.2 SCHEMATIC DIAGRAM OF FLASHER



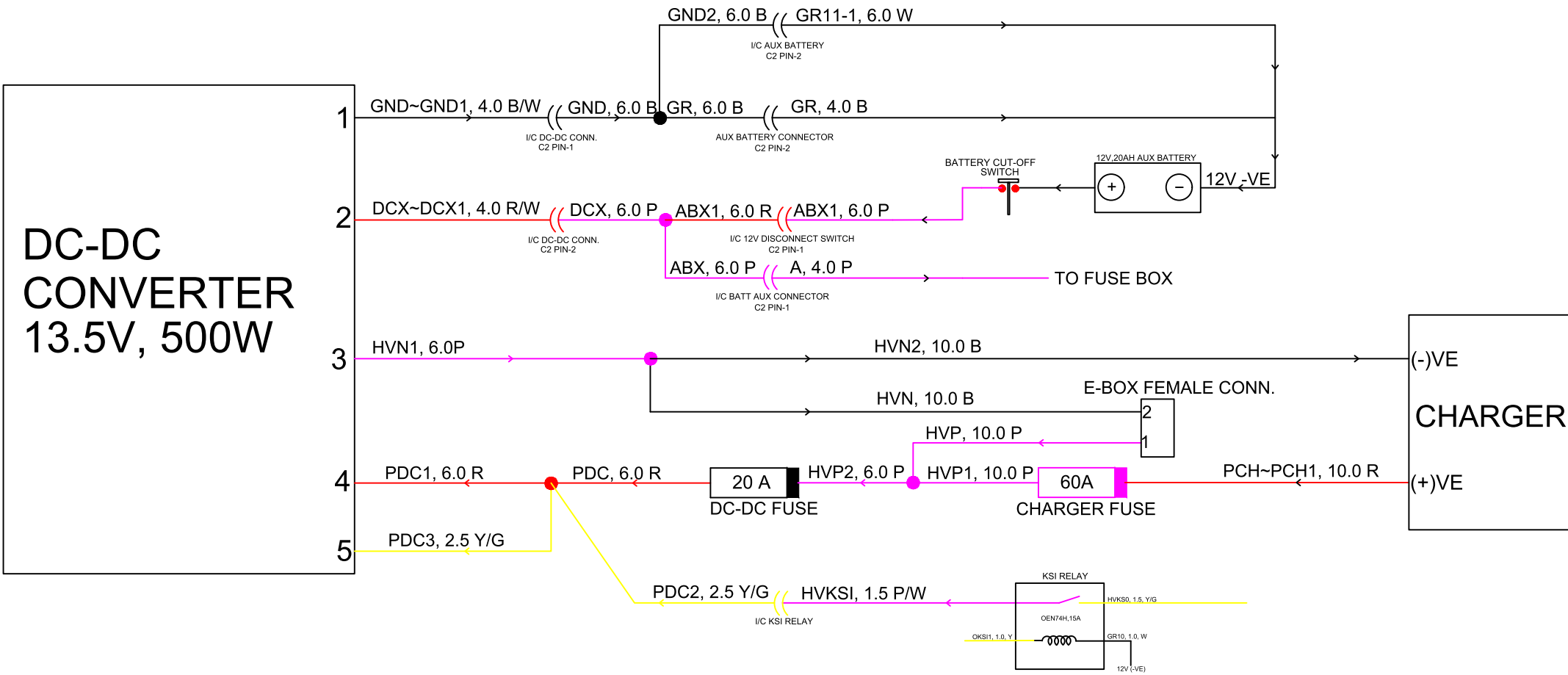
DIMENSION	DEVIATION

5.3 SCHEMATIC DIAGRAM OF 4WD SWITCH



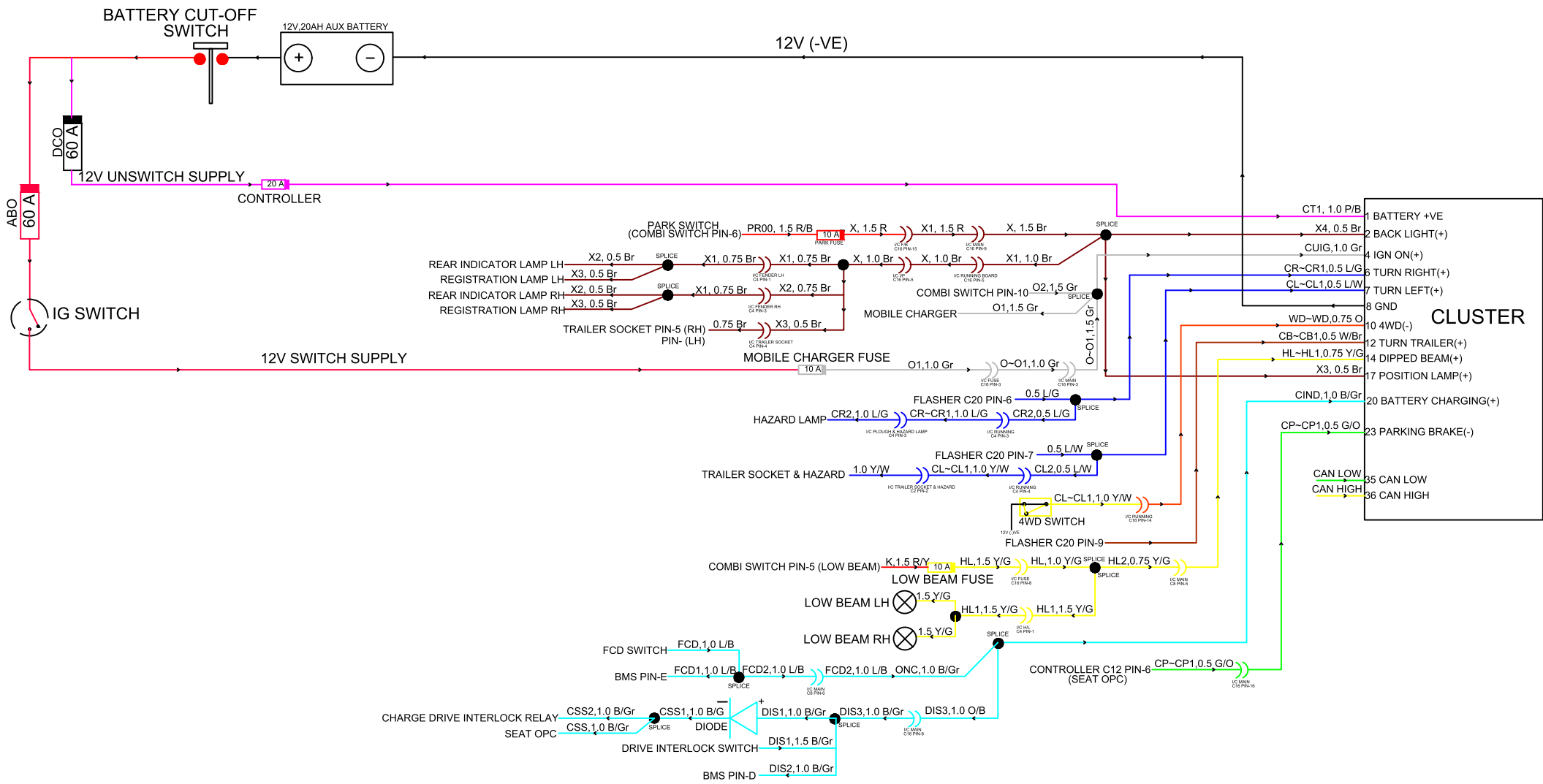
DIMENSION	DEVIATION

5.4 SCHEMATIC DIAGRAM OF DC-DC CONVERTER



DIMENSION	DEVIATION

5.5. SCHEMATIC DIAGRAM OF CLUSTER

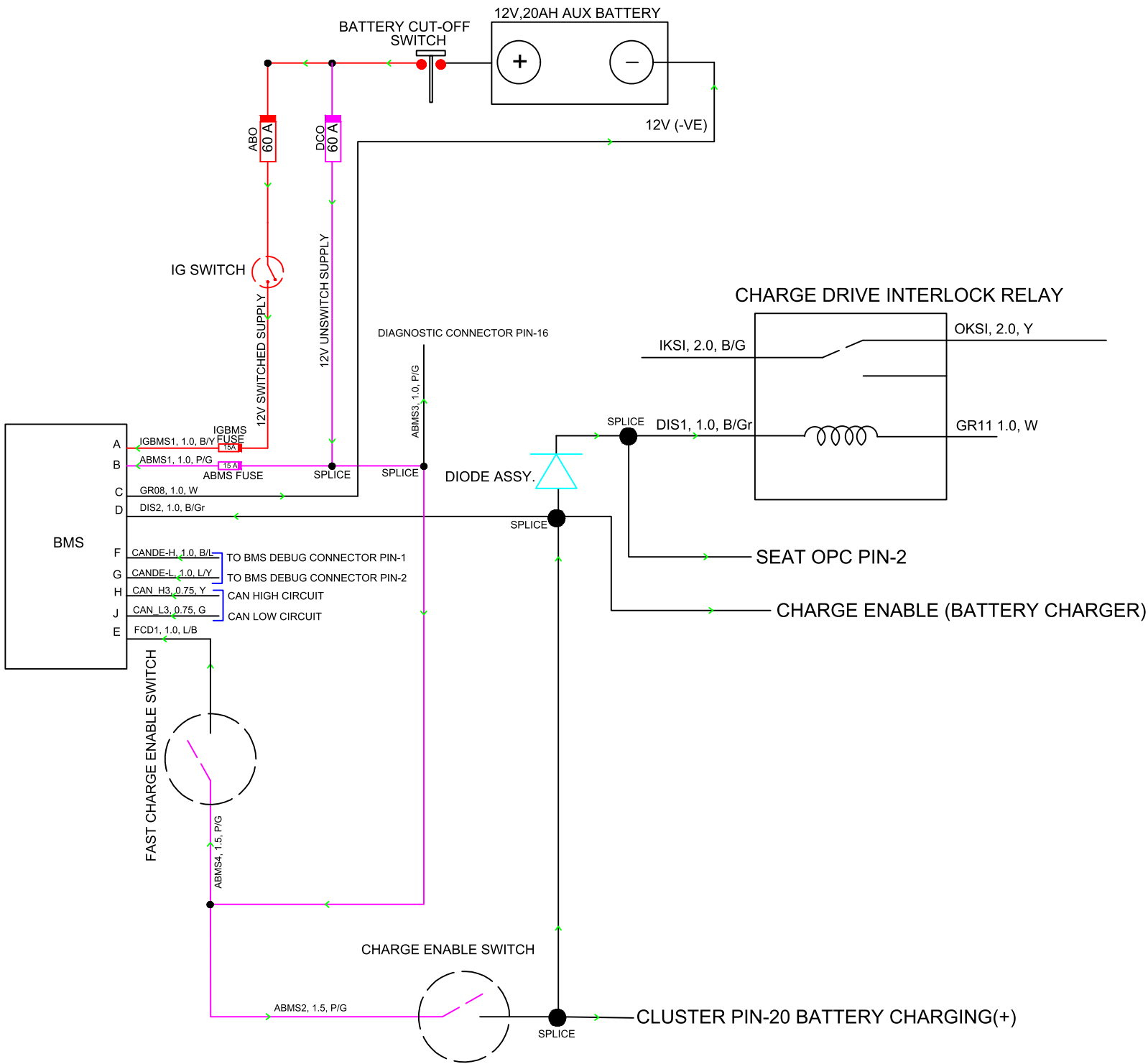


E-CONTROLLER



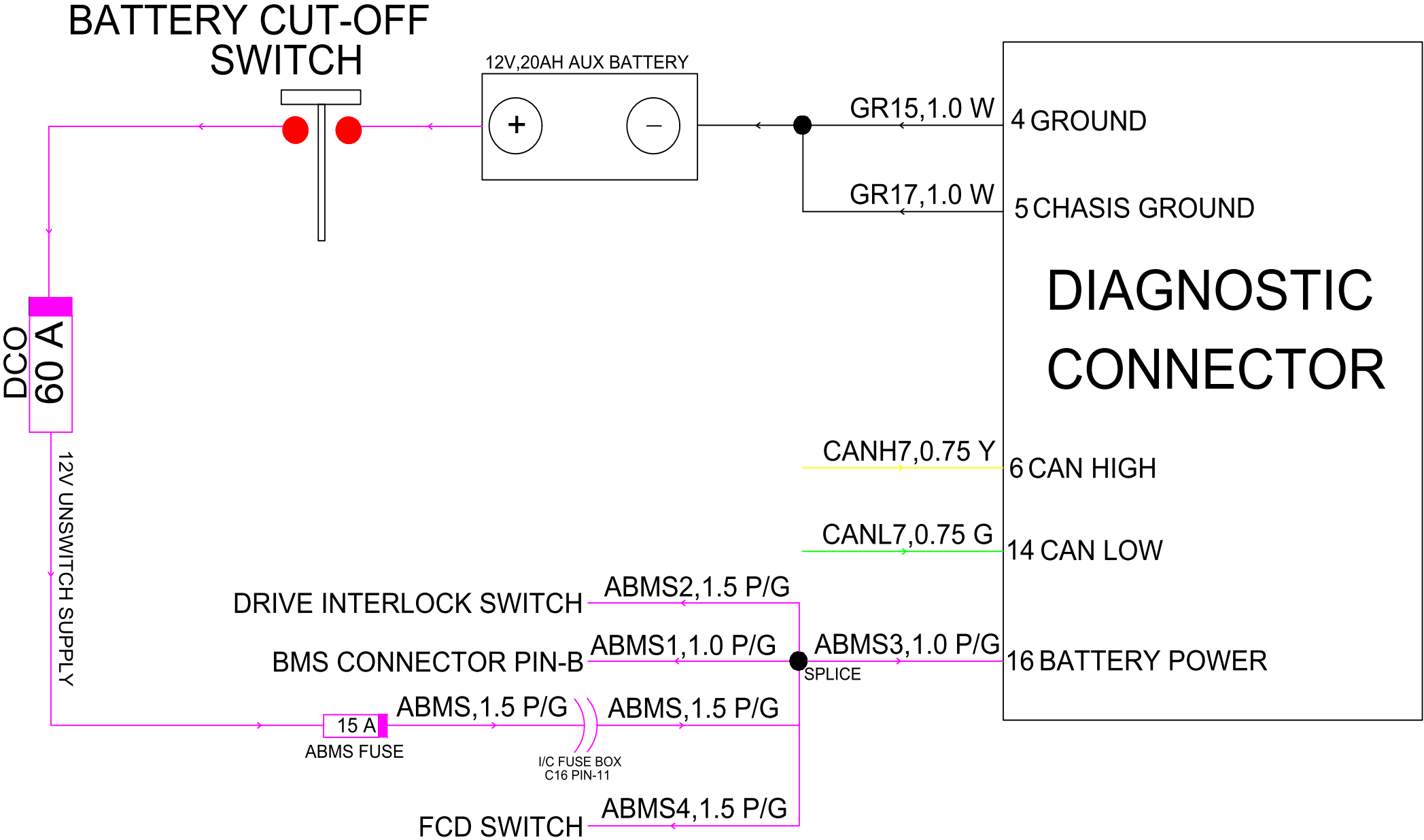
DIMENSION	DEVIATION

5.7 SCHEMATIC DIAGRAM OF BMS



DIMENSION	DEVIATION

5.8 SCHEMATIC DIAGRAM OF DIAGNOSTIC CONNECTOR

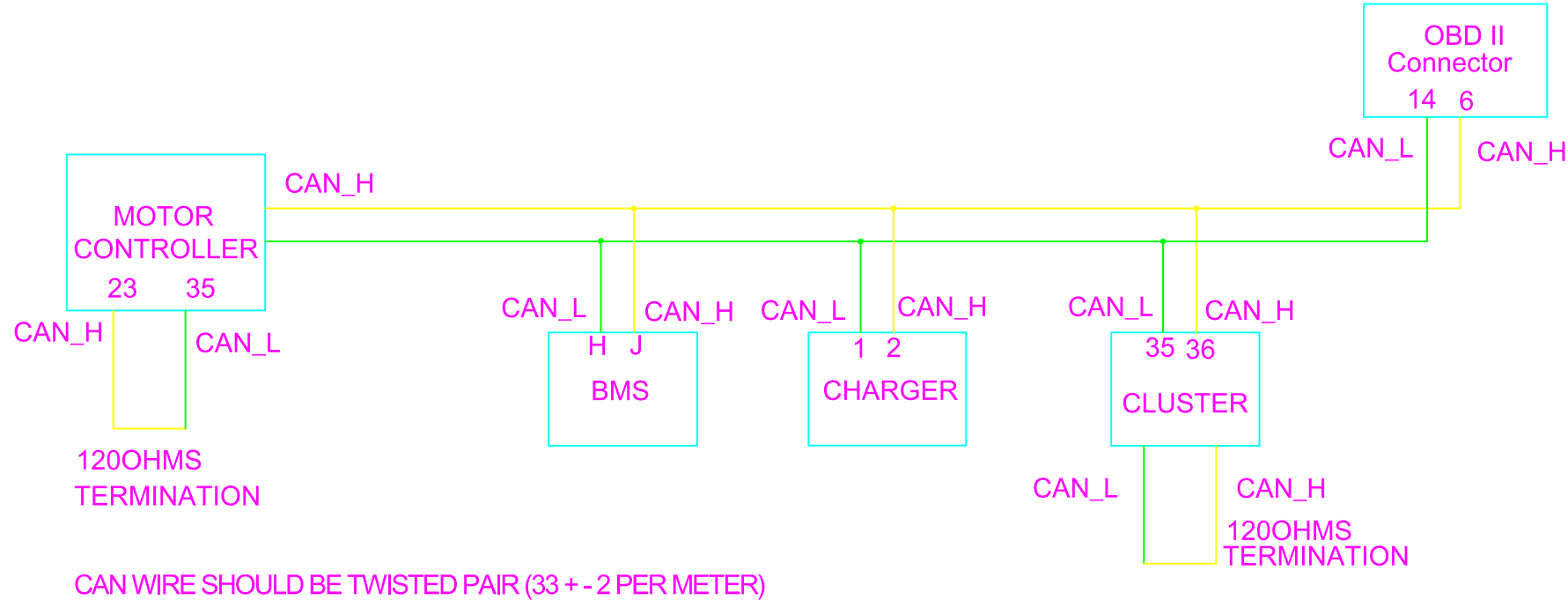


CHARGE DRIVE INTERLOCK RELAY



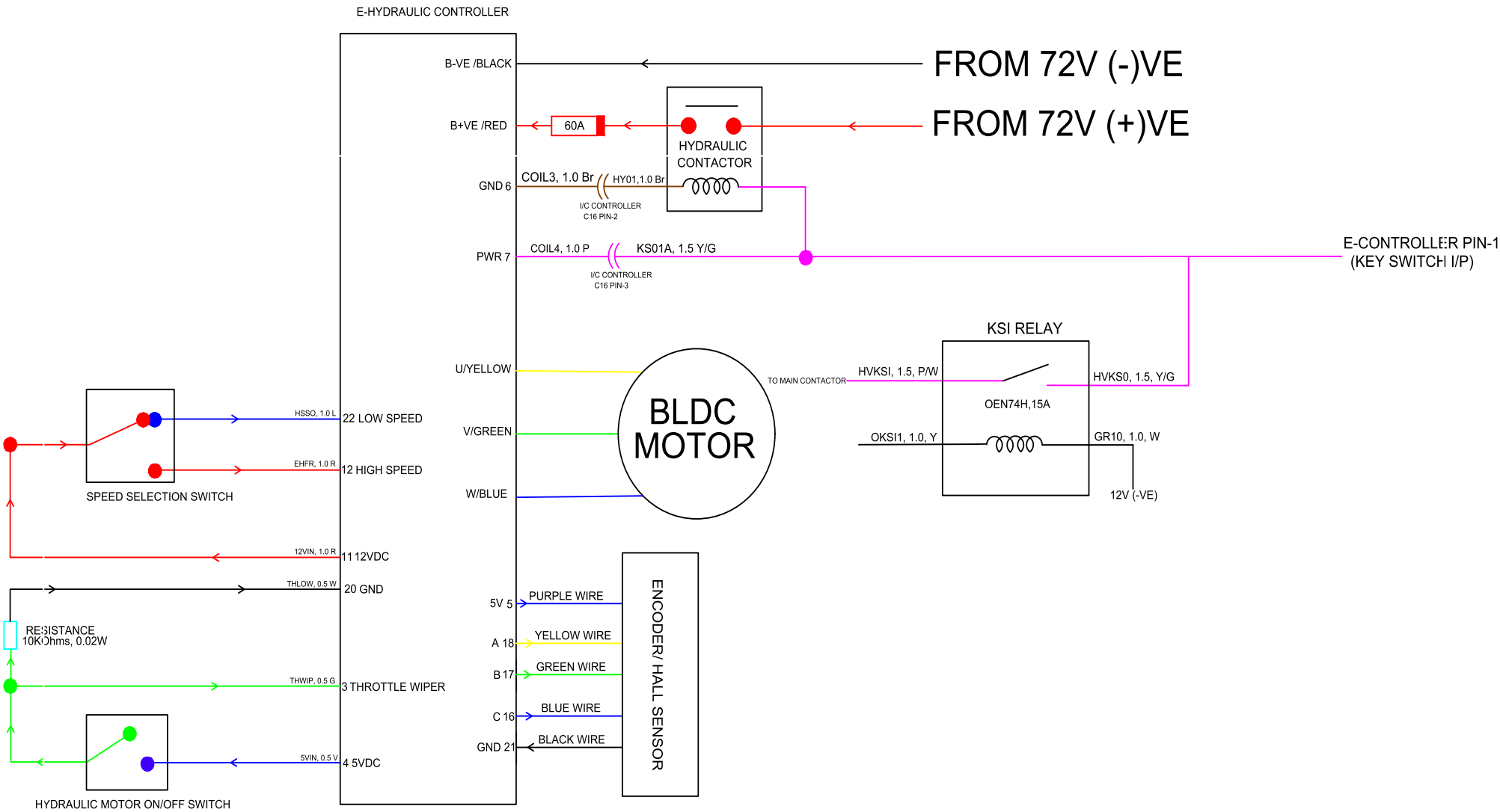
DIMENSION	DEVIATION

5.10 SCHEMATIC DIAGRAM OF CAN CONNECTION



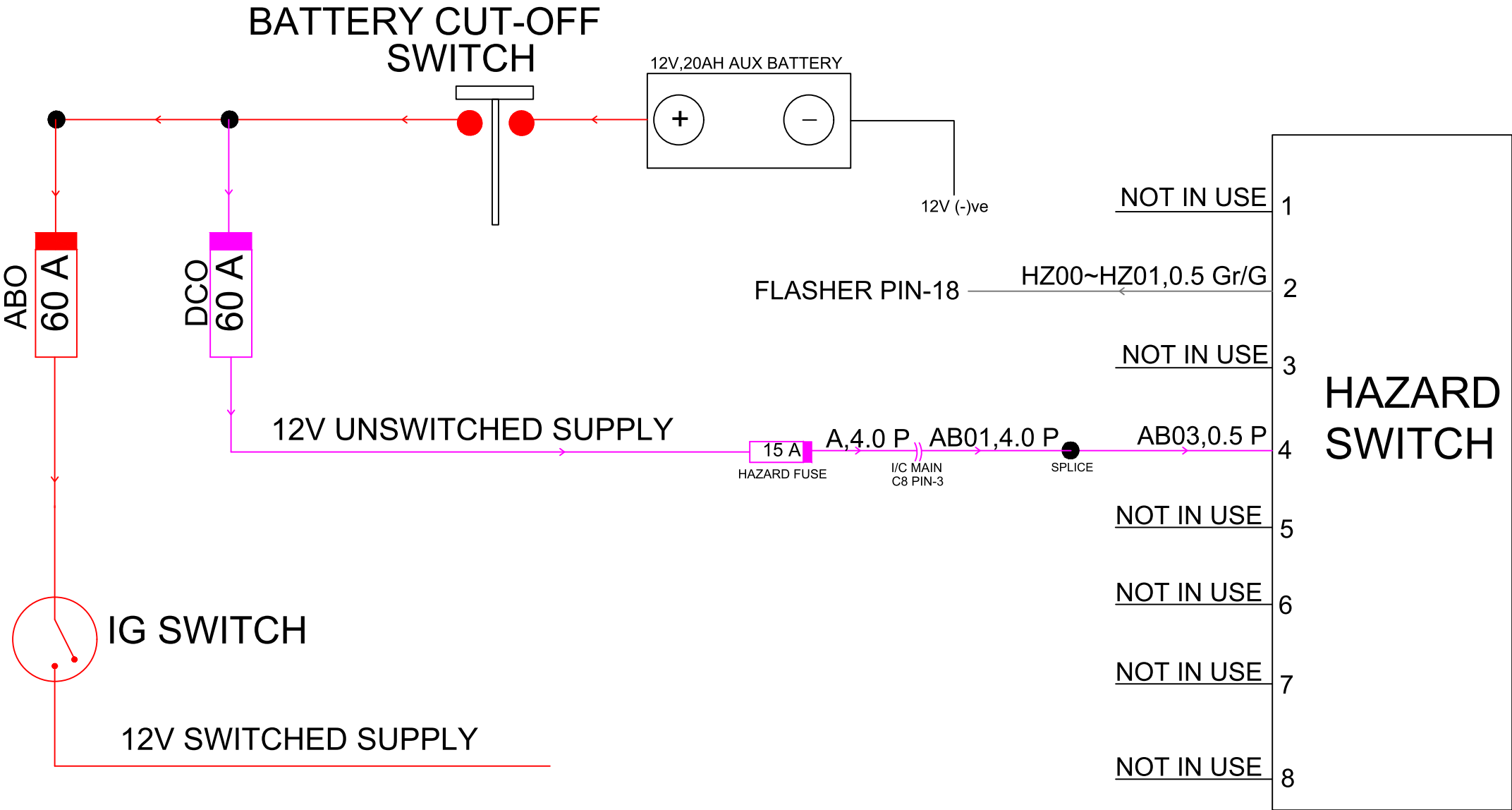
DIMENSION	DEVIATION

5.11 SCHEMATIC DIAGRAM OF E-HYDRAULIC CONTROLLER



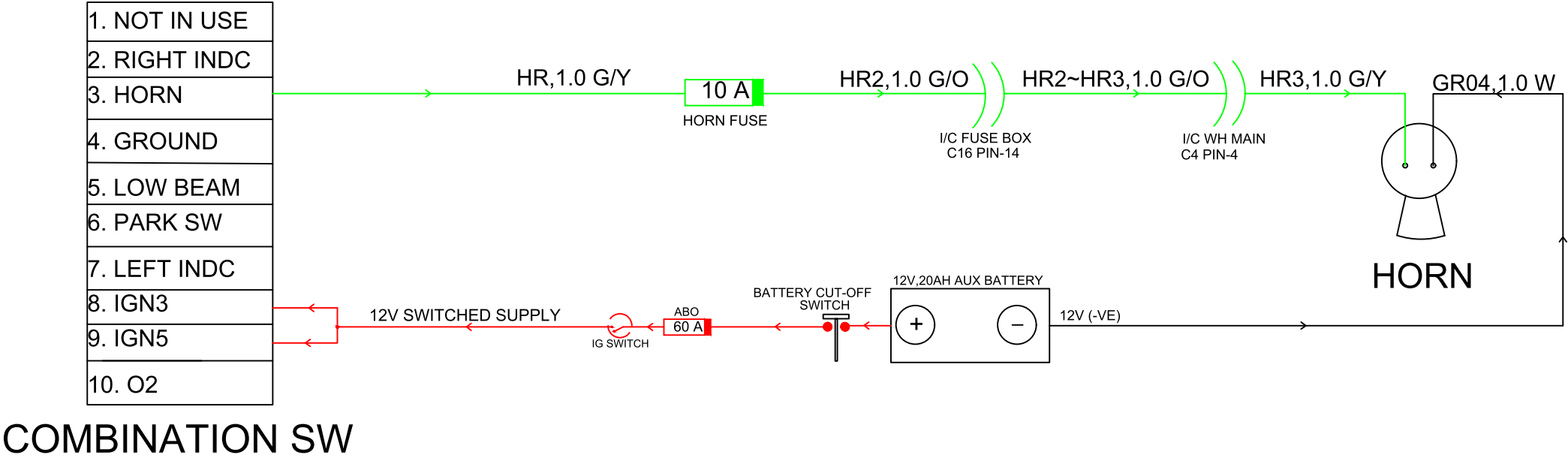
DIMENSION	DEVIATION

5.12 SCHEMATIC DIAGRAM OF HAZARD SWITCH



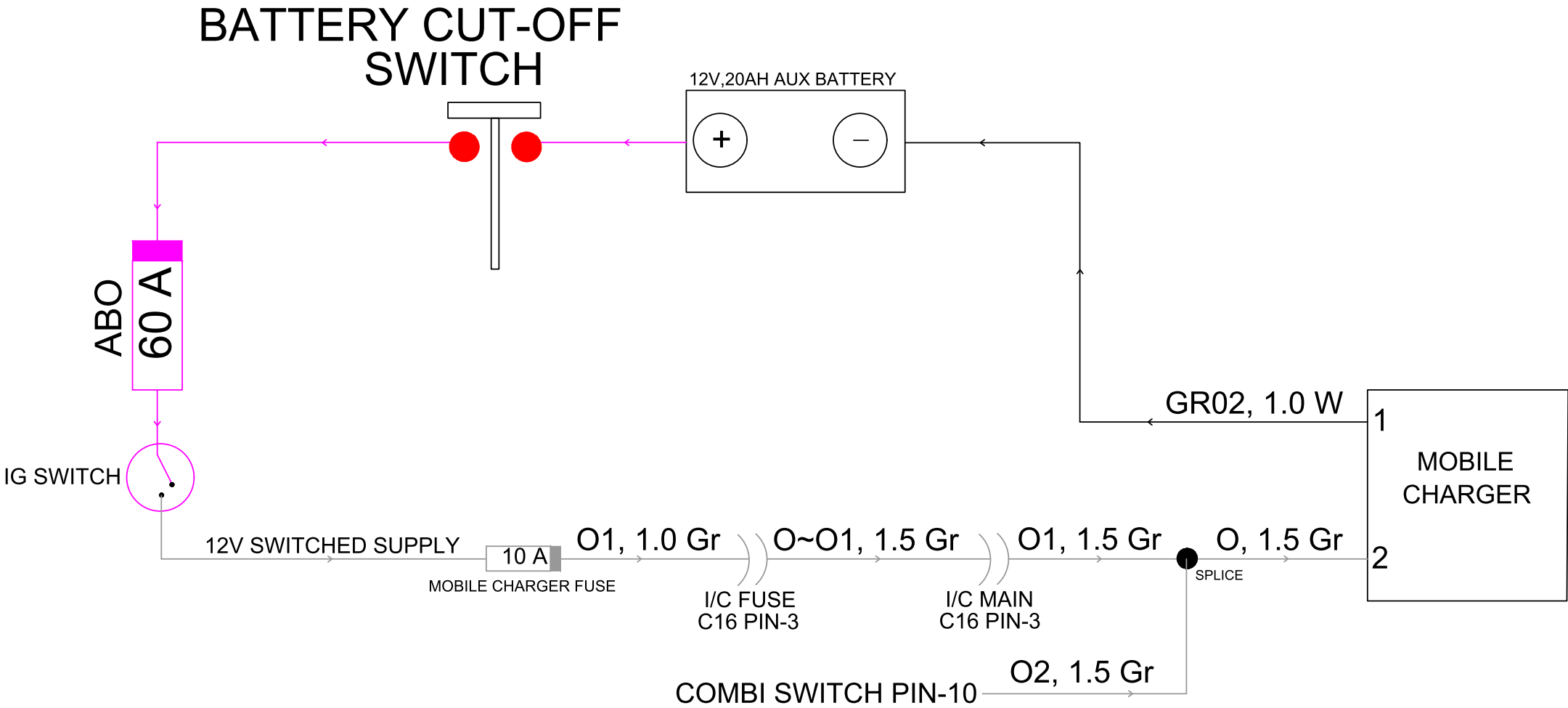
DIMENSION	DEVIATION

5.13 SCHEMATIC DIAGRAM OF HORN

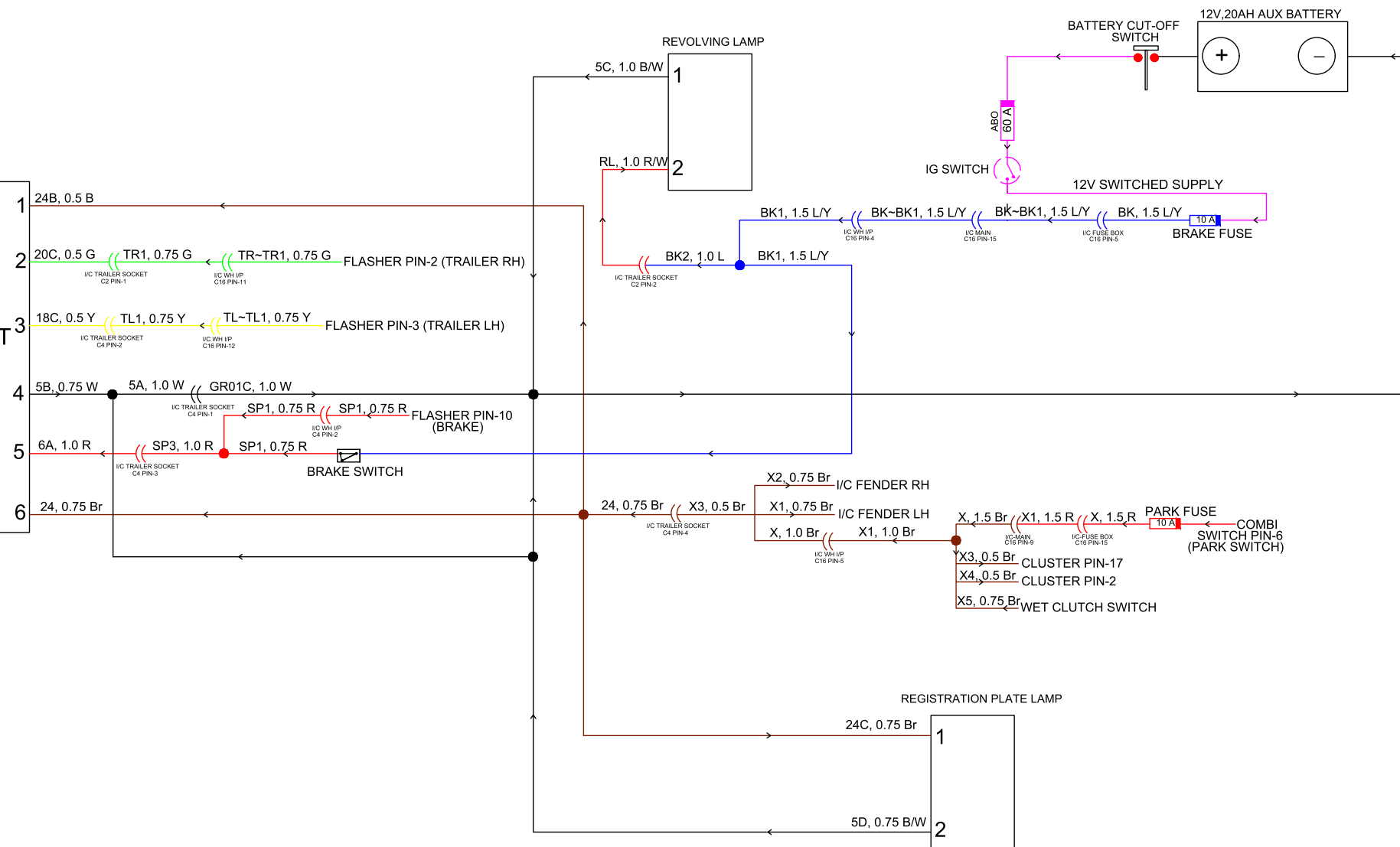


DIMENSION	DEVIATION

5.14 SCHEMATIC DIAGRAM OF MOBILE CHARGER

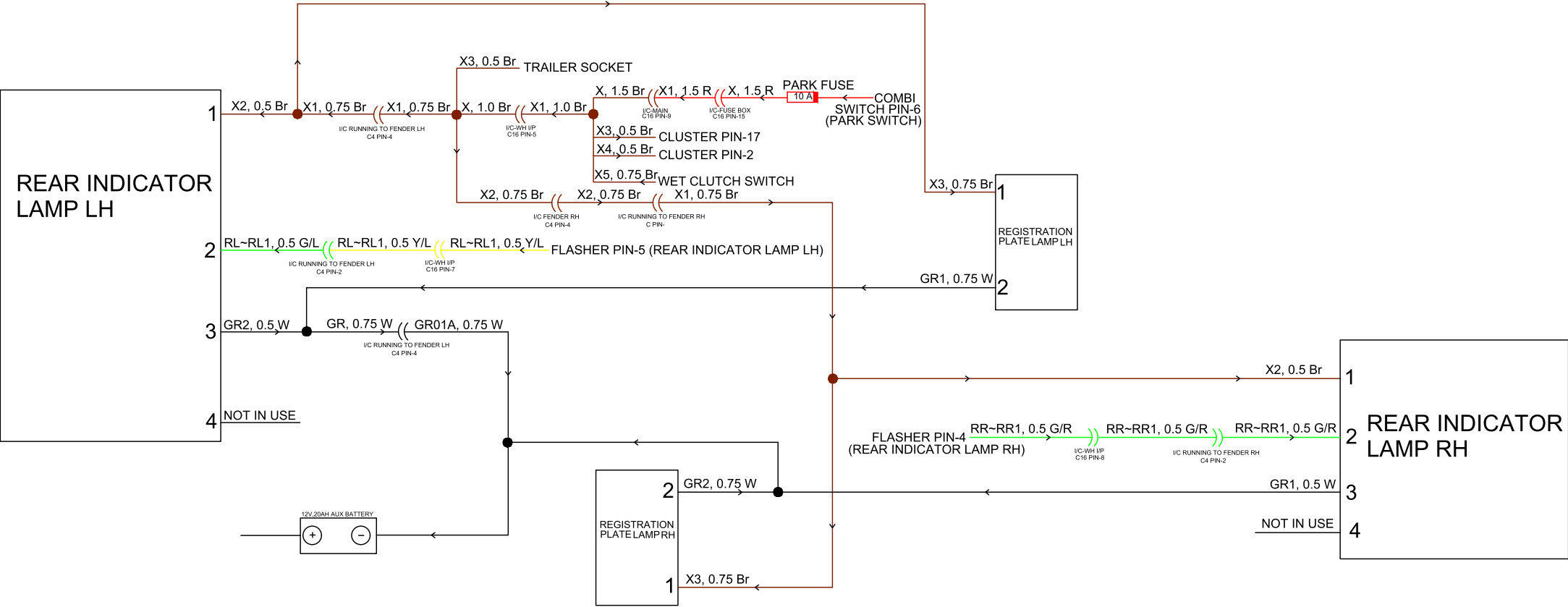


	1
	2
TRAILER SOCKET	3
	4
	5
	6



DIMENSION	DEVIATION

5.16 SCHEMATIC DIAGRAM OF TAIL & STOP LAMP



MOTOR CONTROLLER ERROR CODE

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6.1. BATTERY ERROR CODE	4

6. MOTOR CONTROLLER ERROR CODE

S. No.	Error Code (SPN)	Error Code on diagnostic tool	Name	Effect	Cause	Remedy
1	5920	12	Controller Over Current	Motor Shutdown & Vehicle Will not move	<ol style="list-style-type: none"> External short of phase U,V, or W motor connections. Motor parameters are mis-tuned Controller defective. Speed encoder noise problems. 	<ol style="list-style-type: none"> 1.1 Check short circuit of all individual wires. 1.2 If yes, rectify it. 2.1 Check the motor parameters, if required, set the correct value 3.1 Power up the controller, if it is not getting on, replace it. 4.1 Disconnect encoder connector, remove encoder, if dirty clean it and reconnect it. <p>Set: Phase current exceeded the current measurement limit. Clear: Cycle KSI.</p>
2	519365	13	Current Sensor Fault	Motor Shutdown & Vehicle Will not move	<ol style="list-style-type: none"> Leakage to vehicle frame from phase U,V, or W (short in motor stator). Controller defective. Internal HW fault Current sensor may be faulty 	<ol style="list-style-type: none"> 1.1 Check short circuit of all individual wires. 1.2 If yes, rectify it. 2.1 Power up the controller, if it is not getting on, replace it. 3.1 Replace controller. <p>Set: Controller current sensors have invalid offset reading. Clear: Cycle KSI.</p>
3	8204	15	Controller Severe Undertemp	Motor Shutdown & Vehicle Will not move	<ol style="list-style-type: none"> Controller is operating in an extreme environment (low temp.) 	<p>Provide ambient temperature for controller to work. Set: Heatsink temperature below -40°C. Clear: Bring heatsink temperature above -40°C, and cycle interlock or KSI.</p>
4	8204	16	Controller Severe Overtemp	Motor Shutdown & Vehicle Will not move	<ol style="list-style-type: none"> See temperature of Controller on cluster Temperature. It may be running in red zone Controller is operating in an extreme environment. Excessive load on vehicle. Improper mounting of controller. Inverter cooling fan failure or obstructed. 	<ol style="list-style-type: none"> 1. Provide ambient temperature for controller to work. 2. Reduce the excessive load 3. Check the mounting of controller, if improper, rectify it. 4. Power up the inverter cooling fan, if it is not getting on, clean it. If still doesn't operate, replace it. 5. Check controller cooling fan, if faulty replace it. <p>Set: Heatsink temperature above +70°C. Clear: Bring heatsink temperature below +70°C, and cycle interlock or KSI.</p>
5	8086	17	Severe B+ Undervoltage	Motor Shutdown & Vehicle Will not move	<ol style="list-style-type: none"> Battery parameters are misadjusted. Non-controller system drain on battery. Battery resistance too high. Battery disconnected while driving. Blown B+ fuse or main contactor did not close. System voltage low - battery or wiring /PDU fault 	<ol style="list-style-type: none"> 1. Check the battery parameters, if required, set the correct value 2. Check battery resistance. 3. Check battery connections. 4. Connect it properly. 5.1 Check B+ fuse. If blown out, replace it. 5.2 Check main contactor. if it does not close, replace it. 6.1 If voltage low, check for battery, wiring, and PDU. 6.2 And replace the component accordingly. <p>Set: Capacitor bank voltage dropped below the Severe Undervoltage limit with FET bridge enabled. Clear: Bring capacitor voltage above Severe Undervoltage limit.</p>
6	8086	18	Severe B+ Overvoltage	Motor Shutdown & Vehicle Will not move	<ol style="list-style-type: none"> Battery parameters are misadjusted. Battery resistance too high for given regen current. Battery disconnected while regen braking. Contactor rapid opening or charger fault 	<ol style="list-style-type: none"> 1. Check the battery parameters, if required, set the correct value 2. Check battery connections if disconnected, connect them 3. Check connection of contactor <p>Set: Capacitor bank voltage exceeded the Severe Overvoltage limit (see page 25) with FET bridge enabled. Clear: Bring capacitor voltage below Severe Overvoltage limit, and then cycle KSI.</p>
7	NA	18	Severe KSI Overvoltage	Motor Shutdown & Vehicle Will not move	<ol style="list-style-type: none"> Incorrect (to high) battery-voltage applied to KSI (pin 1) <p>Note: Prevents the Main Contactor closure if KSI is greater than the Severe Overvoltage limit.</p>	<ol style="list-style-type: none"> 1.1 Check voltage level supplied at KSI. 1.2 reduce the current amount. 2.1 Bring KSI voltage below the Severe Overvoltage limit <p>Set: KSI voltage exceeded Severe Overvoltage limit Clear: Bring KSI voltage below the Severe Overvoltage limit</p>
8	8204	22	Controller Overtemp Cutback	Motor Shutdown & Vehicle Will not move	<ol style="list-style-type: none"> See temperature of Controller on cluster Temperature. It may be running in red zone Controller is operating in an extreme environment. Excessive load on vehicle. Improper mounting of controller. Inverter cooling fan failure or obstructed. 	<ol style="list-style-type: none"> 1. Provide ambient temperature for controller to work. 2. Reduce the excessive load 3. Check the mounting of controller, if improper, rectify it. 4. Power up the inverter cooling fan, if it is not getting on, clean it. If still doesn't operate, replace it. 5. Check controller cooling fan, if faulty replace it. <p>Set: Heatsink temperature above +70°C. Clear: Bring heatsink temperature below +70°C, and cycle interlock or KSI.</p>
9	8086	23	B+ Undervoltage Cutback	Motor Shutdown & Vehicle Will not move	<ol style="list-style-type: none"> Battery parameters are misadjusted. Non-controller system drain on battery. Battery resistance too high. Battery disconnected while driving. Blown B+ fuse or main contactor did not close. System voltage low - battery or wiring /PDU fault 	<ol style="list-style-type: none"> 1. Check the battery parameters, if required, set the correct value 2. Check battery resistance. 3. Check battery connections. 4. Connect it properly. 5.1 Check B+ fuse. If blown out, replace it. 5.2 Check main contactor. if it does not close, replace it. 6.1 If voltage low, check for battery, wiring, and PDU. 6.2 And replace the component accordingly. <p>Set: Capacitor bank voltage dropped below the Severe Undervoltage limit with FET bridge enabled. Clear: Bring capacitor voltage above Severe Undervoltage limit.</p>

ERROR CODE

S. No.	Error Code (SPN)	Error Code on diagnostic tool	Name	Effect	Cause	Remedy
10	NA	24	B+ Overvoltage Cutback	Motor Shutdown & Vehicle Will not move	<ol style="list-style-type: none"> 1. Battery parameters are misadjusted. 2. Battery resistance too high for given regen current. 3. Battery disconnected while regen braking. 4. Contactor rapid opening or charger fault 	<ol style="list-style-type: none"> 1. Check the battery parameters, if required, set the correct value 2. Check battery connections if disconnected, connect them 3. Check connection of contactor <p>Set: Capacitor bank voltage exceeded the Severe Overvoltage limit (see page 25) with FET bridge enabled.</p> <p>Clear: Bring capacitor voltage below Severe Overvoltage limit, and then cycle KSI.</p>
11	7951	28	Motor Temp Hot Cutback	Motor Shutdown & Vehicle Will not move	<ol style="list-style-type: none"> 1. Motor temperature is at or above the programmed Temperature Hot setting, and the current is being cut back. 2. Motor high temp due to high load or poor cooling 	<ol style="list-style-type: none"> 1. Reduce the motor load. <p>if problem persists, provide proper cooling.</p> <p>Set: Motor temperature is at or above the Temperature Hot parameter setting.</p> <p>Clear: Bring the motor temperature within range.</p>
12	7951	29	Motor Temp Sensor Fault	Motor Shutdown & Vehicle Will not move	<ol style="list-style-type: none"> 1. Motor thermistor is not connected properly. 2. Temp sensor may be damaged 3. Motor temp sensor wire upto controller may be damaged 	<ol style="list-style-type: none"> 1. Motor temp needle on cluster should show some value, if not, then controller is not getting input from sensor 2. Connect sensor wire properly. 3. Check sensor and sensor wire upto controller
13	NA	31	Coil1 Driver Open/Short	Motor Shutdown & Vehicle Will not move	<ol style="list-style-type: none"> 1. Open or short on driver load. 2. Dirty connector pins. 3. Bad crimps or faulty wiring. 	<ol style="list-style-type: none"> 1.1 Check driver load for open or short circuitry. 1.2 Connect them properly. 2.1 Clean connector pins. 3.1 Check for adequate crimping. Correct it. 3.2 Check for poor wiring. Replace it adequately.
14	NA	31	Main Open/Short	Motor Shutdown & Vehicle Will not move	<ol style="list-style-type: none"> 1. Open or short on driver load. 2. Dirty connector pins. 3. Bad crimps or faulty wiring. 	<ol style="list-style-type: none"> 1.1 Check driver load for open or short circuitry. 1.2 Connect them properly. 2.1 Clean connector pins. 3.1 Check for adequate crimping. Correct it. 3.2 Check for poor wiring. Replace it adequately.
15	NA	36	Encoder Fault	Motor Shutdown & Vehicle Will not move	<ol style="list-style-type: none"> 1. Motor encoder failure. 2. Bad crimps or faulty wiring. 	<ol style="list-style-type: none"> 1.1 Disconnect encoder connector, remove encoder, if dirty clean it and reconnect it. 2.1 Check for adequate crimping. Correct it. 2.2 Check for poor wiring. Replace it adequately. <p>Set: Motor encoder phase failure detected.</p>
16	7950	36	Sin/Cos Sensor Fault	Motor Shutdown & Vehicle Will not move	<ol style="list-style-type: none"> 1. Sin/Cos sensor failure. 2. Bad crimps or faulty wiring. 3. See Monitor menu » Motor: Motor RPM. 	<ol style="list-style-type: none"> 1.1 Power up the controller, if it is not getting on, replace it. 2.1 Check for adequate crimping. Correct it. 2.2 Check for poor wiring. Replace it adequately <p>Set: Greater than Sin_Cos_Fault_Threshold % difference from expected value between two phases seen 5 times within one second.</p> <p>Clear: Cycle KSI, or VCL reset, or Entry into LOS mode if enabled, (or entry into an ACIM auto-characterization).</p>
17	5920	37	Motor Open	Motor Shutdown & Vehicle Will not move	<ol style="list-style-type: none"> 1. Motor phase is open. 2. Bad crimps or faulty wiring. 	<ol style="list-style-type: none"> 1. Check for adequate crimping. Correct it. 2. Check for poor wiring. Replace it adequately <p>Set: Motor phase U, V, or W detected open.</p> <p>Clear: Cycle KSI.</p>
18	NA	38	Main Contactor Welded	Motor Shutdown & Vehicle Will not move	<ol style="list-style-type: none"> 1. Main contactor tips are welded closed. 2. Motor phase U or V is disconnected or open. 3. An alternate voltage path (such as an external precharge resistor) is providing a current to the capacitor bank (B+ connection terminal). 	<ol style="list-style-type: none"> 1.1 Check main contactor tips welding. 1.2 If welded, take suitable steps. 2.1 Check motor phase connections 2.2 If improper, rectify it. 3.1 Check for alternate voltage path. 3.2 If found, block it and provide suitable path. <p>Set: Just prior to the main contactor closing, the capacitor bank voltage (B+ connection terminal) was loaded for a short time and the voltage did not discharge.</p> <p>Clear: Cycle KSI</p>
19	NA	39	Main Contactor Did Not Close	Motor Shutdown & Vehicle Will not move	<ol style="list-style-type: none"> 1. Main contactor coil is not getting adequate supply 2. Main contactor tips are oxidized, burned, or not making good contact.* 3. External load on capacitor bank (B+ connection terminal) that prevents capacitor bank from charging. 4. Blown B+ fuse. 	<ol style="list-style-type: none"> 1. Replace contactor. 2. Reduce over loading. 3. Replace B+ fuse. <p>Set: With the main contactor commanded closed, the capacitor bank voltage (B+ connection terminal) did not charge to B+.</p> <p>Clear: Cycle KSI.</p> <ol style="list-style-type: none"> 4. Check wear & tear of coil wires which coming from controller
20	NA	41	Throttle Wiper High	Motor Shutdown & Vehicle Will not move	<ol style="list-style-type: none"> 1. Throttle pot wiper voltage too high. 	<ol style="list-style-type: none"> 1. Throttle pot wiper (pin 16) voltage is higher than the high fault threshold (can be changed with the VCL function Setup_Pot_Faults()). <p>Clear: Bring throttle pot wiper voltage below the fault threshold.</p>
21	NA	42	Throttle Wiper Low	Motor Shutdown & Vehicle Will not move	<ol style="list-style-type: none"> 1. Throttle pot wiper voltage too low. 	<ol style="list-style-type: none"> 1. Throttle pot wiper (pin 16) voltage is lower than the low fault threshold (can be changed with the VCL function Setup_Pot_Faults()). <p>Clear: Bring throttle pot wiper voltage above the fault threshold.</p>
22	NA	43	Pot2 Wiper High	Motor Shutdown & Vehicle Will not move	<ol style="list-style-type: none"> 1. Potentiometer may get damage 2. Potentiometer is not getting 5V supply from controller 3. Controller is not getting Wiper (Output) from controller 	<p>Replace the potentiometer.</p> <p>Check the voltage between the low and high ends of potentiometer; if incorrect, check the wiring</p> <p>Check the output(wiper) at various instances.</p>

S. No.	Error Code (SPN)	Error Code on diagnostic tool	Name	Effect	Cause	Remedy
22	NA	43	Pot2 Wiper High	Motor Shutdown & Vehicle Will not move	1. Potentiometer may get damage 2. Potentiometer is not getting 5V supply from controller 3. Controller is not getting Wiper (Output) from controller	1. Check the battery parameters, if required, set the correct value Replace the potentiometer. Check the voltage between the low and high ends of potentiometer; if incorrect, check the wiring Check the output(wiper) at various instances.
23	NA	44	Pot2 Wiper Low	Motor Shutdown & Vehicle Will not move	1. Potentiometer may get damage 2. Potentiometer is not getting 5V supply from controller 3. Controller is not getting Wiper (Output) from controller	Replace the potentiometer. Check the voltage between the low and high ends of potentiometer; if incorrect, check the wiring Check the output(wiper) at various instances.
24	519365	46	EEPROM Failure	Motor Shutdown & Vehicle Will not move	1. Failure to write to EEPROM memory. This can be caused by EEPROM memory writes initiated by VCL, by the CAN bus, by adjusting parameters with the programmer, or by loading new software into the controller. 2. Internal HW fault	1.1 Check for Failure of EEPROM memory 1.2 Replace it. 2.1 Replace it. Set: Controller operating system tried to write to EEPROM memory and failed. Clear: Download the correct software (OS) and matching parameter default settings into the controller and cycle KSI.
25	NA	47	HPD/Sequencing Fault	Motor Shutdown & Vehicle Will not move	FNR may be engaged Throttle may be engaged	FMR and throttle should be in neutral position.
26	NA	49	Parameter Change Fault	Motor Shutdown & Vehicle Will not move	1. This is a safety fault caused by a change in certain parameter settings so that the vehicle will not operate until KSI is cycled. For example, if a user changes the Throttle Type this fault will appear and require cycling KSI before the vehicle can operate.	1.1 Check for parameter change and adjust the parameter setting accordingly. Set: Adjustment of a parameter setting that requires cycling of KSI. Clear: Cycle KSI.
27	NA	72	PDO Timeout	Motor Shutdown & Vehicle Will not move	1. Time between CAN PDO messages received exceeded the PDO Timeout Period.	1.1 Cycle KSI or receive CAN NMT message. Set: Time between CAN PDO messages received exceeded the PDO Timeout Period. Clear: Cycle KSI or receive CAN NMT message.
28	7950	73	Stall Detected	Motor Shutdown & Vehicle Will not move	1. Stalled motor. 2. Motor encoder failure. 3. Bad crimps or faulty wiring. 4. Problems with power supply for the motor encoder. 5. See Monitor menu » Motor: Motor RPM. 6. Motor mechanical load excessive	1.1 Reduce the load 2.1 Replace the motor. 3.1 Rectify the faulty crimps and wiring. 4.1 Replace the power supply 5.1 Reduce the excessive mechanical load. Set: No motor encoder movement detected. Clear: Either cycle KSI, or if parameter LOS Upon Encoder Fault = On and Interlock has been cycled, then the Stall Detected fault is cleared and Encoder LOS fault (code 93) is set, allowing limited motor control.
29	7950	88	Encoder Pulse Count Fault	Motor Shutdown & Vehicle Will not move	1. Encoder Steps parameter does not match the actual motor encoder. 2. Motor sin/cos sensor or wiring faulty	1.1 Set: Detected wrong setting of the Encoder Steps parameter. Clear: Ensure the Encoder Steps parameter matches the actual encoder; cycle KSI.
30	NA	99	Parameter Mismatch	Motor Shutdown & Vehicle Will not move	1. Dual drive enabled on only one controller. 2. Incorrect position feedback type chosen for motor technology in use. 3. Dual drive is enabled in torque mode.	1.1 Rectify the parameters. 2.1 Rectify the type of feedback chosen for motor technology. 3.1 Disable dual drive in torque mode. Set: When the Dual Drive software is enabled, the controller must be set to either Speed Mode Express or Speed Mode; otherwise this fault is set. Motor Technology=0 must be paired with Feedback Type=1, and Motor Technology=1 must be paired with Feedback Type=2; otherwise this fault is set. Clear: Adjust parameters to appropriate values and cycle KSI.
31	NA	25	Supply Failure	Motor Shutdown & Vehicle Will not move	1. External load impedance on the +5V supply (pin 26) is too low. 2. See Monitor menu » outputs: 5 Volts and Ext Supply Current.	1.1 Set: +5V supply (pin 26) outside the 5 V±10% range. Clear: Bring voltage within range.
32	NA	89		Motor Shutdown & Vehicle Will not move	Motor Type in the setting is not zero.	Check the setting or motor controller and enter zero in the field of motor type.

6.1. BATTERY ERROR CODE

S. No.	Error code (Diagnostic tool)	Name	Message ID	Effect	Cause	Remedy
1	100	SOC is too high	0x18F108F3	Battery over charged	1. BMS S/W faults which allow battery to get over charged 2. BMS S/w get corrupted 3. BMS not working	1. Rectify the causes 2. Do not put vehicle on charge
2	101	SOC is too low	0x18F108F3	Battery is discharged below the threshold limit	1. BMS S/W faults which allow battery to discharge below threshold limit 2. BMS S/w get corrupted 3. BMS not working	1. Rectify the causes 2. Put vehicle on charge
3	102	Total voltage is too high	0x18F108F3	Battery over charged	1. BMS S/W faults which allow battery to get over charged 2. BMS S/w get corrupted 3. BMS not working	1. Rectify the causes 2. Do not put vehicle on charge
4	103	Total voltage is too low	0x18F108F3	Battery is discharged below the threshold limit	1. BMS S/W faults which allow battery to discharge below threshold limit 2. BMS S/w get corrupted 3. BMS not working	1. Rectify the causes 2. Put vehicle on charge
5	104	Charge current fault	0x18F108F3	Battery will not charge	1. Current sensor not working 2. Current sensor calibration not okay 3. Charging status from charger coming wrong	1. Replace current sensor 2. Calibrate current sensor 3. Check charger and replace if not working
6	105	Discharge current fault	0x18F108F3	Battery will not discharge	1. Current sensor not working 2. Current sensor calibration not okay 3. Discharging status from charger coming wrong	1. Replace current sensor 2. Calibrate current sensor 3. Check charger and replace if, not working
7	106	Battery temperature is too low	0x18F108F3	Battery will not allow charge and discharge	1. Check the ambient temp, it should not be below -10Deg C 2. Temp sensor is faulty 3. Check the wiring of temp sensor	1. Replace temp sensor 2. Replace the wiring of temp sensor, if faulty 3. Stop charging and discharging the battery till the ambient temp (0-25 Deg C) is reached
8	107	Battery temperature is too high	0x18F108F3	Battery will not allow charge and discharge if, temp rise above 54 Deg C	1. Temp sensor is faulty 2. Check the wiring of temp sensor 3. Battery is charging and discharging at full load condition and the temp rises at 54 Deg C	1. Replace temp sensor 2. Replace the wiring of temp sensor, if faulty 3. Stop charging and discharging the battery till the ambient temp(0-25Deg C) is reached
9	108	Battery undervoltage	0x18F108F3	Battery is discharged below the threshold limit	1. BMS S/W faults which allow battery to discharge below threshold limit 2. BMS S/w get corrupted 3. BMS not working	1. Rectify the causes 2. Put vehicle on charge
10	109	Battery overvoltage	0x18F108F3	Battery over charged	1. BMS S/W faults which allow battery to get over charged 2. BMS S/w get corrupted 3. BMS not working	1. Rectify the causes 2. Do not put vehicle on charge
11	110	battery temperature unbalance	0x18F108F3	Battery will not allow charge and discharge	1. Check the ambient temp, it should be between 0-25 Deg C 2. Temp sensor is faulty 3. Check the wiring of temp sensor	1. Replace temp sensor 2. Replace the wiring of temp sensor, if faulty 3. Stop charging and discharging the battery till the ambient temp (0-25 Deg C) is reached
13	112	The battery does not match	0x18F108F3	Battery will not allow charge and discharge		Replace the battery
14	113	The temperature of the output pole is too high	0x18F108F3	Battery will not allow charge and discharge	1. Check the ambient temp, it should be between 0-25 Deg C 2. Temp sensor is faulty 3. Check the wiring of temp sensor	1. Rectify the causes 2. Replace the battery
15	116	The parameters of memory fault	0x18F108F3			
16	117	Data memory fault	0x18F108F3			
17	118	Cell voltage detection fault	0x18F108F3		1. Faulty cell 2. Current sensor faulty	
18	119	Temperature detection fault	0x18F108F3	Battery will not allow charge and discharge	1. Check the ambient temp, it should be between 0-25 Deg C 2. Temp sensor is faulty 3. Check the wiring of temp sensor	1. Rectify the causes 2. Replace the battery
19	120	Current detection fault	0x18F108F3	Battery will not charge	1. Current sensor not working 2. Current sensor calibration not okay 3. Charging status from charger coming wrong	1. Replace current sensor 2. Calibrate current sensor 3. Check charger and replace if not working
20	121	Internal total voltage detection fault	0x18F108F3			Replace the battery
21	122	External total voltage detection fault	0x18F108F3			Replace the battery
22	123	Insulation monitoring fault	0x18F108F3	Vehicle will not move	1. Wiring fault 2. Wear and tear might have occurred	1. Check the whole wiring and replace accordingly
23	124	Clock fault	0x18F108F3	NA		
24	125	Internal CAN communication fault	0x18F108F3			

25	126	Serious insulation fault	0x18F108F3	Vehicle will not move	1.Wiring fault 2. Wear and tear might have occurred	1. Check the whole wiring and replace accordingly
26	127	Slight insulation fault	0x18F108F3	Vehicle will not move	1.Wiring fault 2. Wear and tear might have occurred	1. Check the whole wiring and replace accordingly
27	140	System fault level	0x18F108F3	Vehicle will not move	1. BMS hardware fault 2. BMS software fault 3. Relay (main) not working 4. Battery fuse blowdown	1. Replace battery fuse 2. Check the MSD, it should be ON at ignition ON condition 3. Check BMS low voltage power supply(12V DC)
28	142	BMS fault need maintenance	0x18F108F3	Vehicle will not move	1. BMS hardware fault 2. BMS software fault 3. Relay (main) not working 4. Battery fuse blowdown	1. Replace battery fuse 2. Check the MSD, it should be ON at ignition ON condition 3. Check BMS low voltage power supply(12V DC)
29	143	Battery fault need maintenance	0x18F108F3	Vehicle will not move	1. BMS hardware fault 2. BMS software fault 3. Relay (main) not working 4. Battery fuse blowdown	1. Replace battery fuse 2. Check the MSD, it should be ON at ignition ON condition 3. Check BMS low voltage power supply(12V DC)
30	144	Battery system fault needs maintenance	0x18F108F3	Vehicle will not move	1. BMS hardware fault 2. BMS software fault 3. Relay (main) not working 4. Battery fuse blowdown	1. Replace battery fuse 2. Check the MSD, it should be ON at ignition ON condition 3. Check BMS low voltage power supply(12V DC)
31	145	The battery needs to maintenance (full charging and full discharging)	0x18F108F3	Vehicle will not move	1. BMS hardware fault 2. BMS software fault 3. Relay (main) not working 4. Battery fuse blowdown	1. Replace battery fuse 2. Check the MSD, it should be ON at ignition ON condition 3. Check BMS low voltage power supply(12V DC)
32	146	Maintenance mode status	0x18F108F3	Vehicle will not move	1. BMS hardware fault 2. BMS software fault 3. Relay (main) not working 4. Battery fuse blowdown	1. Replace battery fuse 2. Check the MSD, it should be ON at ignition ON condition 3. Check BMS low voltage power supply(12V DC)

SERVICE MANUAL

STEERING SYSTEM

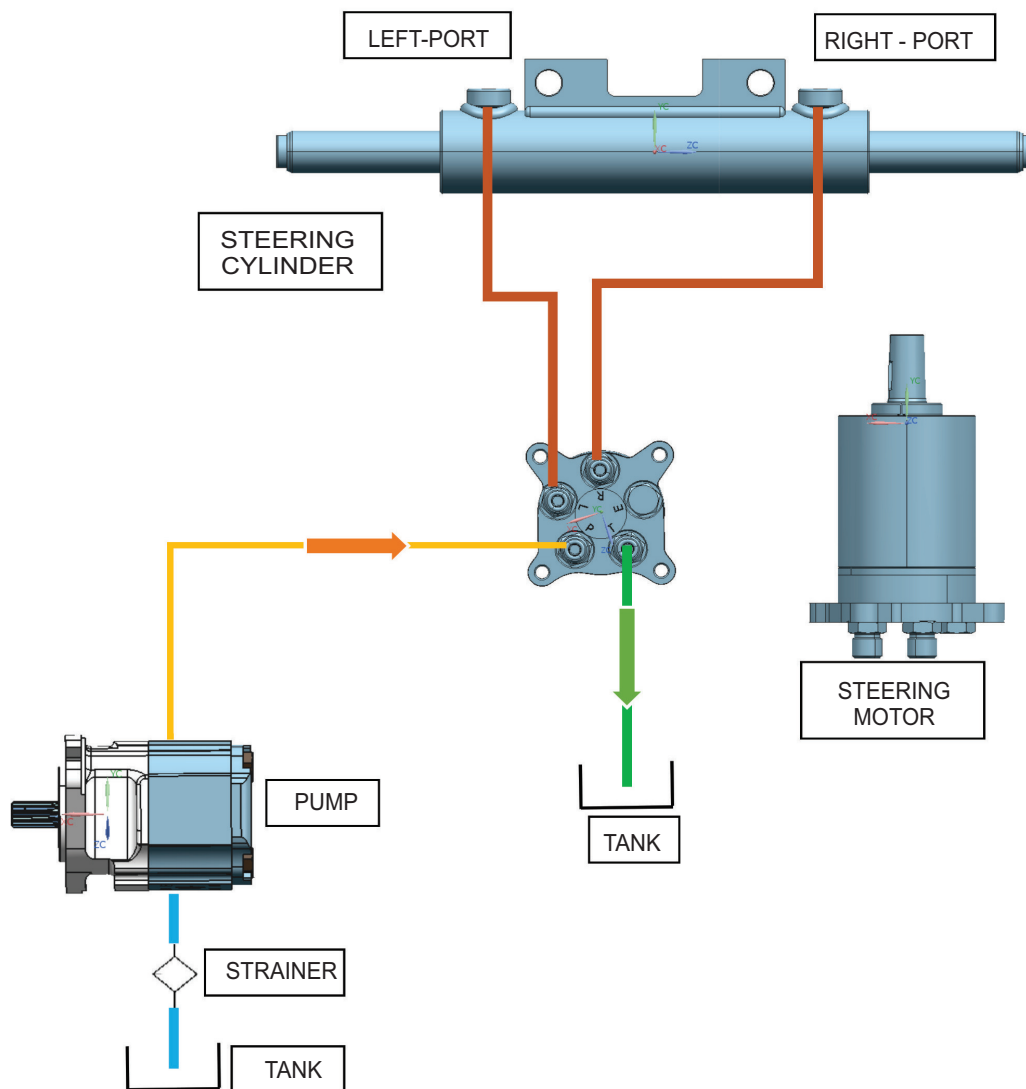
STEERING SYSTEM

CONTENTS	PAGE
1. STEERING SYSTEM IN NEUTRAL CONDITION	1
2. STEERING SYSTEM IN LEFT TURN - CONDITION	2
3. STEERING SYSTEM IN RIGHT TURN - CONDITION	3
4. DESCRIPTION AND OPERATION	4
5. EXPLODED VIEW OF HSU UNIT	5
6. STEERING CYLINDER ASSEMBLY & DISASSEMBLY	6
7. TORQUE SPECIFICATIONS	7

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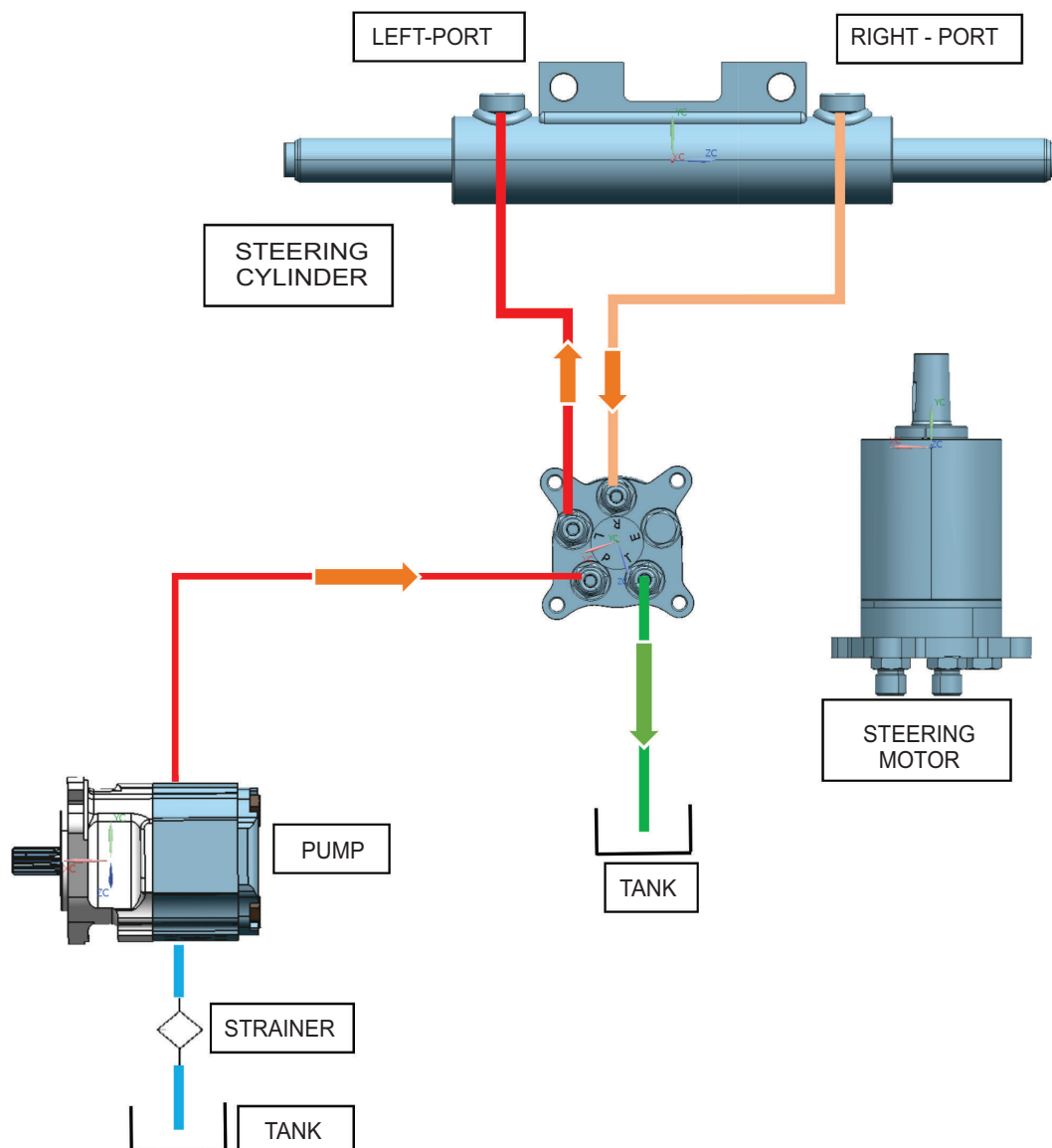
OIL FLOW IN STEERING CIRCUIT**STEERING SYSTEM IN
NEUTRAL - CONDITION**

The below figure shows the steering system in NEUTRAL position. The fluid provided by the pump enters into the P Port located in the steering motor. The same fluid comes out of T Port and goes back to the tank. No oil will go in L and R Port joining the steering motor to the steering cylinder. No oil will go in L and R Port joining the steering motor to the steering cylinder.



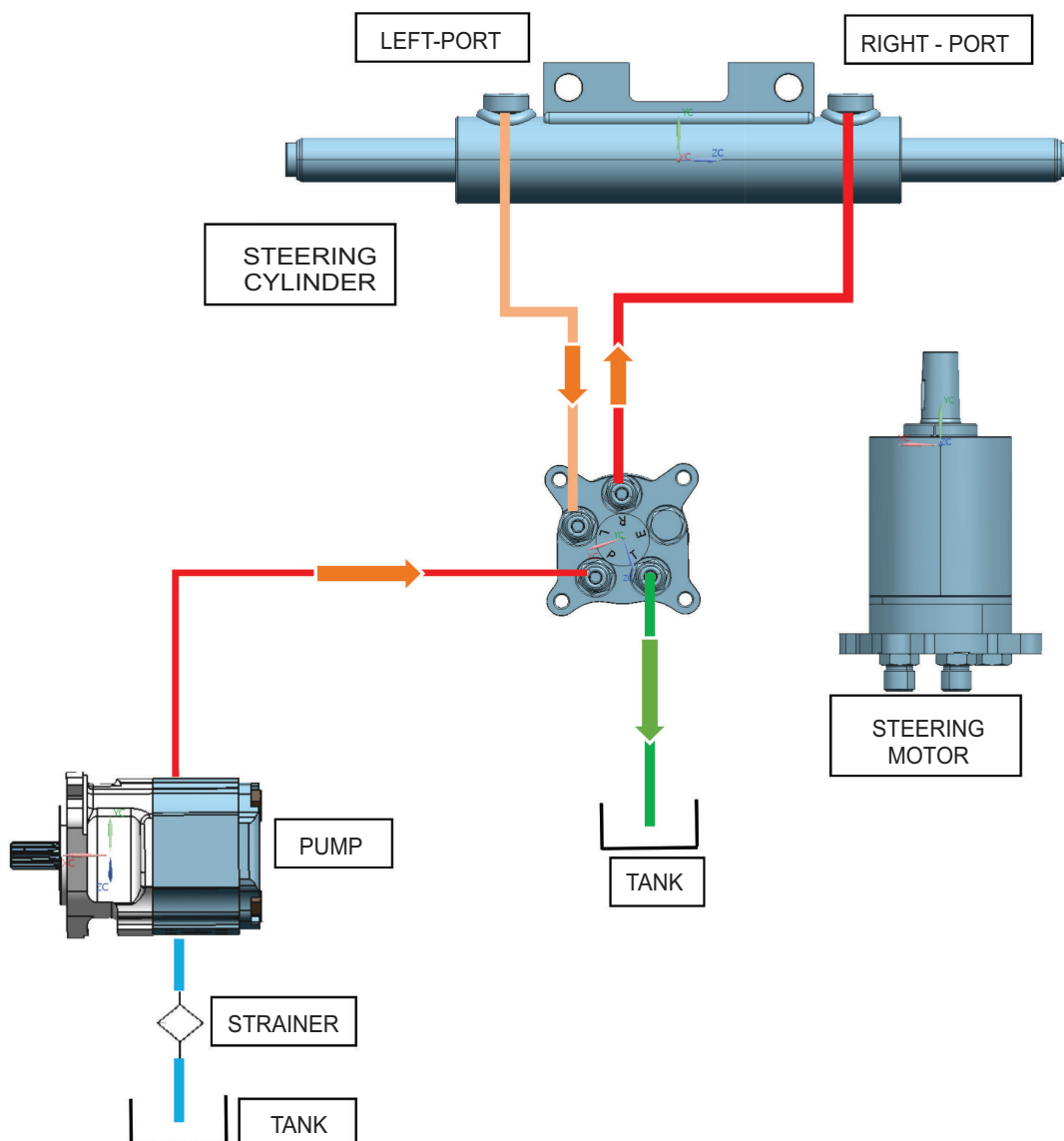
**STEERING SYSTEM IN LEFT
TURN - CONDITION**

The below figure show the steering system in left turn position. The fluid provided by the pump enters into the P Port located in the steering motor while steering wheel turns left side. The P Port is connected to the L Port of steering motor. Oil will flow from L-port of steering motor to L-Port of steering Cylinder. The oil from the R Port of steering cylinder enters into the R Port of steering motor. The R Port is connected to the T Port of steering motor. Now oil will drain back to tank through T Port of steering Unit.



STEERING SYSTEM IN IN RIGHT TURN - CONDITION

The below figure show the steering system in right turn position. The fluid provided by the pump enters into the P Port located in the steering motor while steering wheel turns right side. The P Port is connected to the R Port of steering motor. Oil will flow from R-port of steering motor to R-Port of steering Cylinder. The oil from the L Port of steering cylinder enters into the L Port of steering motor. The L Port is connected to the T Port of steering motor. Now oil will drain back to tank through T Port of steering Unit.



STEERING SYSTEM

1. DESCRIPTION AND OPERATION

Farmtrac feature an hydraulic power assisted, hydrostatic steering system. The components are serviced separately and consist of the steering column shaft, steering motor, front steering cylinder, power steering pump, oil cover and reservoir, and the hoses and tubes required to connect the system.

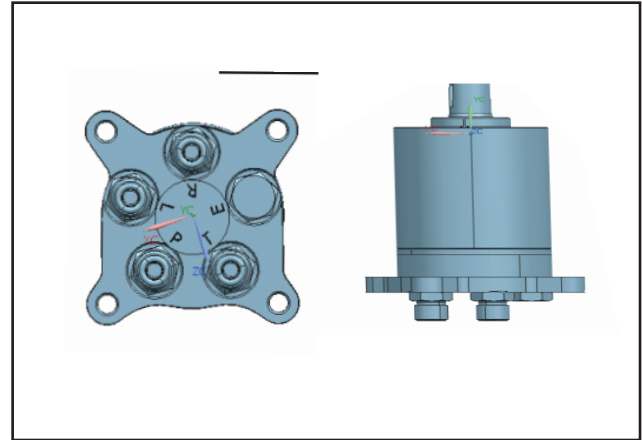
The integral power steering pump is mounted on the rear of the engine front cover plate at the left-hand side of the engine. The pump is connected to the steering motor by single oil tube.

The steering wheel is secured to the steering column shaft. The steering column upper shaft is joined to the power steering motor input shaft by a coupling secured with a pinch bolt. The power steering motor and steering column assembly are mounted on a housing bracket which is bolted at the clutch housing.

The hydrostatic steering motor uses a linear control valve to control the direction of the steered wheels and a metering unit to control the rate of turn. In the event of pump failure the metering unit functions as an hydraulic pump and the wheels can be turned manually.

2. STEERING CYLINDER

The double acting steering cylinder is transversely mounted on the front axle. The cylinder end of the assembly is bolted to an adjuster bar which forms an integral part of the front axle assembly and facilitates re-positioning of the cylinder when adjusting the track setting. The rod end is attached to the left-hand spindle arm which is connected by the track rod to the right-hand spindle arm. The cylinder incorporates a piston centrally mounted on the piston rod. This arrangement enables the piston to present surfaces of equal area to the operating oil and the resultant forces ensure similar right and left-hand turning circles.



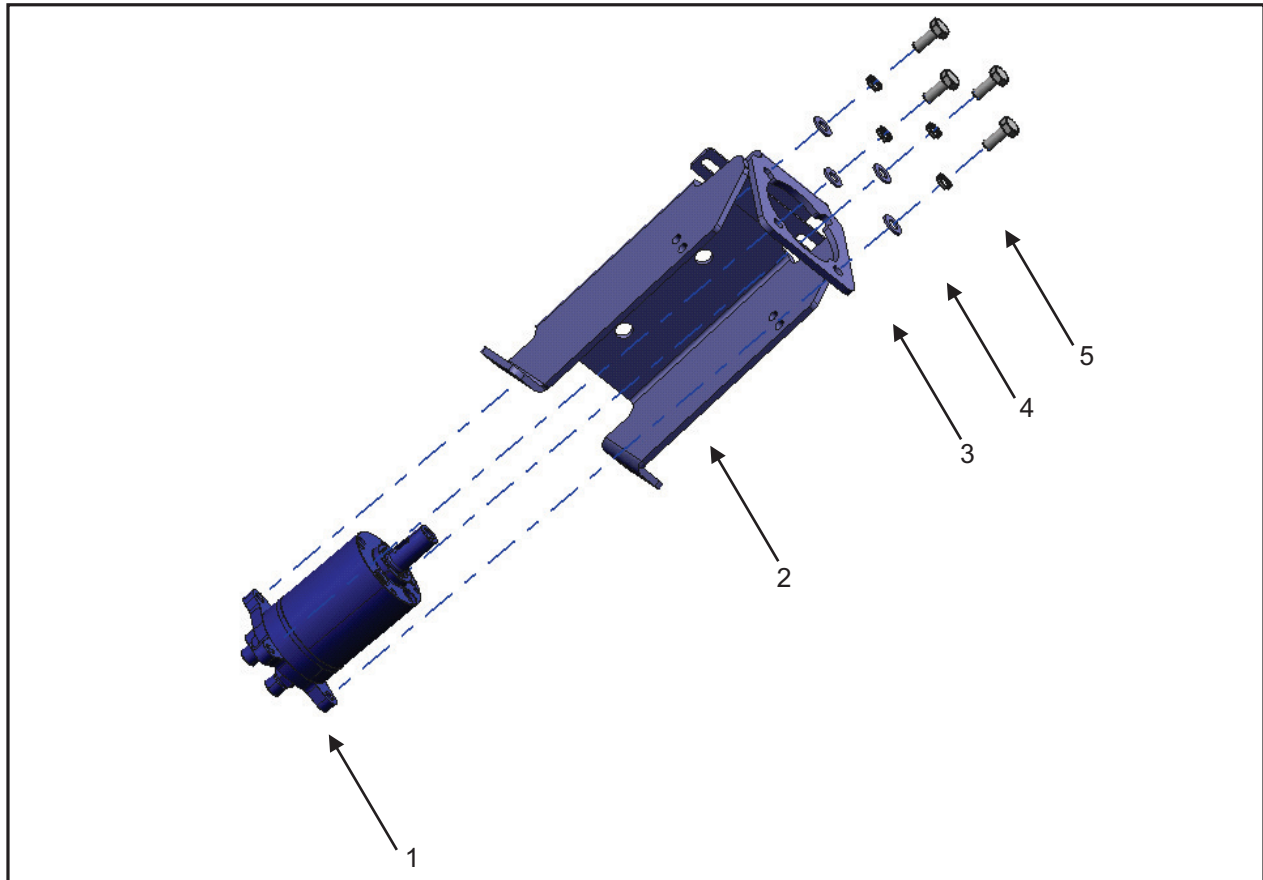
A. Steering Motor Connections and Pipes

3. HYDROSTATIC STEERING SYSTEM OVERHAUL

A. REMOVAL

1. Disconnect the battery ground cable at the battery.
2. Clean the flexible steering hose to rigid pipe connections.
3. With a suitable container to store the escaping steering oil, mark and separate the flexible steering hoses from the rigid pipes. Cap and seal the pipes, using suitable plugs.
4. Slacken the retainer bolts securing the pipes to the side of the engine.
5. Unclip the separate the throttle screws and remove the lower steering column shroud by withdrawing main harness connector to gain access to the steering column to motor coupling.
7. Remove the four bolts retaining the steering motor support bracket.
8. Slacken clamp bolts securing the steering column to the motor and carefully withdraw the motor assembly from the left-hand side of the tractor.

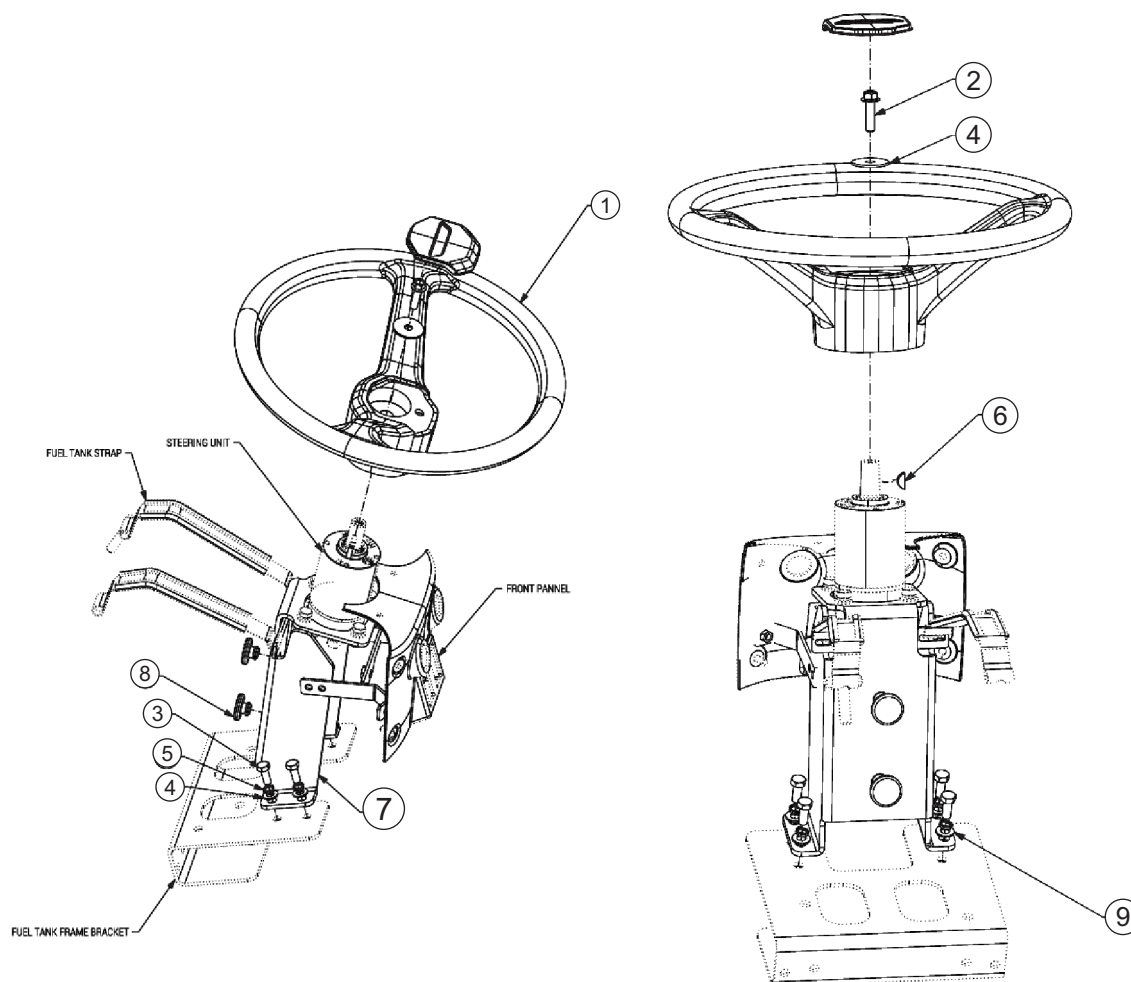
EXPLODED VIEW OF HYDROSTATIC STEERING UNIT



S.No.	PART NO.	DESCRIPTION
1.	D10524330	Power Steering Motor Assembly
2.	D10564510	Bracket Assembly Steering Column Mounting
3.	D85500050	Washer M8 Flat
4.	D86500030	Washer M8 Spring Lock
5.	D81500110	M8x1.25x20 Bolt (20-25 Nm)

STEERING WHEEL DISASSEMBLY

- Remove the cap using the screw driver.
- Remove the steering bolt and washer securing the wheel using the T rod with socket size 12mm.



S.NO.	PART NO.	PART DESCRIPTION	QTY.	TORQUE
1	D10569180	WHEEL ASSEMBLY STEERING	1	
2	D81502240	BOLT M8X1.25X30-10.9 HEX HEAD FLANGED	1	30-35Nm
3	D81500110	BOLT M8X1.25X20-8.8 HEX HEAD	4	20-25Nm
4	D85500700	WASHER M8 OD35 FLAT	1	
5	D86500030	WASHER M8 SPRING LOCK	4	
6	D91000280	WOODRUFF KEY 5X6.5	1	
7	D10564510	BRACKET ASSEMBLY STEERING COLUMN MOUNTING	1	
8	D10562340	GROMMET FUEL TANK	2	
9	D85500050	WASHER M8 FLAT	4	

4. HYDROSTATIC STEERING SYSTEM

CYLINDER-OVERHAUL

REMOVAL AND DISSASSEMBLY

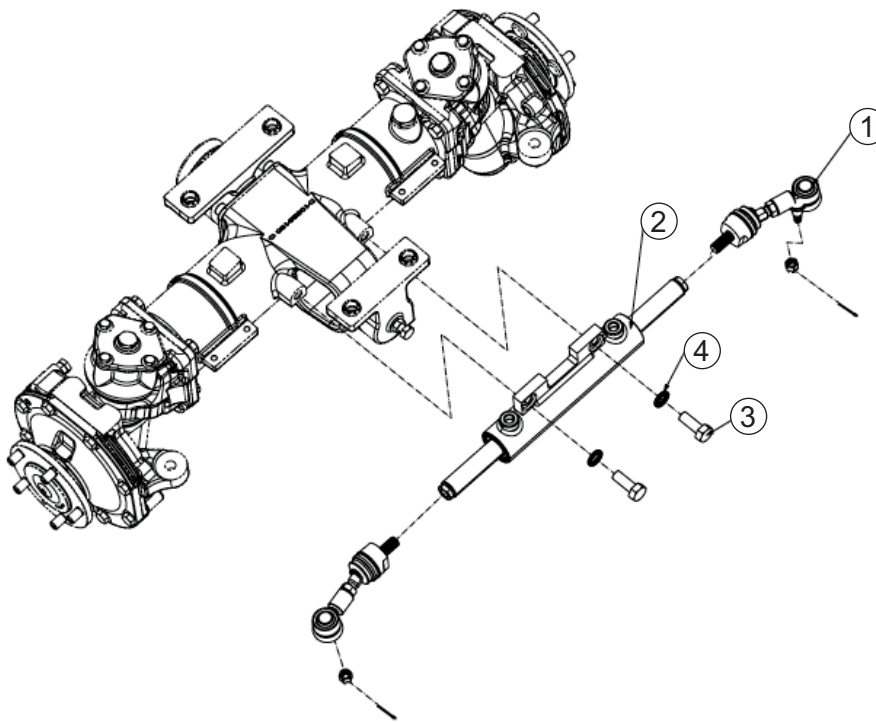
1. Disconnect the two oil feed pipes from the power cylinders. Cap the pipe ends.
2. Unscrew the ball stud nuts.
3. Remove the power cylinder assembly from the tractor.
4. Loosen the clamp retaining the ball end to the piston rod and unscrew the ball end assembly.
5. Remove the piston rod bush retaining snap ring and remove the scraper, outer seal, retainer and inner seal.

NOTE: The power cylinder assembly cannot be further dismantled and if faulty, must be replaced as a unit.

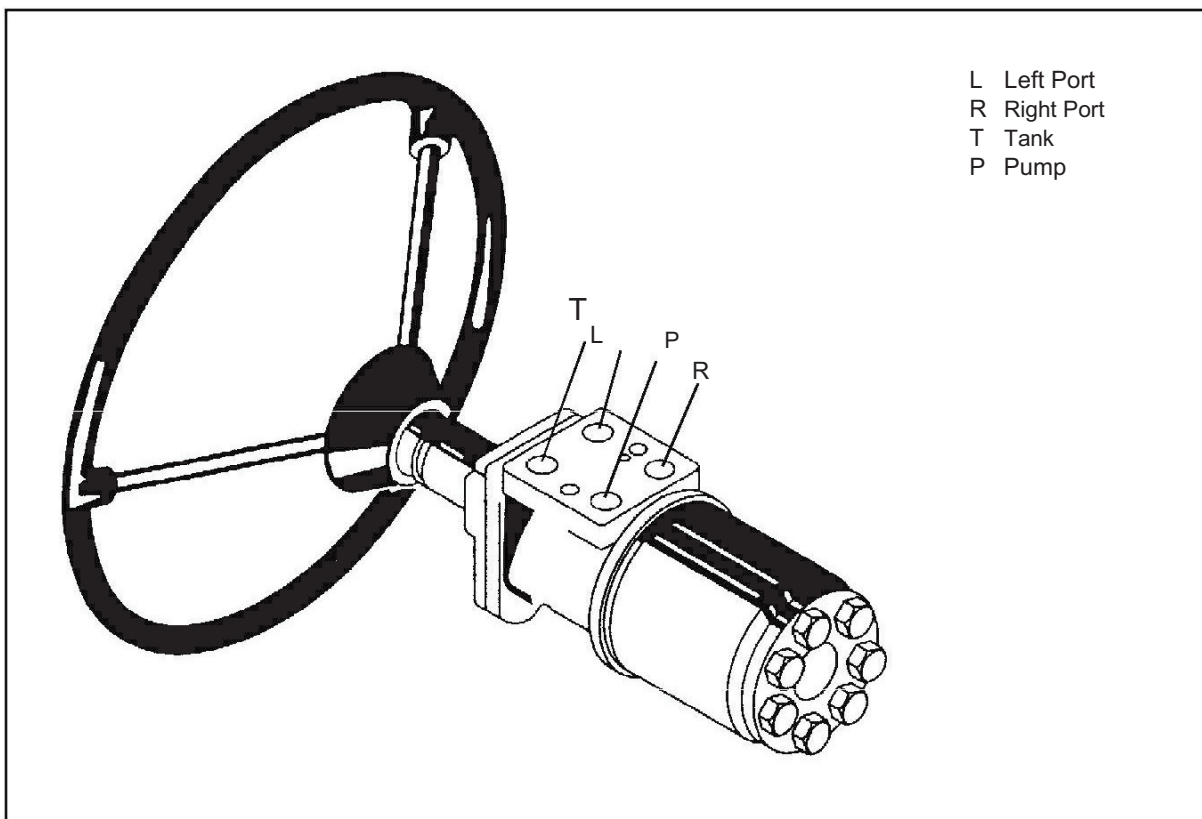
RE-ASSEMBLY AND INSTALLATION

- Re-assembly and installation follows the disassembly and removal procedures in reverse. On installation observe the following requirements.
- Tighten all nuts to the correct torque i.e. 147 to 166.6 Nm
- Operate the Steering several times with the engine running to expel all air from the system then re-check the oil level.

WARNING : Do not mix oil types any mixture or an unapproved oil, could deteriorate the seal, Enough fluid could then leak to create a loss of power steering assists. Do not allow fluid level to go below fill line on dipstick. Before adding new fluid, completely drain oil from the system. It may be necessary also that you flush systems with clean oil.



S.NO.	PART NO.	PART DESCRIPTION	QTY.	TORQUE (Kg-M)
1	D10537731	LINK ASSEMBLY POWER STEERING	2	-
2	D10537740	CYLINDER ASSEMBLY POWER STEERING	1	-
3	D81500740	BOLT M14X2.00X35-10.9 HEX HEAD LOCK	2	15-17
4	D85500520	WASHER M14 LOCK (NORD TYPE)	2	-

5. TORQUE SPECIFICATIONS AND HYDRAULIC CONNECTIONS

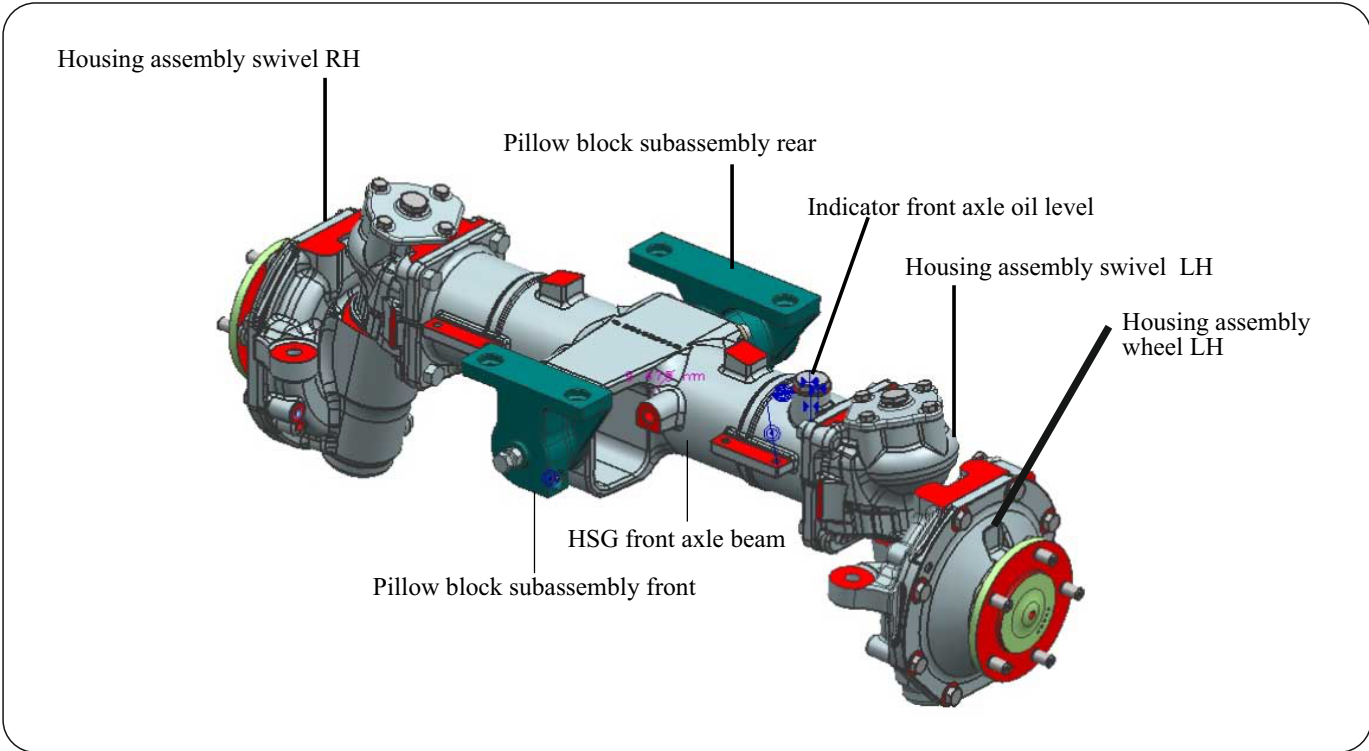
Max. Tightening Torque Nm		
Bolts	Spring Lock Washer	Flat Washer
M8x1.25x20	21.6-28 Nm	21.6-28 Nm

SERVICE MANUAL

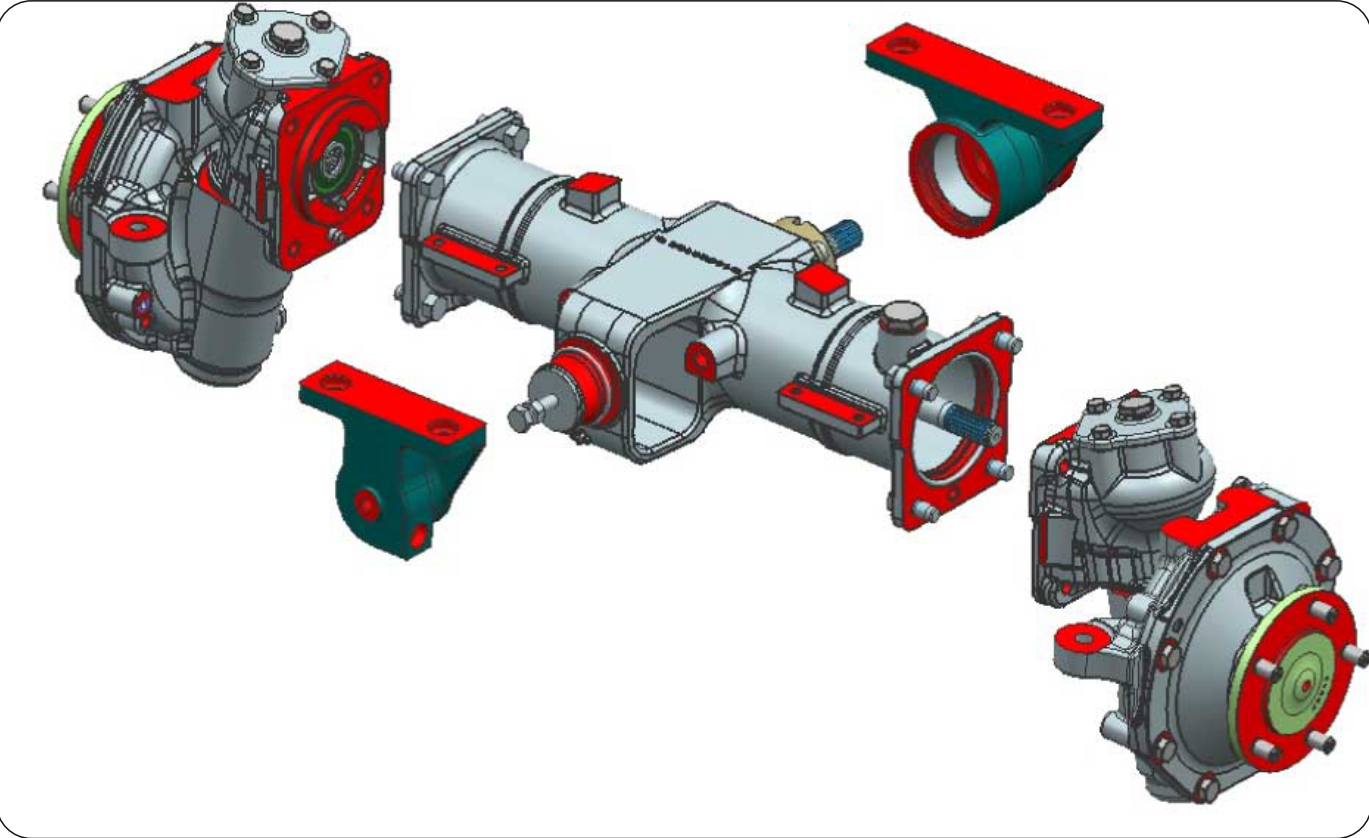
FRONT AXLE

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EXPLODED VIEW OF STEERING CYLINDER	4
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EXPLODED VIEW OF FRONT AXLE



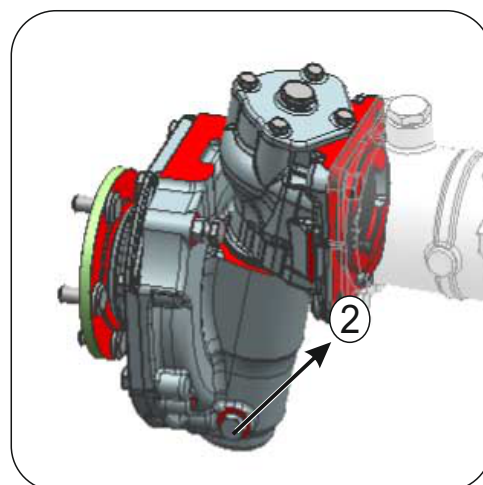
Service manual

FRONT AXLE DIS-ASSEMBLY

Separating Front Axle

Draining front axle case oil

1. Place the oil pan underneath the front axle case.
2. Remove the both the right and left hand side drain plugs(2) with 18 no. socket and filling plug (1) to drain the oil.
3. After draining, reinstall the drain plugs (2).

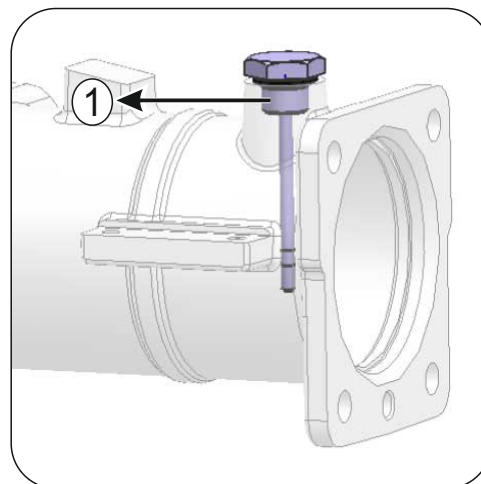


2) Drain plug

Refilling

Fill with new oil up to the upper notch on the dipstick.
After fifteen minutes, check the oil level again and add oil to proper level. The oil capacity is 3.2 litre and oil grade is SAE 80W 90.

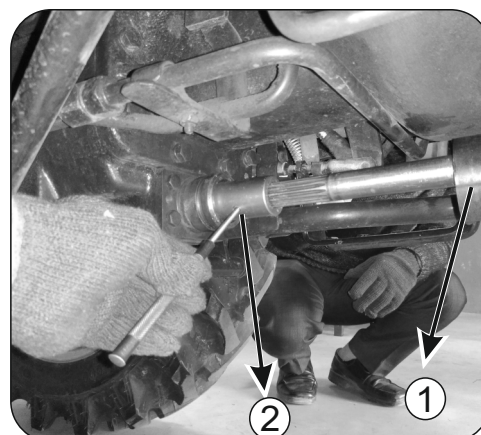
NOTE: If there is any repair needed in swivel HSG, just drain the oil and open 4 bolts to separate swivel HSG. No need to disconnect propeller shaft.



1) Filling plug with dipstick

Disconnecting propeller shaft

1. Loosen the clamps and slide the propeller shaft cover (1) in the forward direction.

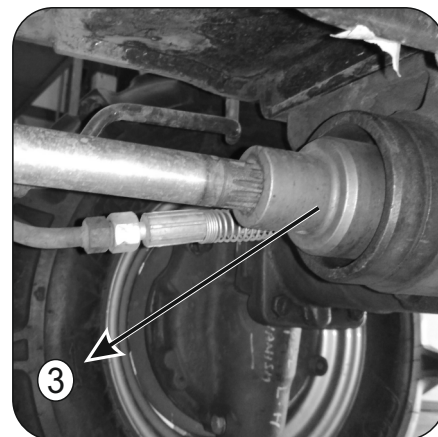


1) Propeller shaft cover 2) Roller pin

2. Tap out the roller pin (2) and slide the coupling (3) in the rearward direction.

Reassembling

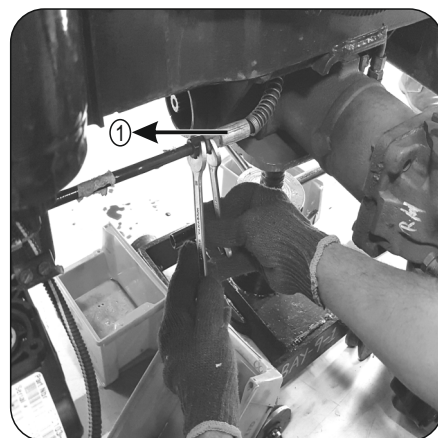
Apply grease to the spline of the propeller shaft.



3) Coupler

Hydraulic hose

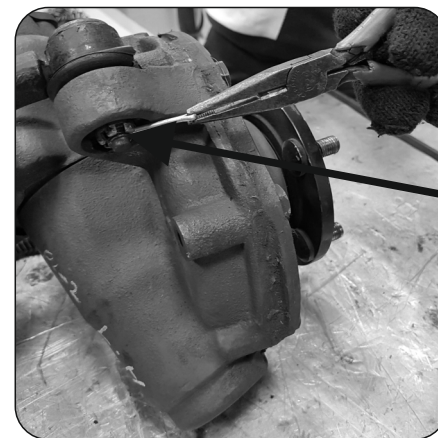
1. Remove the hydraulic hose (1) from the front cylinder assy from both sides.
2. Use 17 & 19 No. Spanner to remove hydraulic hose.



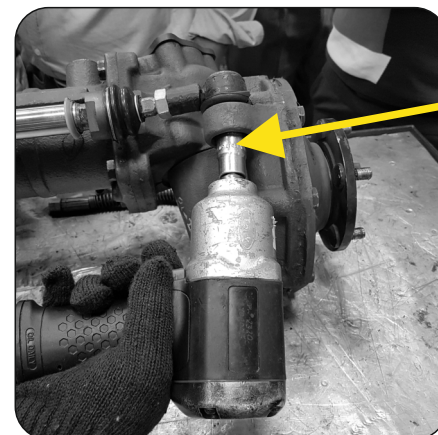
1) Hydraulic hose

STEERING CYLINDER GROUP DISASSEMBLY

- 1) Remove the cotter pin.
- 2) Unloose the steering arm locknut of some turns till it is over the end of the cotter pin. Beat on the nut with a hammer in order to disjoin the steering arm from the swivel housing.



1. Cotter Pin



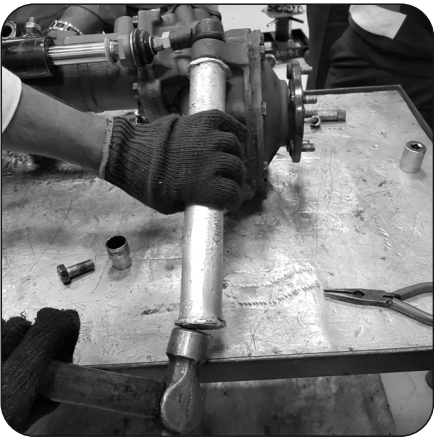
1. Opening bolt

Warning: Do not beat on the end of the cotter pin.

NOTE: This is a destructive operation for the nut.

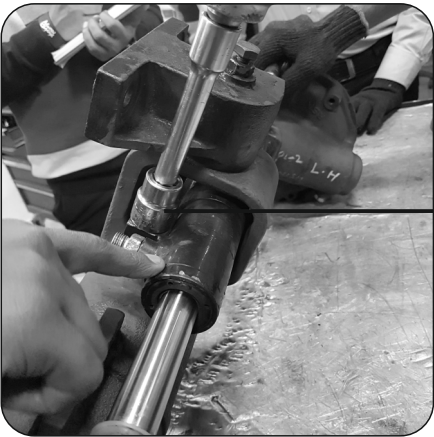
Service manual

3) Remove the guide tie rod by loosening the nut with a suitable wrench, then checks its conditions.



Shaft drift (aluminium)

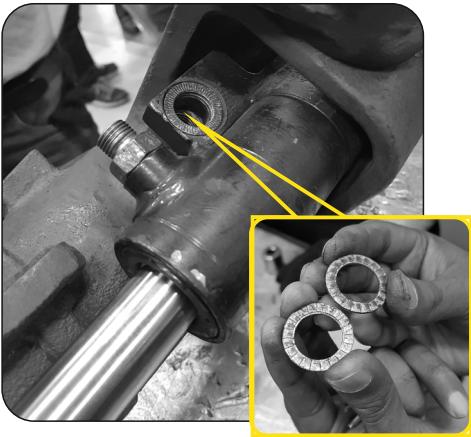
4) Unscrew the fastening screws of the cylinder, then remove the cylinder out of its seat and, if necessary, use a shaft drift hammer. Remove only that parts that need to be overhauled and/or replaced.



Opening bolt

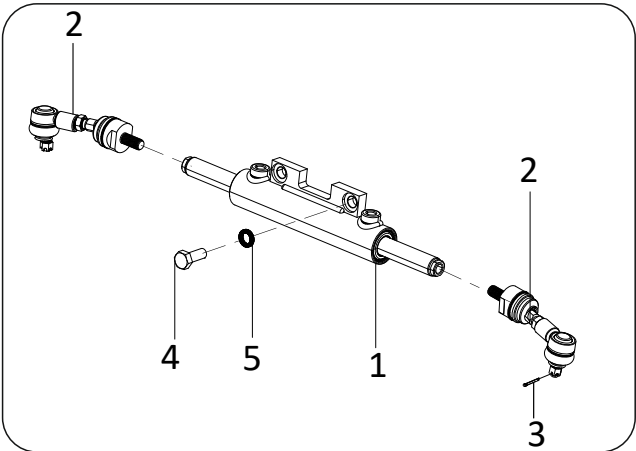
5) Detach the cylinder head from the cylinder case. Remove the cylinder head and the rod from the cylinder case. Remove all the seals.

NOTE: Some of the following pictures may not show exactly your axle, but the process is the same.



Step washer

EXPLODED VIEW OF STEERING CYLINDER



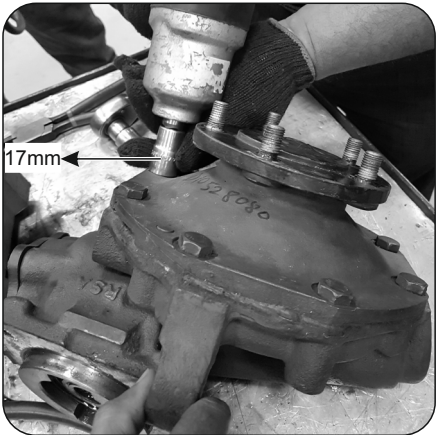
Complete power steering cylinder

1	CYLINDER ASSEMBLY POWER STEERING
2	LINK ASSEMBLY POWER STEERING
3	PIN 3.2X25.0 COTTER
4	BOLT M14X2.00X35-10.9 HEX HEAD LOCK
5	WASHER M14 LOCK (NORD TYPE)

Service manual

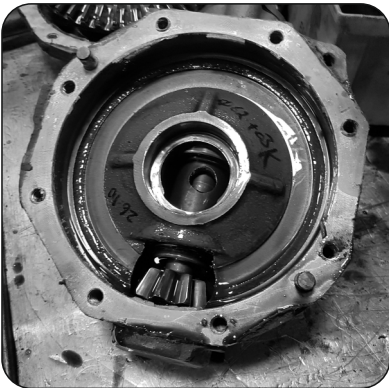
Swivel housing Disassembly

- 1) Drain the oil completely from the swivel housing assembly.
- 2) Unscrew 8 M10 bolts using 17mm socket.



Opening 8 bolts

- 3) Remove the wheel housing.

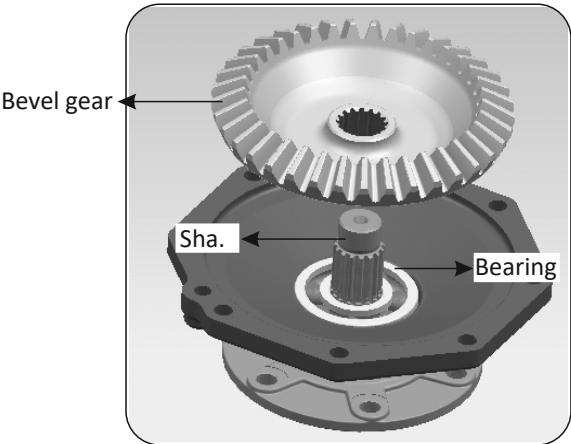


Swivel Assembly

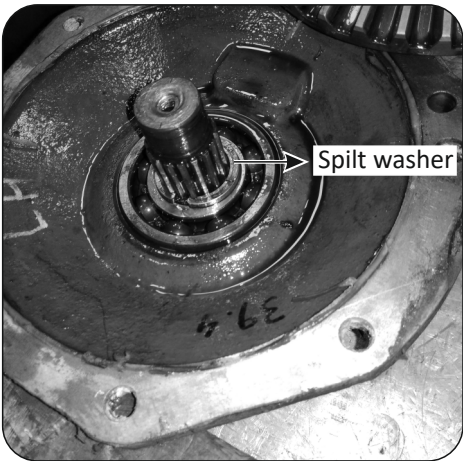


Wheel Housing Assembly

- 4) Remove the Bearing 6305 and remove the bevel Z-37 gear.

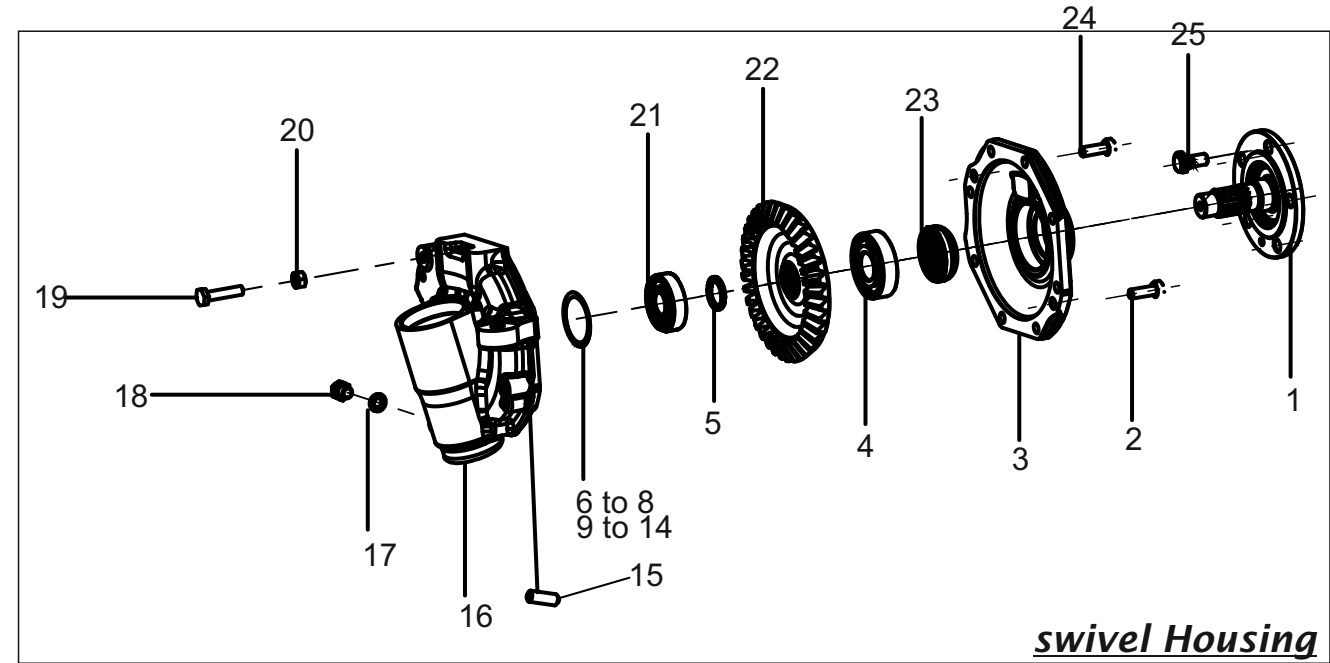


- 5) Remove Split washer from the shaft groove.
Collect the bearing 6306 and check its condition.



Service manual

EXPLODED VIEW OF SWIVEL HOUSING



swivel Housing

№	Part Name	Qty.
1	SHAFT FRONT AXLE WHEEL	1
2	BOLT M10X1.50X30-10.9 HEX HEAD	8
3	HOUSING WHEEL FRONT AXLE	1
4	BEARING BALL 6305	1
5	WASHER SPLIT WHEEL END	2
6	SHIM 60X50 (0.075 MM)	1
7	SHIM 60X50 (0.2285 MM)	1
8	SHIM 60.X50 (0.4065 MM)	1
9	SHIM REAR AXLE SHAFT (0.075 MM)	1
10	SHIM REAR AXLE SHAFT (0.125 MM)	1
11	SHIM REAR AXLE SHAFT (0.2285 MM)	1
12	SHIM REAR AXLE SHAFT (0.4065 MM)	1
13	SHIM REAR AXLE SHAFT (0.5335 MM)	1
14	SHIM REAR AXLE SHAFT (0.7875 MM)	1
15	DOWEL POSITIONING 10X25	1
16	HOUSING SWIVEL FRONT AXLE LH	1
17	WASHER 12.0X22.0 SCREW RAIL	1
18	SCREW M12X1.75X12-8.8 HEX HEAD	1
19	BOLT M10X1.50X45-8.8 HEX HEAD WITH ROUNDED TOP	1
20	NUT M10X1.50-8 HEX	1
21	BEARING BALL 6306	1
22	GEAR DRIVEN BEVEL WHEEL Z-37	1
23	SEAL OIL 35X60X14.5 PTO OUTPUT SHAFT	1
24	BOLT M10X1.50X30-10.9 HEX HEAD	8
25	BOLT M12X1.5 FRONT WHEEL HUB	5

Service manual

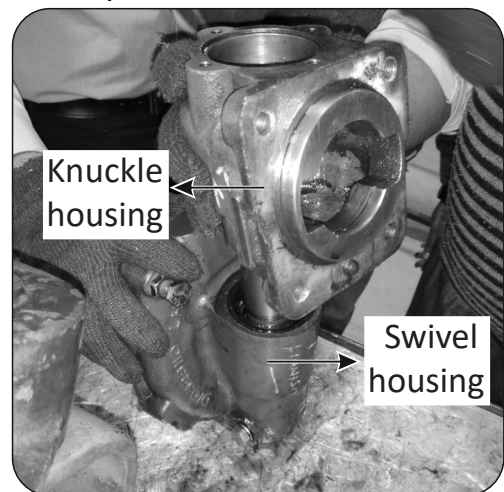
Knuckle housing disassembly

- Use 13 mm socket to open four bolts mounted on the top of knuckle housing.

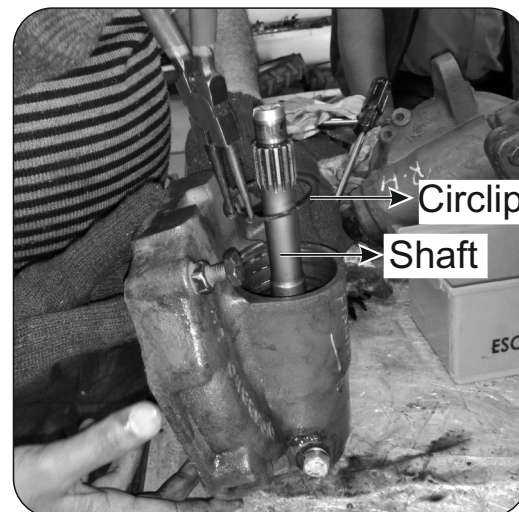


Top cover 4 Bolt

- Bearing no 30304 is inside knuckle housing & also in swivel housing bottom side.
- Shims are used between knuckle housing and knuckle cover.



- Remove circlip (B62) and bevel gear (Z10) from the knuckle housing. Remove Z16 gear which is inside knuckle housing through a slot.



NOTE: Sealing is done between knuckle housing & swivel housing to prevent oil leakage and dust entry.

- There is a slot to take out bevel gear.
- Ball bearing 6909 outside & 6908 inside used in swivel housing.
- Remove 30304 & washer then bevel gear Z16.
- Taper roller bearing is inside knuckle housing.



Service manual

- Remove taper roller bearing 30304 & washer.
- Remove the bevel gear.

NOTE: Z9 Shaft must fitted with cir-clip A-40 before fitment.

- (1) Remove circlip A-40 to separate knuckle HSG from swivel HSG.
- (2) Remove Oil seal.
- (3) Remove 6909 bearing.
- (4) Remove B-62 circlip.
- (5) Remove bearing 6908.
- (6) Remove Z-9 shaft.

- **Note:** Bearing 30304 cone press Z-9 shaft or cup pressed into swivel HSG.

TIPS : Bearing identification tip

Last two digit on the bearing X 5 = ID

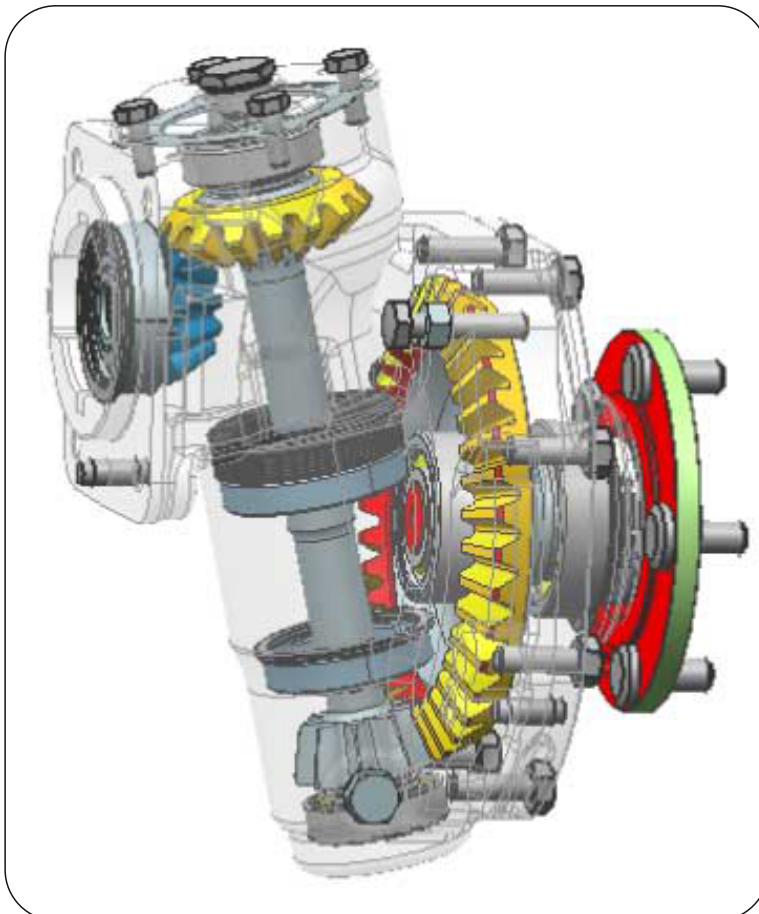
For example

09 X 5 = 45 is ID for bearing.

NOTE: Cut side of knuckle housing keep it always toward inner side.

knuckle housing Arrangement sequence order from bottom to top:

- (1) Bearing (30304)
- (2) Circlip A-40
- (3) Bearing 6908.
- (4) Circlip B-62
- (5) Bearing 6909.
- (6) seal.
- (7) sleeve.
- (8) bevel gear (Z16).
- (9) washer.
- (10) Bearing 30304.
- (11) Knuckle cover at the top.

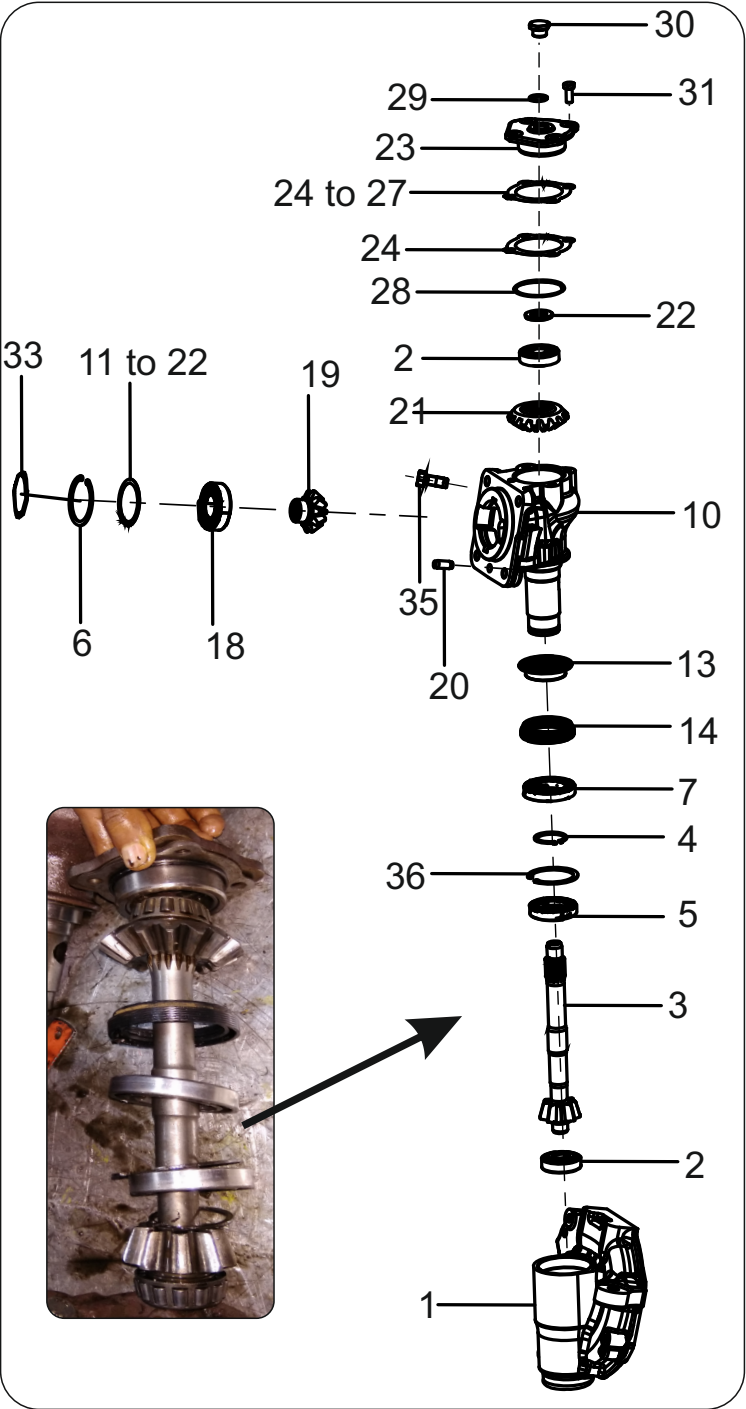


Housing swivel front axle LH

Service manual

EXPLODED VIEW OF KNUCKLE HOUSING DISASSEMBLY

S.no.	Part No.	Qty.
1	HOUSING SWIVEL FRONT AXLE LH	1
2	BEARING TAPER ROLLER 30304	2
3	SHAFT DRIVER BEVEL GEAR Z-9	1
4	CIRCLIP A40X1.75 N	1
5	BEARING BALL 6908	1
6	CIRCLIP B62X2.0 N (IS 3075 PART-II)	2
7	BEARING BALL 6909	1
8	SLEEVE OIL SEAL SWIVEL HOUSING	1
9	SEAL OIL SWIVEL HOUSING 52X70X10	1
10	HOUSING KNUCKLE FRONT AXLE	1
11	SHIM 61.8X51 (0.2285 MM)	1
12	SHIM 61.8X51 (0.4065 MM)	1
13	SHIM 61.8X51 (0.5335 MM)	1
14	SHIM 61.8X51 (0.7875 MM)	1
15	SHIM 61.8X51 (1 MM)	1
16	SHIM 61.8X51 (1.2 MM)	1
17	SHIM 61.8X51 (1.5 MM)	1
18	BEARING BALL 6206	1
19	GEAR DRIVER BEVEL KNUCKLE Z-10	1
20	DOWEL POSITIONING 10X25	3
21	GEAR DRIVEN BEVEL KNUCKLE Z-16	1
22	D85500450.9 WASHER 36.0X20.0X3.0	1
23	D10542450.9 COVER KNUCKLE HOUSING	1
24	SHIM COVER KNUCKLE (0.075 MM)	1
25	SHIM COVER KNUCKLE (0.125 MM)	1
26	SHIM COVER KNUCKLE (0.2285 MM)	1
27	SHIM COVER KNUCKLE (0.4065 MM)	1
28	SEAL O RING 2.62X62.00	1
29	WASHER M18 FLAT COPPER	1
30	PLUG M18X1.5X12-6.8 HEX HEAD	1
31	BOLT M8X1.25X20-8.8 HEX HEAD	4
32	NUT M10X1.50 NYLOCK HEX	1
33	SEAL O RING 3.53X95.0	1
34	LOCTITE 574 AR	AR
35	SCREW M12X1.75X30-10.9	4
36	CIRCLIP B62X2.0 N (IS 3075 PART-II)	1



Service manual

Exploded View of Differenal Assembly

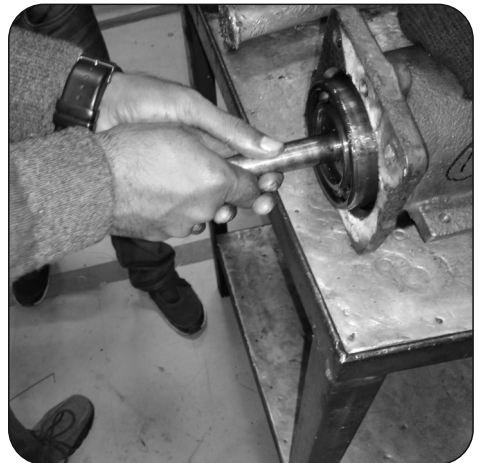
First remove circlips (B90) by using pliers.



Remove spacer of 3mm.
Remove shims.



Use drift shaft & hammer to hit the differential assembly to take out whole assembly from right hand side.

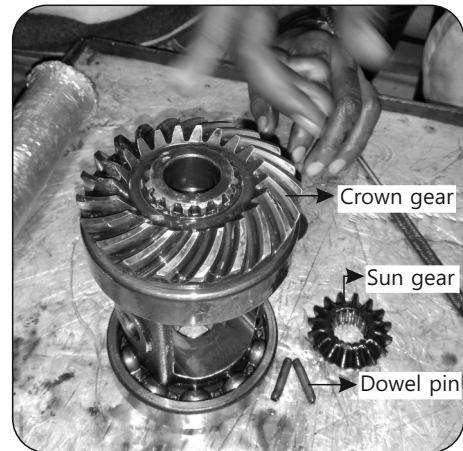


- In Differential assy, left hand shaft is smaller than right hand.



Service manual

- Remove dowel pin from sha, then remove half axle sha.



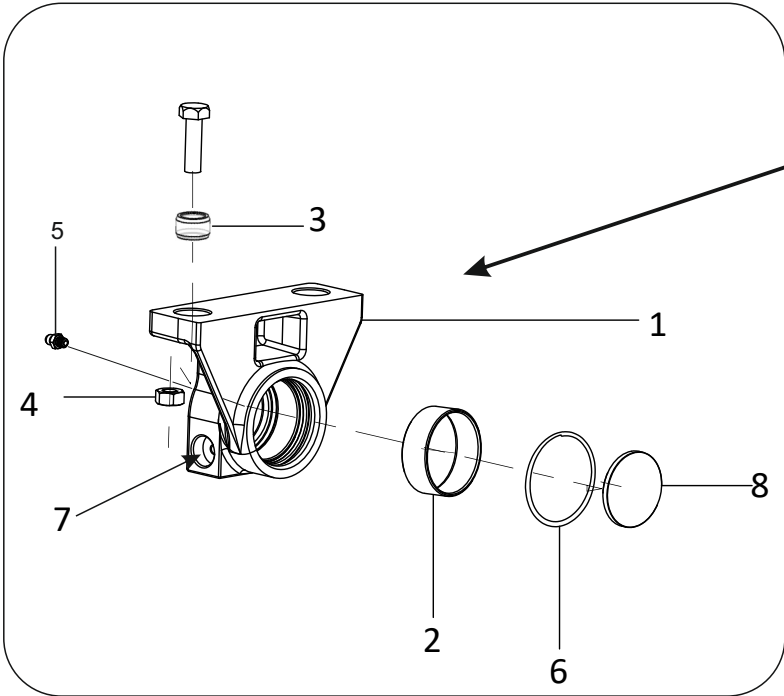
- Tap into dowel pin to remove the crown gear.
- Remove 6210 bearing in Differenal assy.
- Spacer have slots that will be toward sun gear.



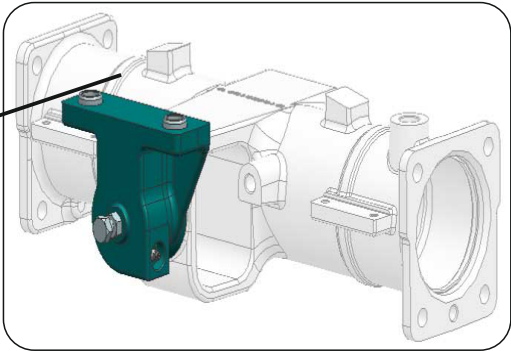
NOTE :

- Front wheel housing cut should be on top and all dowel and bolt should be aligned.
- Open face of the dowel pin should not face the gear as the force may result in damage.
- **Pinion pre-load** gh t the nut to get pre-load 1.82 to 2.6 Nm and crimp the nut at same posion.

Exploded View Of Pillow Block Sub Assembly Front



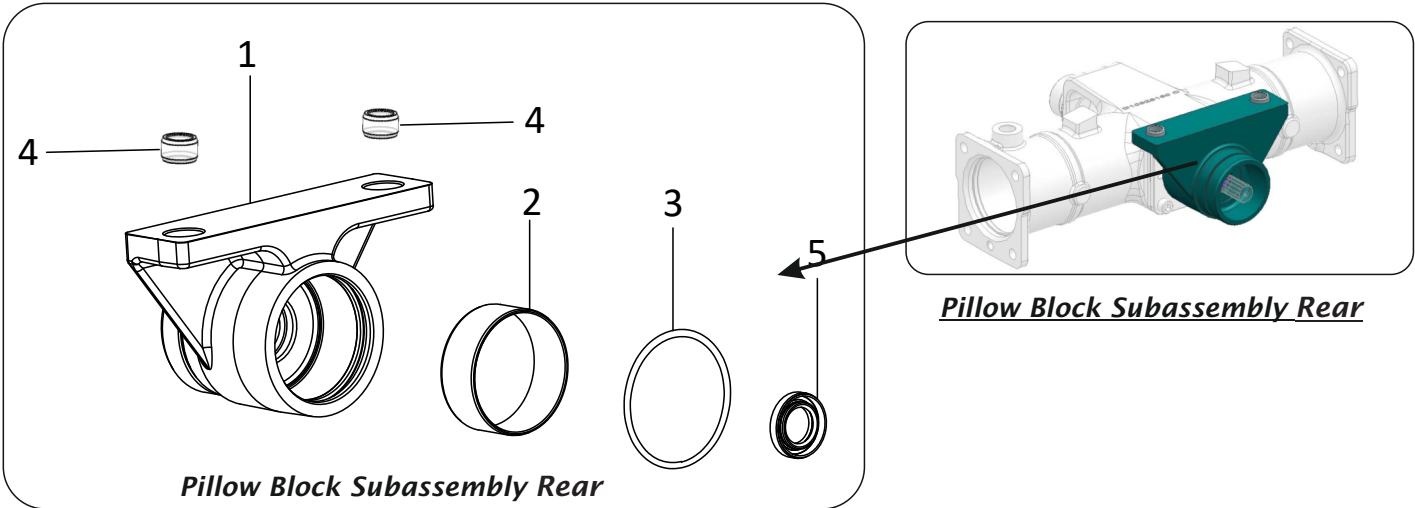
Pillow Block Subassembly Front



Pillow Block Subassembly Front

Sn. No.	Description	Qty
1	PILLOW BLOCK ASSEMBLY FRONT	1
2	BUSH PILLOW BLOCK FRONT	1
3	DOWEL BUSH PILLOW BLOCK	2
4	NUT M10X1.50-8 HEX	1
5	BOLT M10X1.50X35-6.6P HEX HEAD	1
6	SEAL O RING 2.62X55.0	1
7	GREASE NIPPLE B M6	1
8	WASHER 48.0X4.0 THRUST	1

Exploded View of Pillow Block Sub Assembly Rear



Disassembling of pillow block subassembly rear

Sn. No.	Description	Qty
1	PILLOW BLOCK ASSEMBLY REAR	1
2	BUSH PILLOW BLOCK REAR	1
3	SEAL O RING 3.53X72.0	1
4	DOWEL BUSH PILLOW BLOCK	2
5	SEAL OIL 22X37X7.0	1

Service manual

Disassembling of pillow block subassembly rear

- Tap out rear pillow block & remove the oil seal.



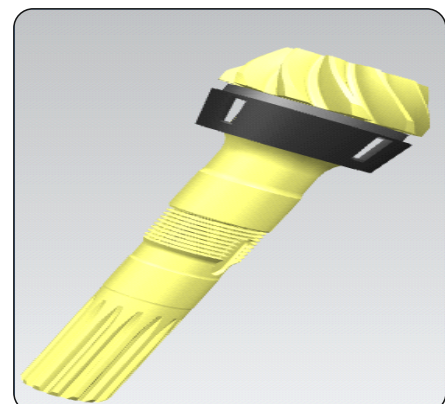
- Open 4 bolts M8 allen & Use two jumping bolt to open



- Separate the Retainer & bevel pinion Shaft Assy.

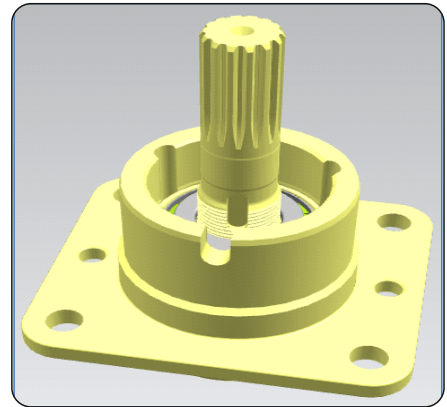


- Place the pinion shaft on fixture

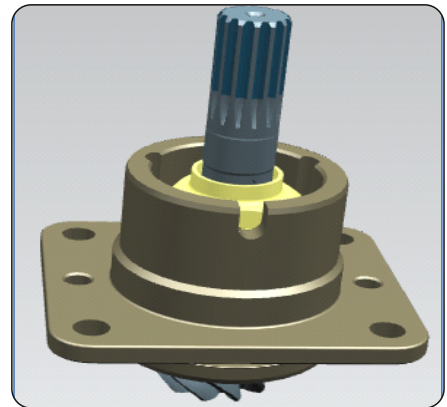


Differential Assembling

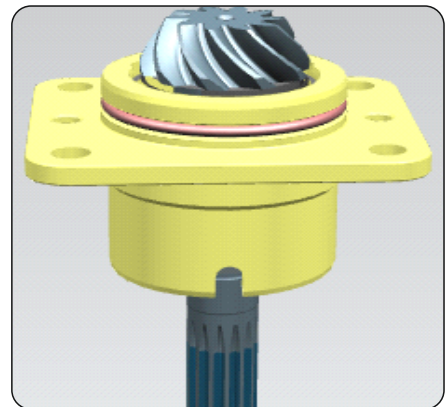
- Place the retainer on fixture and press pinion shaft into it.



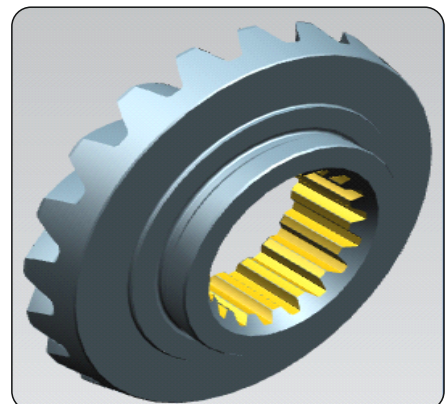
- Put the taper roller bearing along with locknut



- Put another taper roller bearing in retainer.



- Place the differential case on fixture (opposite side of crown wheel).



Service manual

Press it on the retainer.

Assemble the tail pinion with retainer and press inner race on tail pinion shaft.

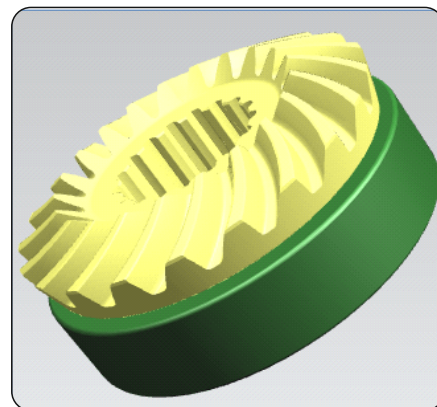
Put seal o ring on retainer.

Tight the assembly with nuts.

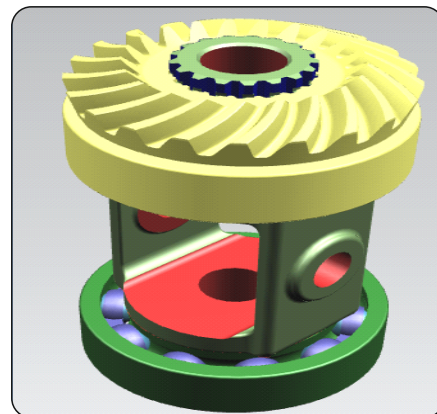
Set pre load of tail pinion at 1.8 - 2.6 nm with torque of chuck nut and lock with lock washer.

Gauging of tail pinion for distance measurement and shimming.

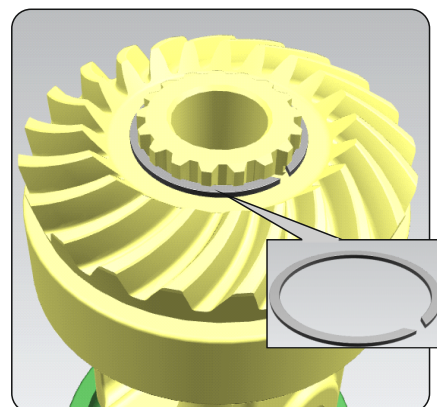
- Put the bearing 6210 on ram. Press it to the differential case (opposite side of crown wheel).



- Assemble the crown wheel with the ball bearing 6210. Assemble the crown wheel and bearing sub-assy on differential case splines.

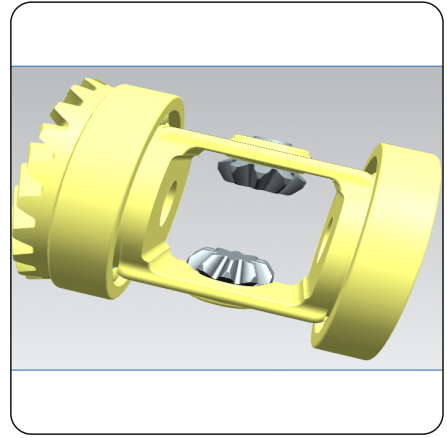


- Lock the assembly with snap ring.

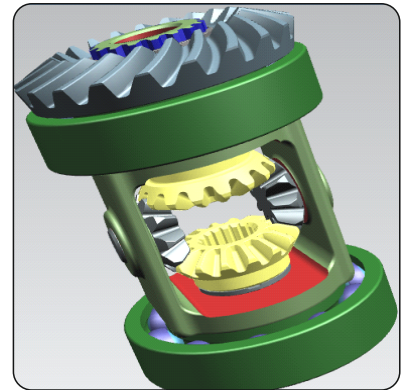
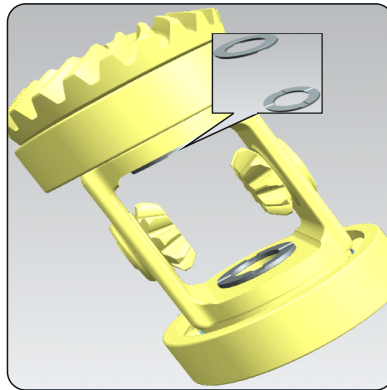


Service manual

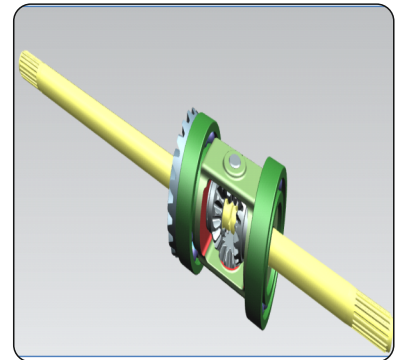
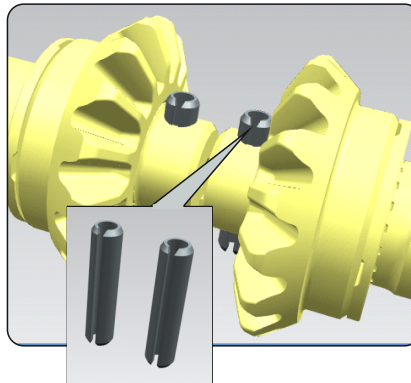
- Insert the star/spider gears inside the diff. case.



- Insert the sun gears inside the differential case along with washer washer groove side should face towards sun gear butting face”



- Assemble the LH and RH shaft in sun gear splines and lock with spring dowels

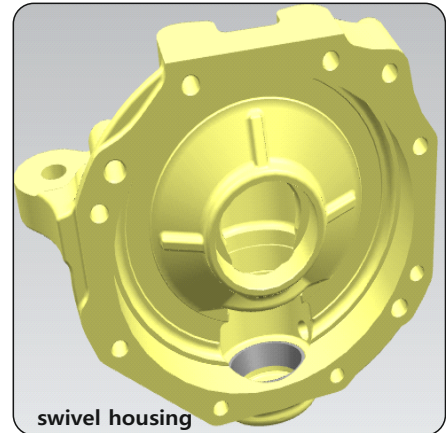


- Assemble differential assembly then put the Pinion & retainer assy. in beam assy. and check the backlash and adjust accordingly shimming and backlash.
- Oil seal should be face flushed.
- while assembling cut section should be at top in pillow block.
- Apply little grease on pillow block o-ring to adjust front axle float.

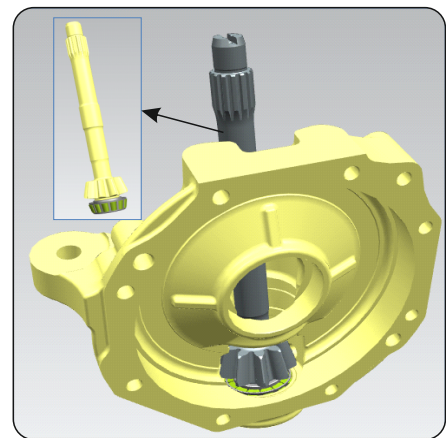
Service manual

Assembling of swivel housing

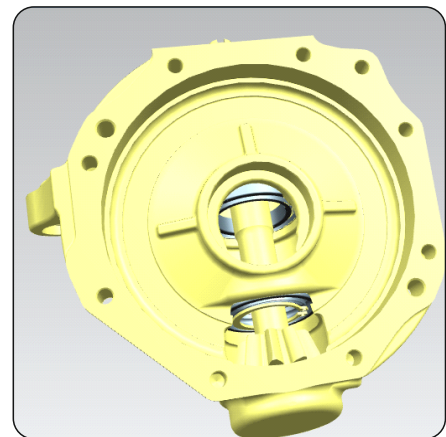
- Put the bevel shaft on fixture (on bevel shaft gear side).



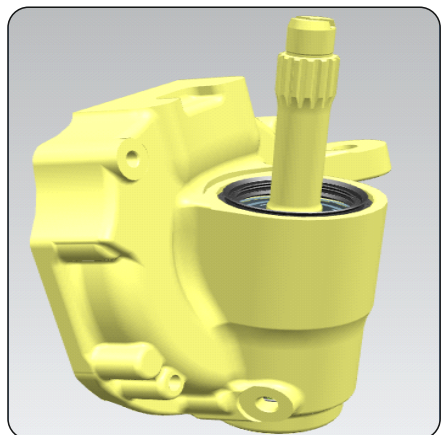
- Put the taper roller bearing(30304) on ram. Press it to the bevel gear shaft. Put the swivel housing on fixture.



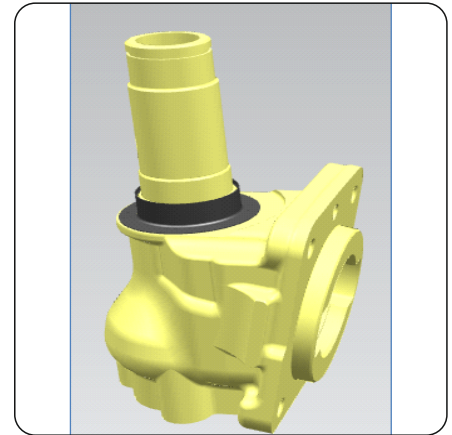
- Press TRB 30304 outer race in swivel housing. Insert bevel shaft sub-assy on taper roller. bearing. Drop the circlip A-40.



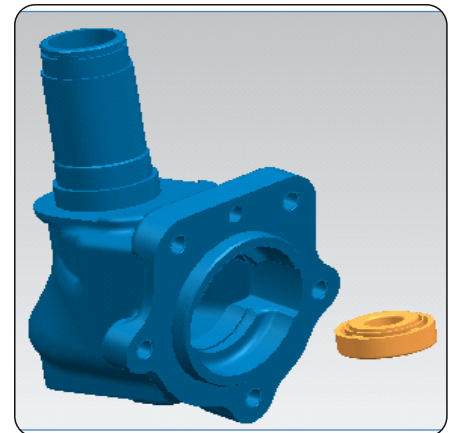
- Insert bearing 6908 in swivel housing. Lock the bearing with circlip B62. Insert bearing 6909 in swivel housing. Press oil seal in swivel housing.



- Press sleeve oil seal on knuckle housing.

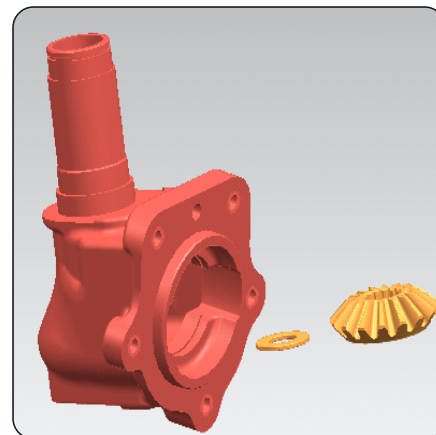


- Assemble the gear holding fixture to the knuckle housing.

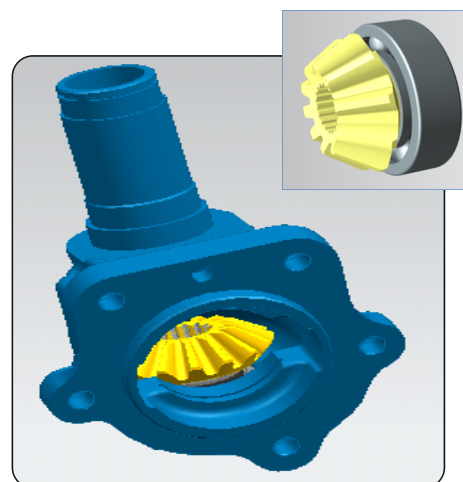


Assembling of knuckle housing

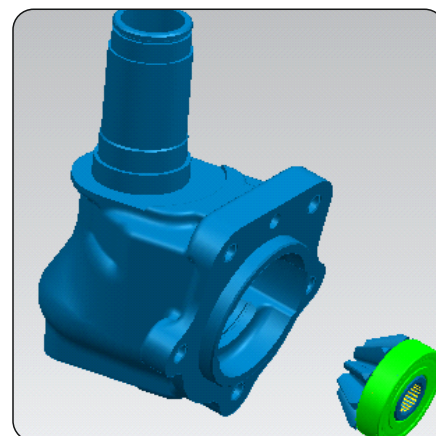
- Insert washer in knuckle housing



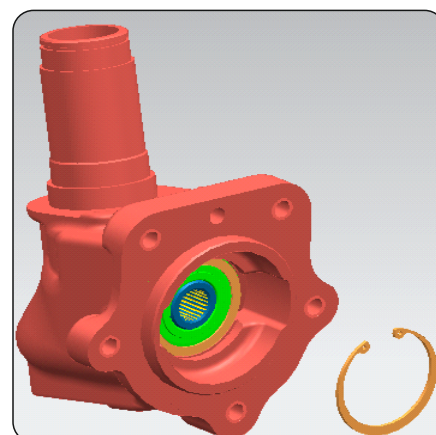
- Insert gear driven bevel Z-16 in knuckle housing, on fixture



- Insert the knuckle housing sub. Assembly in swivel housing sub assembly

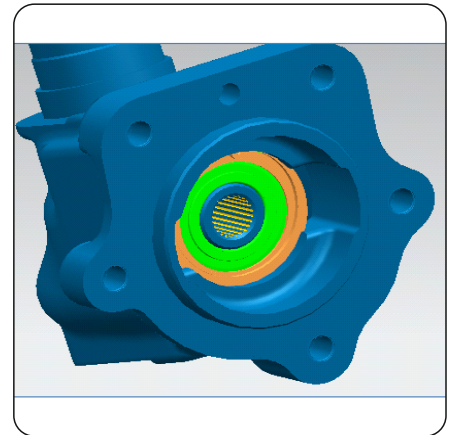


- Insert assembly of gear driver Z-10 in knuckle housing
Lock the position of bearing with circlip B-62

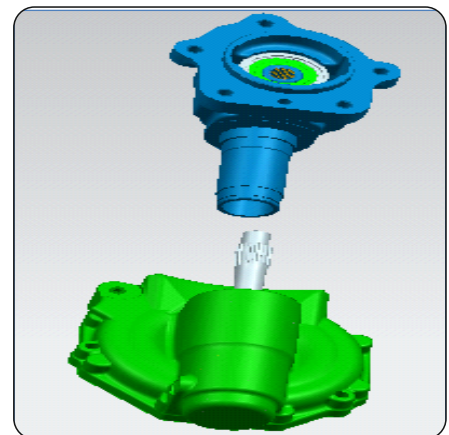


Assembling of knuckle housing

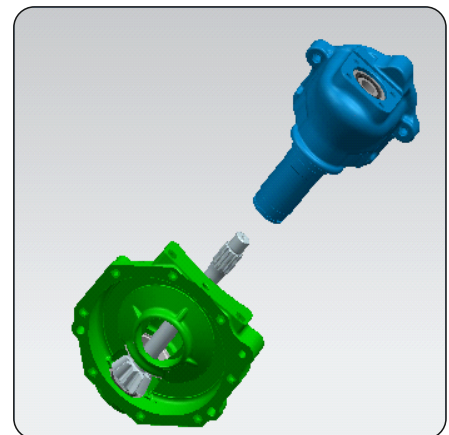
- Press gear driver bevel Z-10 in bearing 6206



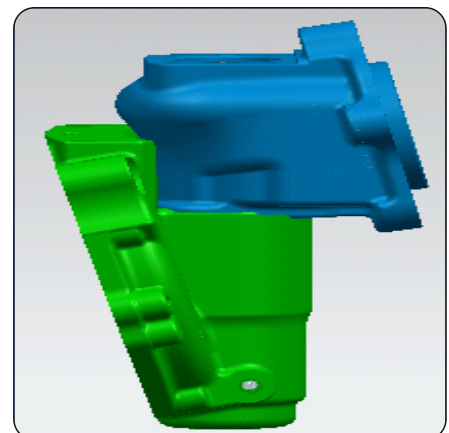
- Lock the knuckle housing in bottom ball bearing with circlip A-40. Remove the gear holding fixture from knuckle housing and assemble taper roller bearing inner race on bevel shaft top. Insert washer & bearing 30304.



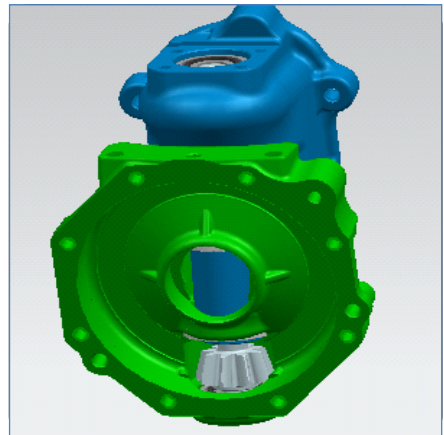
- Press taper roller bearing outer race 30304 in cover knuckle.
Apply loctite 574 on knuckle cover Housing.



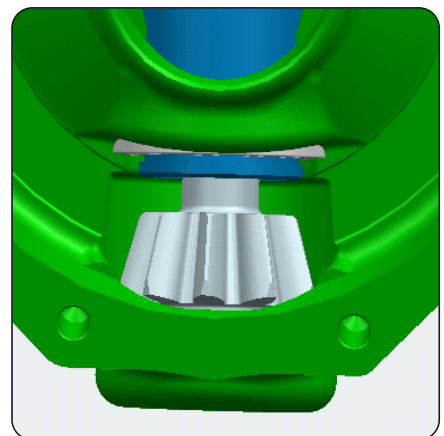
- Assemble the cover knuckle housing on knuckle housing.



- Perform the pre loading of bevel shaft with pre loading and shimming gauge.



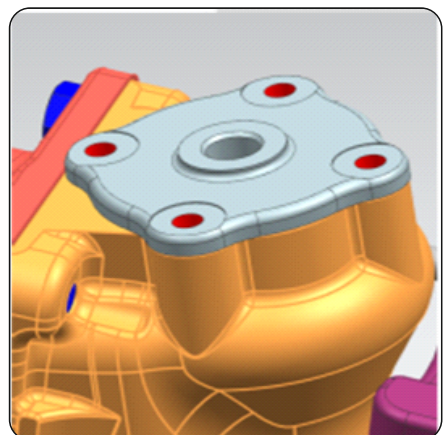
- Insert the o-ring and shim b/w cover knuckle housing and knuckle housing.

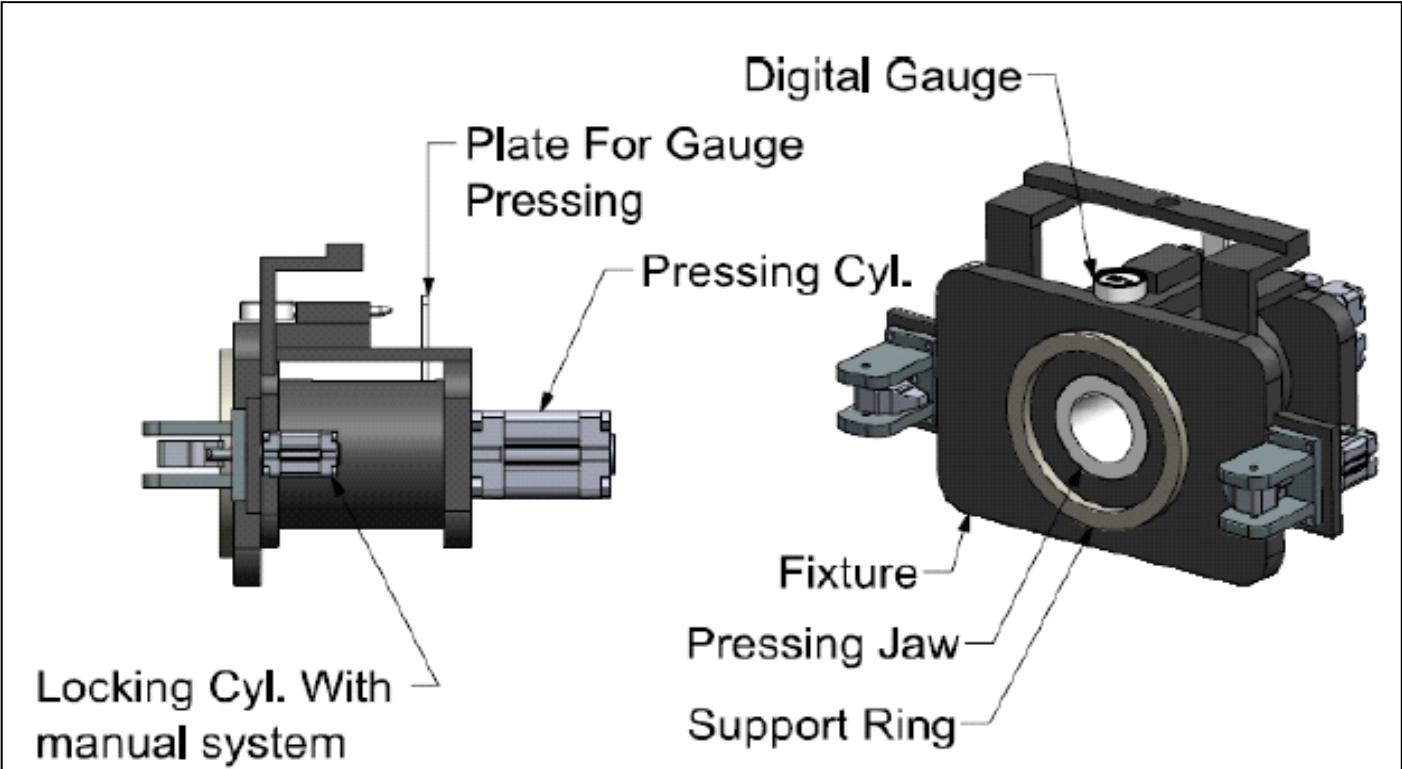
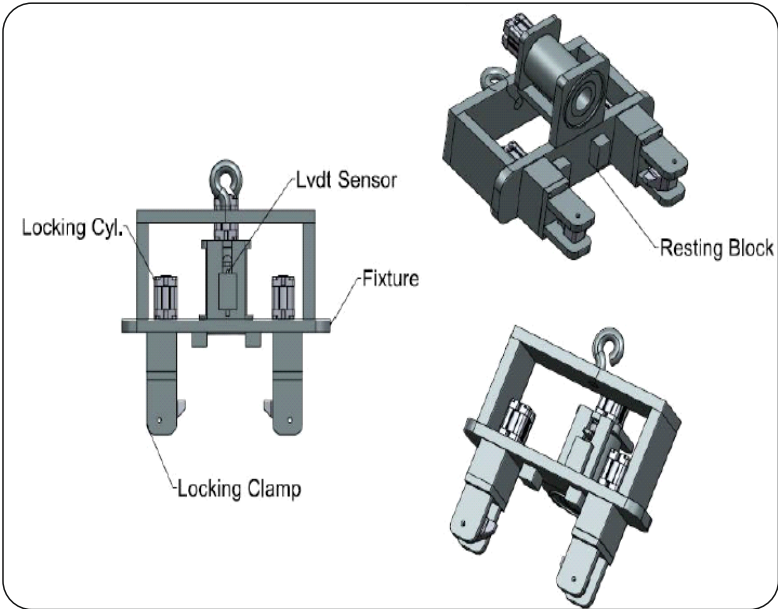


- Tight the cover with bolt M8 4 nos. And torque at 20-25 NM.



- After pre loading set the backlash of gear driver bevel Z-10 by putting shims between bearing 6206 and circlip.

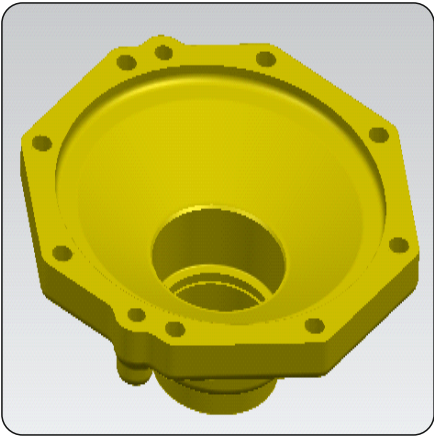




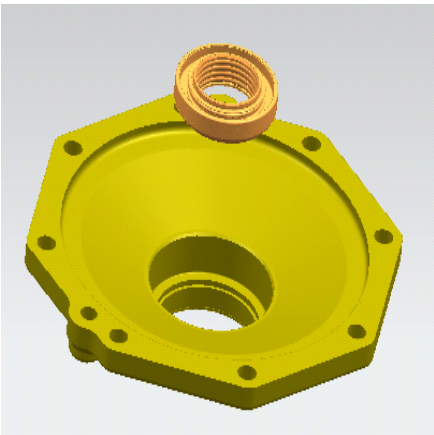
Assembly plug M18 on cover knuckle housing along with copper housing

Assembling wheelend housing

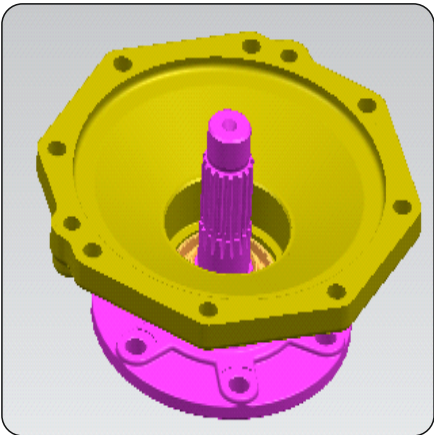
Place the housing wheel front axle on same fixture



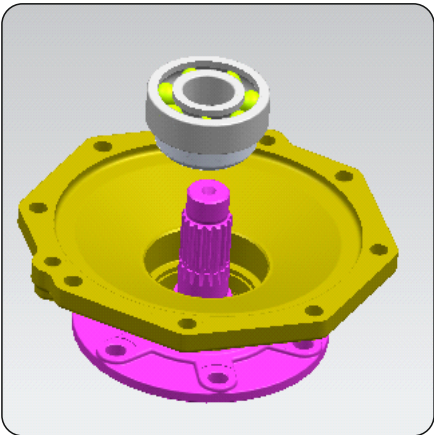
Press oil seal (35x60x14.5) in front wheel housing



Place the shaft front axle on fixture. Press 5 bolts M12 on the wheel housing.

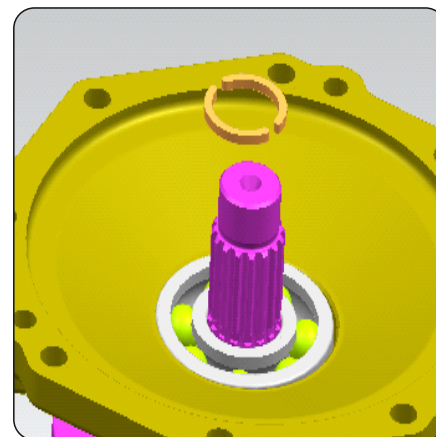


Press ball bearing 6306 on axle shaft

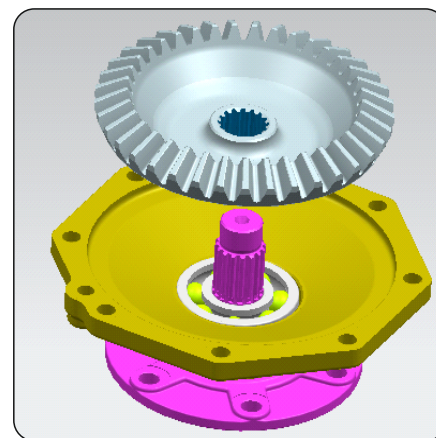


Service manual

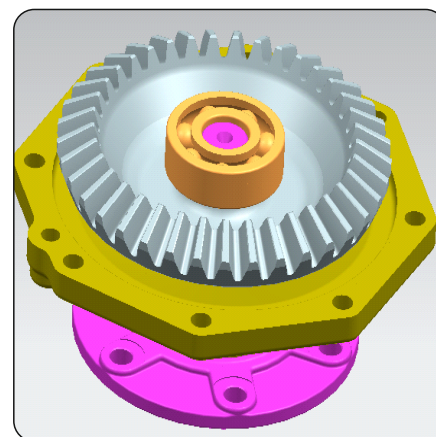
Assemble split washer on axle shaft groove



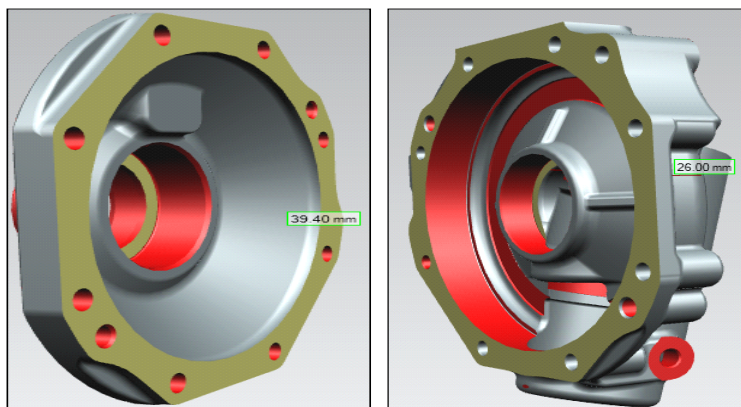
Insert and assemble the gear driven bevel Z-37 on front axle shaft splines.



Check for the backlash and select the required shim from gauging.
Put ball bearing 6306 on front axle shaft.



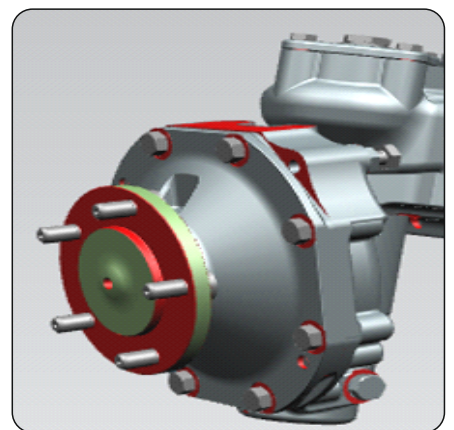
Insert the required shim between wheel end housing and swivel housing.



Service manual

Apply loc-tite 574 on mating surface
with roller.
Tight the housing with bolts m10x30, 8nos.
Torque all the bolts at 55-65 nm.

Press 5 m12 bolt on the front wheel hub.



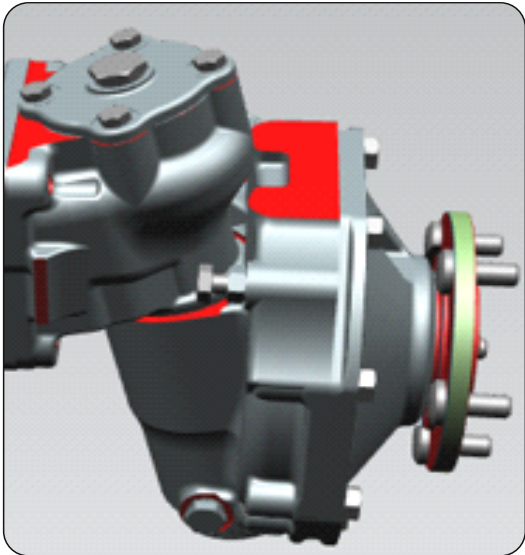
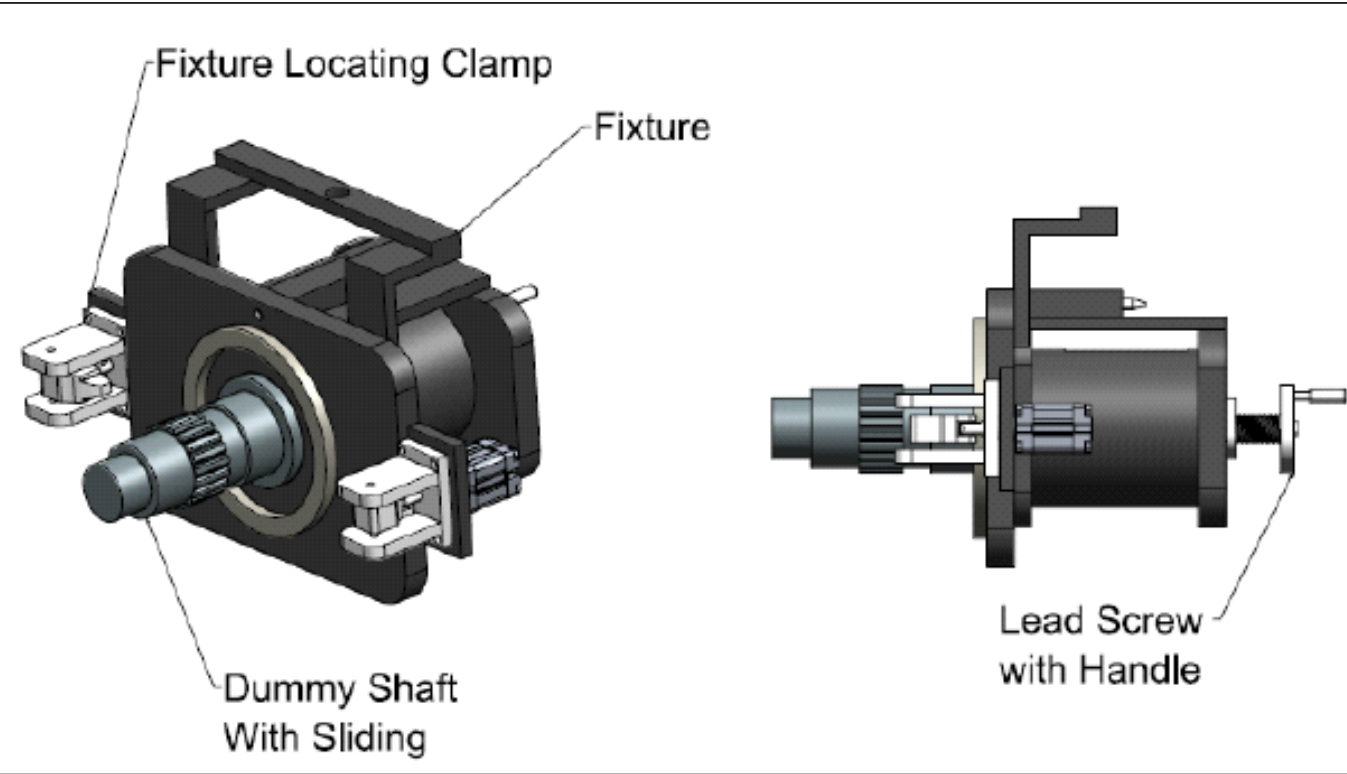
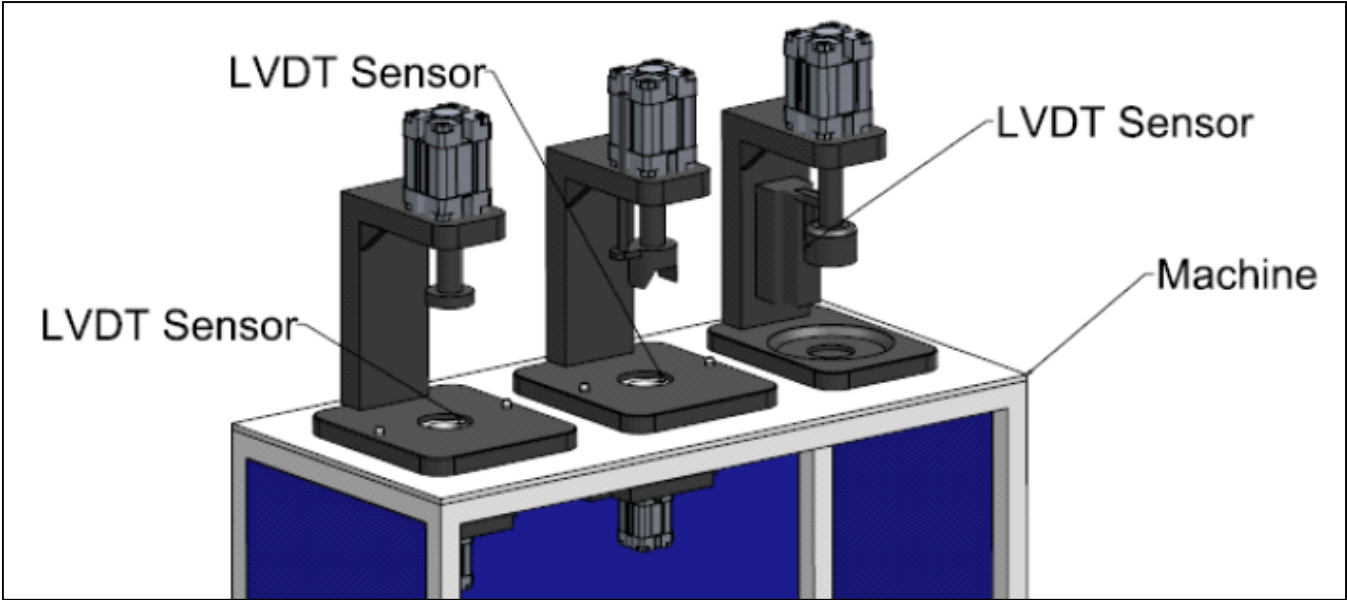


CHART LIQUID SEALANT - COMPACT 9+3

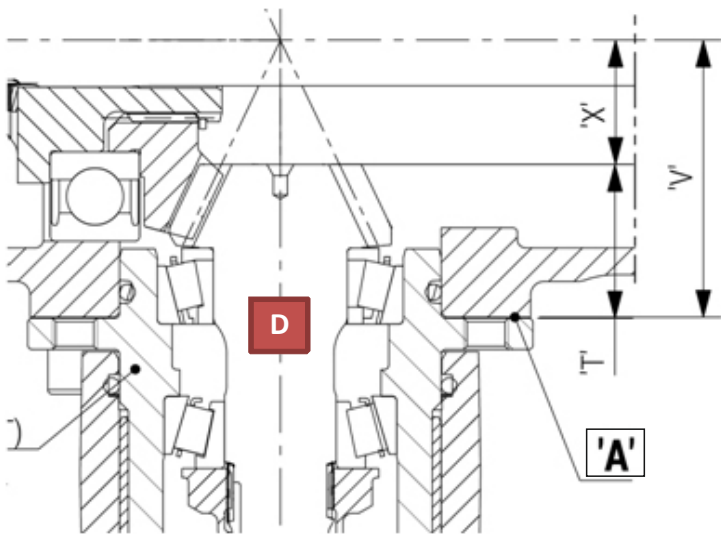
S.No.		JOINT LOCATION	Sealant Grade	D Code
	4WD FRONT AXLE	Front Axle Housing to Knuckle Housing	Loctite 574	D95000410
		Swivel Housing to Wheel End Housing		

Service manual

S.NO.	Problem	Cause	Acon
1	Differenal is not working	- Differenal Gear Broken - Bearing dia. not ok in Front Axle Beam	Replace Bevel Gears Check Front axle bearing dia
2	Gear Z-10/Z-16 Teeth ping	- Excessive Load on Gear - Contact pattern & Backlash is not ok - Preloading of TRB 30304 is not ok	Replace Bevel Gears Check backlash value properly as recommended
3	CWP set (Z-10/Z-21) teeth ping	- Excessive Load on Pinion - Contact pattern & Backlash is not ok - Pinion preload nut loosened	Replace CWP set Check backlash value properly as recommended Torque nut to achieve recommended
4	Gap between Knuckle Housing & Front Axle Beam	- Chamfer in Front Axle Beam is not ok - Size of o'ring is not ok	Checking O' Ring size & related dimn in Front Axle Beam
5	Leakage from Knuckle housing & Knuckle cover	- Missing of O'Ring - O'Ring damaged - Knuckle Cover Bolt not properly torque - Plug M18x1.5 not properly torque	Check O'ring condition Torque the bolts properly as recommended Torque the plug properly as recommended
6	Leakage from Knuckle housing & Swivel Housing	- Seal pressing is not ok - Runout of seal face not ok - Seal dia not ok in Swivel housing - Seal lips damaged - Seal sleeve not pressed properly in Knuckle	Replace seal with new one & press properly with proper tool Check runout of seal & should be as per recommended specs Press sleeve properly
7	Excessive gap between Knuckle housing & Swivel Housing	- Circlip A40x2.5 missing or jump out from groove - Seal sleeve not bung properly	Assembled circlip & ensure insering of circlip in groove properly Press sleeve properly
8	Gear Z-9/Z-37 Teeth broken from edges	- Excessive Load on Gear - Contact pattern & Backlash is not ok	Replace Bevel Gears Check backlash value properly as
9	Wheel end shaft not rotating or jammed	- Shimming value for backlash & contact pattern is not ok - Over torquening of mounting bolts - Differenal not working	Ensure proper shimming for both backlash & contact pattern Recheck torque value & torque bolts as per recommended specs Check Differenal Assembly condition i.e gear broken
10	Gap between Wheel end shaft & tyre mounting bolt	- Mounting bolt chamfer not ok - Bolt dia not ok - Shaft hole dia not ok	Replace shaft with new one Replace bolt with new one
11	Leakage from Pinion Shaft	- Missing of Seal - Seal pressing is not ok - Runout of seal face not ok - Seal lips damaged	Replace seal with new one & press properly with proper tool Check runout of seal & should be as per recommended specs
12	Leakage from Retainer Pinion Shaft	- Missing of O'Ring - O'Ring damaged	Check O'ring condition
12	Preload of pinion shaft disturbed	- Torque value on Nut is not ok - Crimp of nut not properly in pinion slot	Check torque value & re-torque nut to ensure proper preloading of pinion shaft Crimp nut properly in pinion slot
13	Excessive float in Front Axle Assembly	- Pillow Block washer missing - Bolt & nut not properly tightening - Pillow Block mounting hole not ok in Front	Assembled washer & ensure full tightening of bolt & nut then loose half thread of bolt to ensure proper gap b/w Pillow block &

Shimming Procedure - Differential

- A- Distance between beam butting face & retainer face
- B- Distance between washer and bearing 6210.



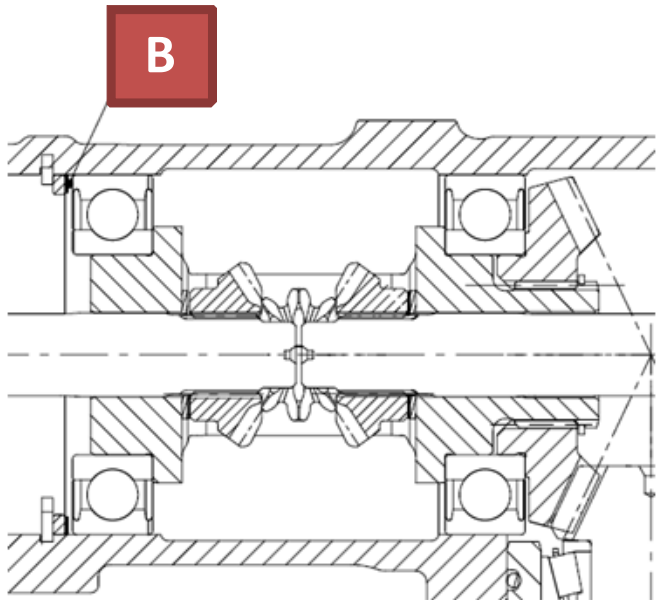
Shimming At Location 'a':

- X = Etch Value On Pinion Face (etched On Pinion Face 'd')
- T = Etching Face To Retainer Mounting Face
- V = Distance From Front Axle Housing Centre To Retainer Butting Face
- Shim Size : $(x + T) - V$

PART NO.	PART NAME (FOR SHIMMING)
D10541580	SHIM RETAINER PINION (0.075 (MM)
D10541590	SHIM RETAINER PINION (0.125 MM)
D10541600	SHIM RETAINER PINION (0.2285 MM)
D10541610	SHIM RETAINER PINION (0.4065 MM)

Shimming At Location 'b':

Select Shim At Location 'b' To Ensure Backlash Between Crown Wheel (z-21) & Pinion Shaft (z-10) Is 0.15 To 0.3 Mm

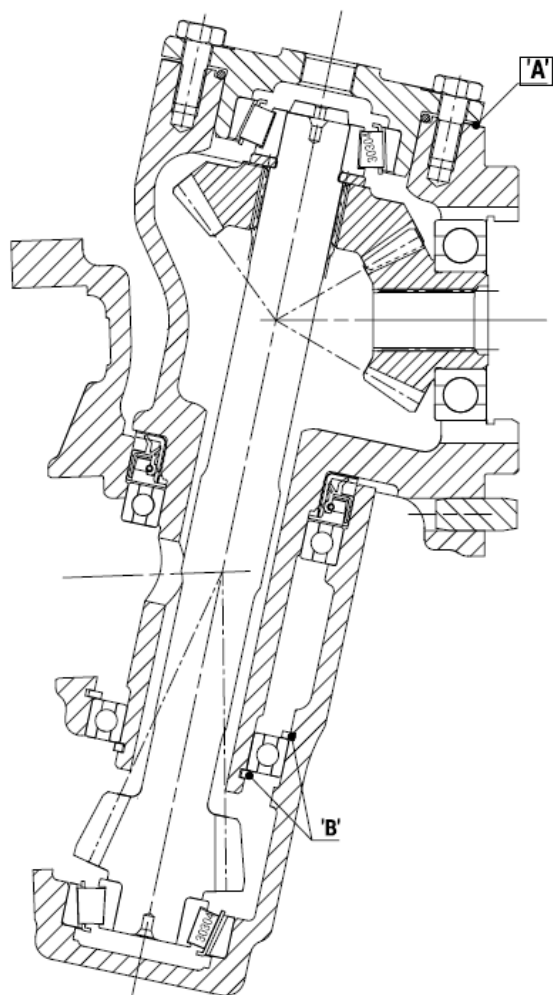


PART NO.	PART NAME (FOR SHIMMING)
D10546970	SHIM 89.90x81.0 (0.125 MM)
D10546980	SHIM 89.90x81.0 (0.2285 MM)
D10546990	SHIM 89.90x81.0 (0.4065 MM)

NOTE : X Value is printed at location D. In case, it is not available, arrange another pinion crown set which has etch value written on it.

Shimming Procedure - Knuckle Housing Cover

- A - Gap measured between cover & knuckle housing.
B - Bottom cir-clip rests on knuckle housing. Top cir-clip rests on swivel housing with bearing 6908 between them.



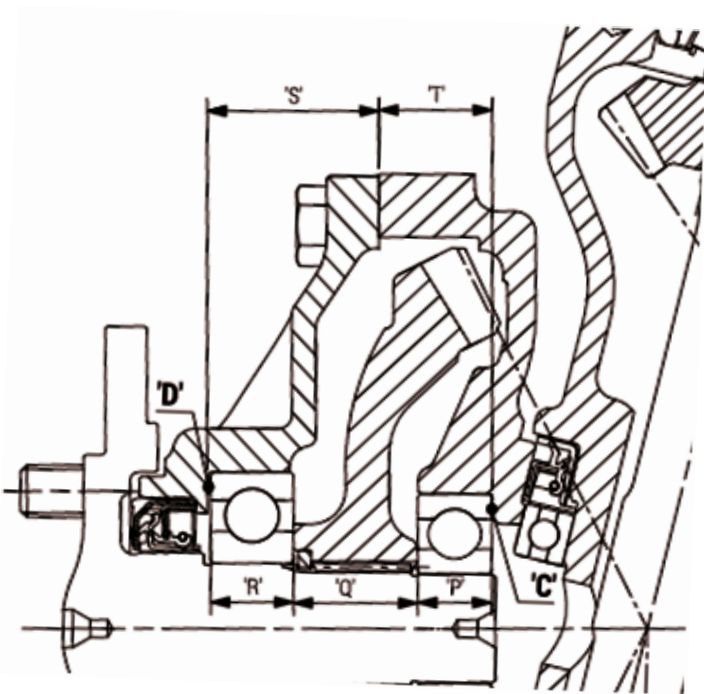
Shimming At Location 'A':

- 1) Assemble Both Knuckle & Swivel Housing So That No Gap Between Bearing Ball 6908 & Cir-clip (at Location 'B').
- 2) Measure The Gap Between Knuckle Cover & Knuckle Housing with bolts (torque 20-25 Nm) at location 'A'.
- 3) Calculate Shim Thickness
 $\text{Thickness} = A - 0.075$

DESCRIPTION	DRAWING NO
SHIM COVER KNUCKLE (0.075 MM)	D10544670
SHIM COVER KNUCKLE (0.125 MM)	D10544680
SHIM COVER KNUCKLE (0.2285 MM)	D10544690
SHIM COVER KNUCKLE (0.4065 MM)	D10544700

Shimming Procedure - Swivel and wheel Housing

- P - Width of swivel housing bearing.
R - Width of wheel housing bearing.
Q - Width of crown wheel between seating faces.
S - Distance from wheel housing mounting faces. to bearing 6306 butting face.
T - Distance from swivel housing mounting face to bearing 6305 butting face.



Shimming At Location 'c' & 'd':

- 1) Measure Shim Gap At Location 'c' & 'd'
(gap $G = C + d$)
Gap 'g' = $T + S - (r + Q + P)$

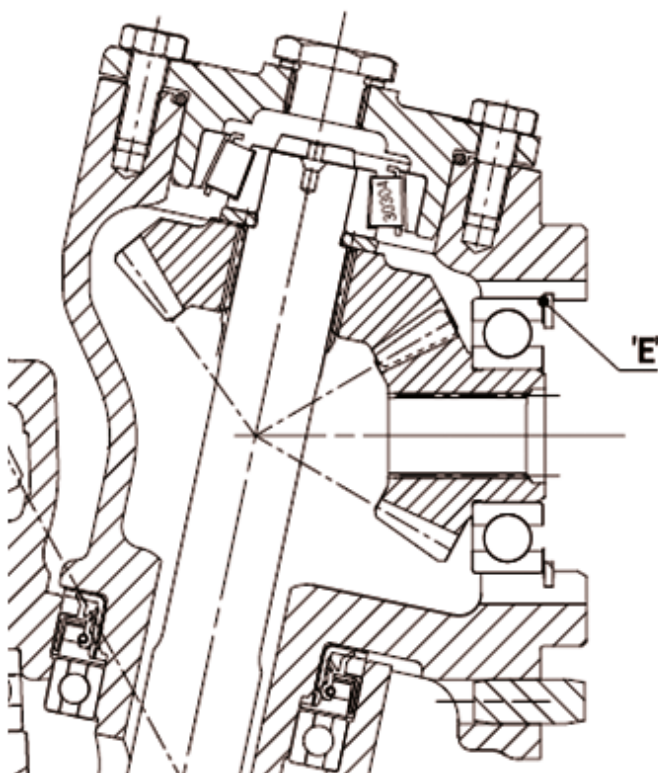
Total Shim At Location 'c' & 'd' = $n = G - 0.2\text{mm}$

- 2) Select Shim At Location 'c' To Ensure Backlash Between Gear Driven Z-37 & Shaft Driver Z-9 Is 0.15 To 0.3mm
3) Shim Thickness At Location 'd'
Thickness At 'd' = $N - C$

DESCRIPTION	DRAWING NO
SHIM AT LOCATION 'C'	
SHIM 60x50 (0.075 MM)	D10542390
SHIM 60x50 (0.2285 MM)	D10542390
SHIM 60X50 (0.4065 MM)	D10542400

SHIM AT LOCATION 'D'	
SHIM FRONT AXLE WHEEL SHAFT (0.075 MM)	D10537800
SHIM FRONT AXLE WHEEL SHAFT (0.125 MM)	D10537810
SHIM FRONT AXLE WHEEL SHAFT (0.2285 MM)	D10537820
SHIM FRONT AXLE WHEEL SHAFT (0.4065 MM)	D10537830
SHIM FRONT AXLE WHEEL SHAFT (0.5335 MM)	D10537840
SHIM FRONT AXLE WHEEL SHAFT (0.7875 MM)	D10537850

Shimming Procedure - Knuckle Housing Cover



Shimming At Location 'e':

- 1) Ensure No Gap Between Bearing Ball 6206 & Circlip.
- 2) Check Backlash Between Gear Driven Z- 16 & Gear Driver Z-10.
- 3) Select Shim Thickness At Location 'e' To Ensure Backlash Between Gear Driven Z- 16 & Gear Driver Z-10 Is 0.15 To 0.3mm

DESCRIPTION	DRAWN NO.
SHIM 61, 8x51 (0.2285 MM)	D10542310
SHIM 61, 8x51 (0.4065 MM)	D10542320
SHIM 61.8x51 (0.5335 MM)	D10542330
SHIM 61.8x51 (0.7875 MM)	D10542340
SHIM 61.8X51 (1.00MM)	D10542350
SHIM 61.8X51 (1.20 MM)	D10542360
SHIM 61.8X51 (1.50 MM)	D10542370

SERVICE MANUAL TRANSMISSION

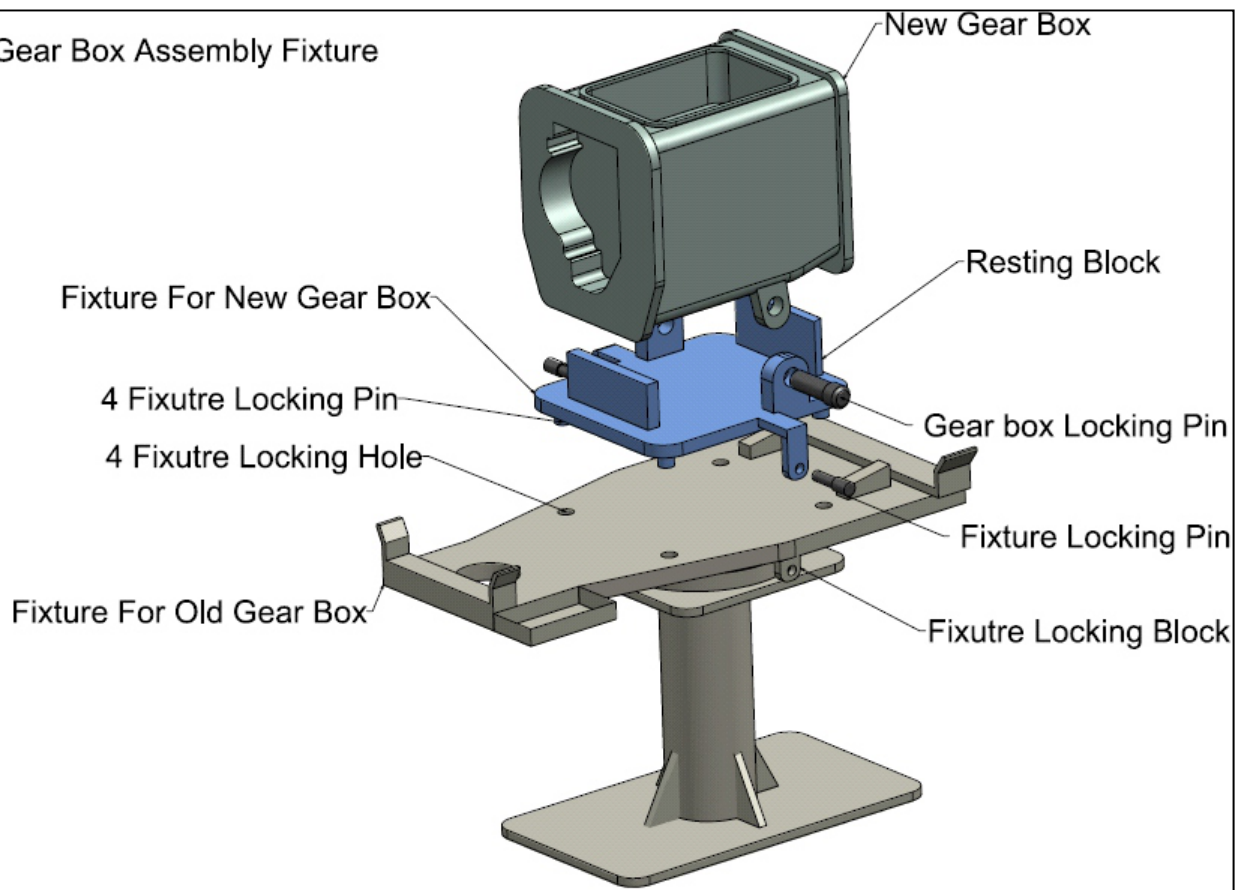
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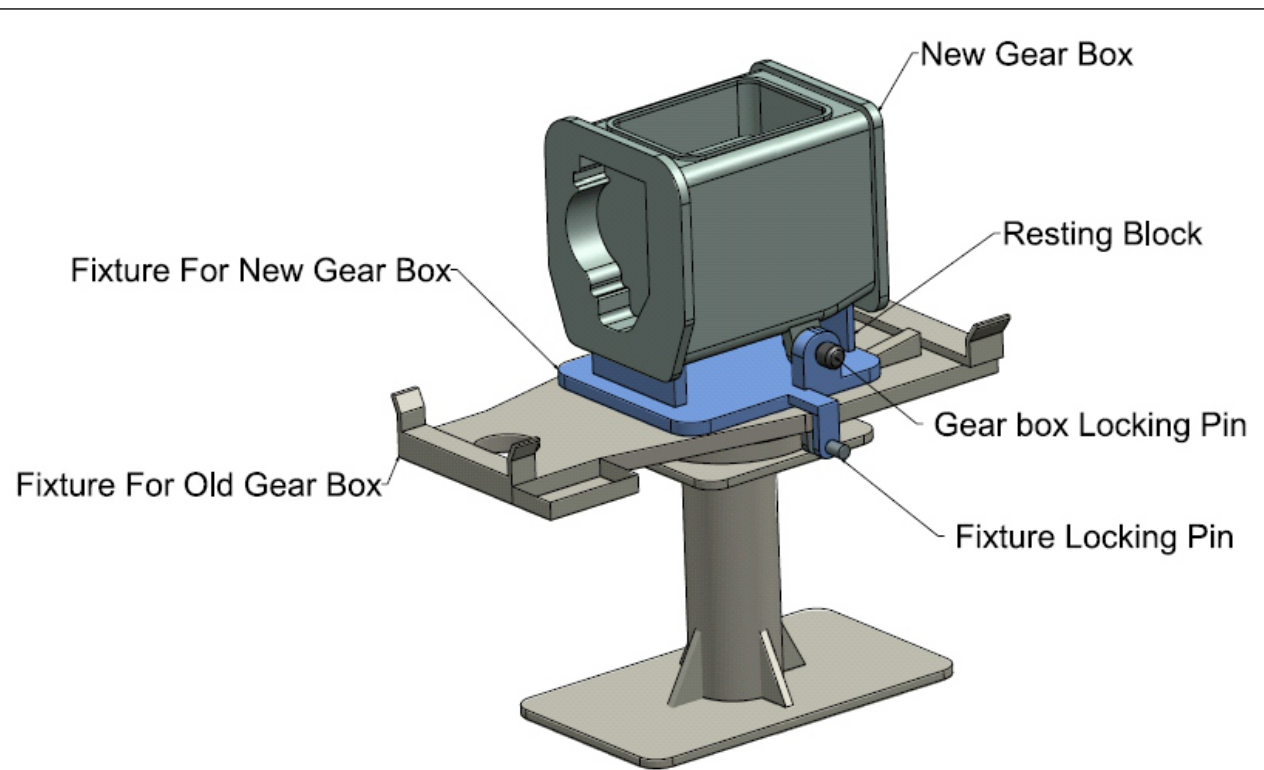
Service manual

A. Assembly Process

(a) Gear Box Assembly Fixture



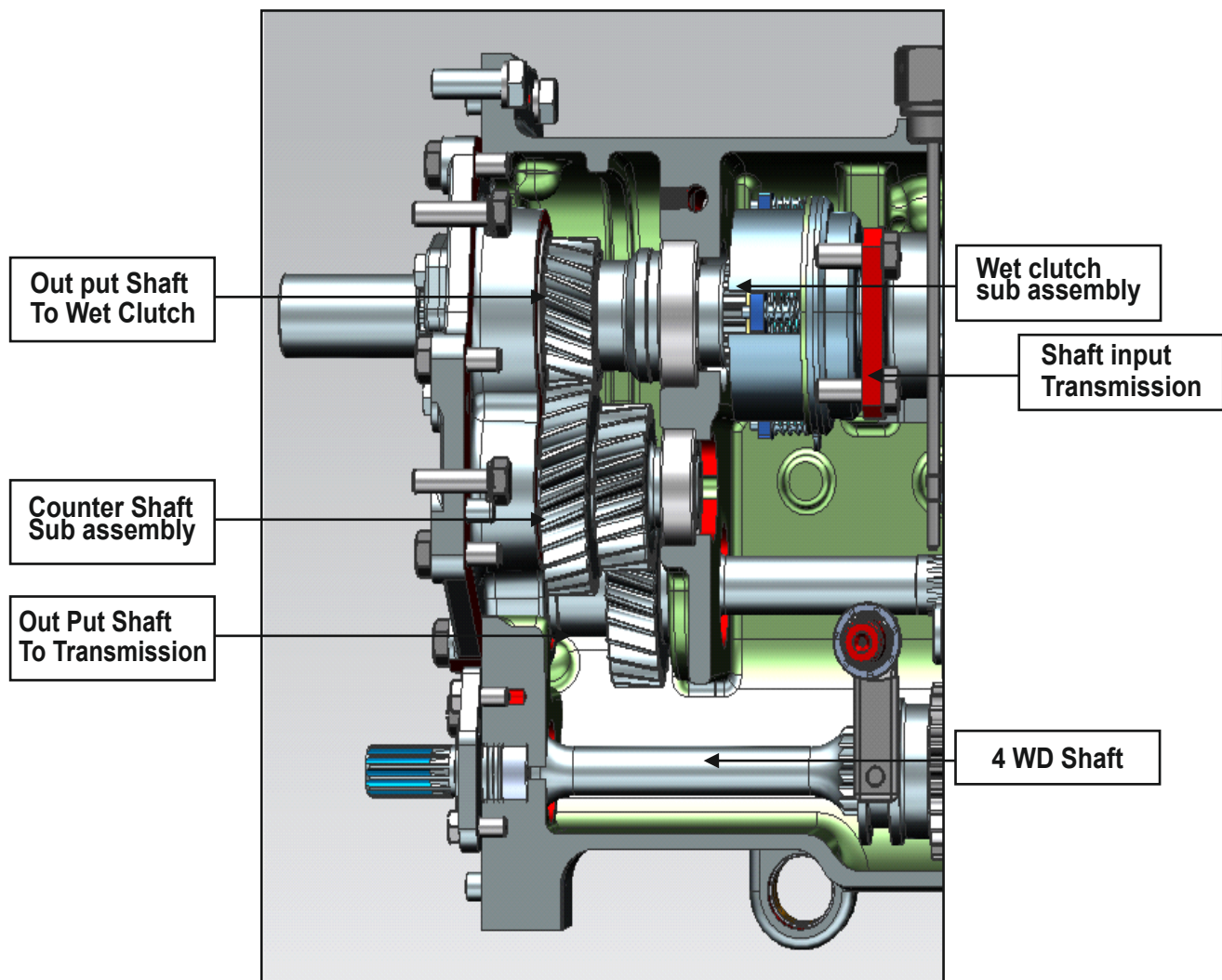
Put the adopter fixture on conveyor



Put the gear box housing on fixture and lock it

Service manual

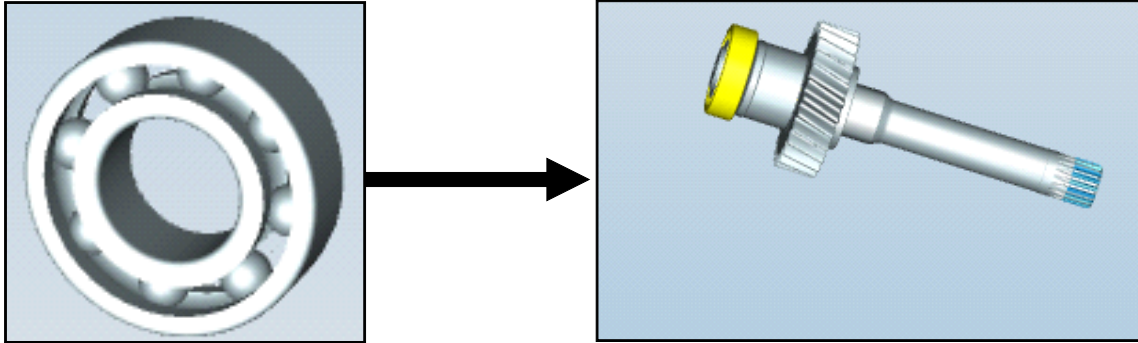
Transmission Assembly



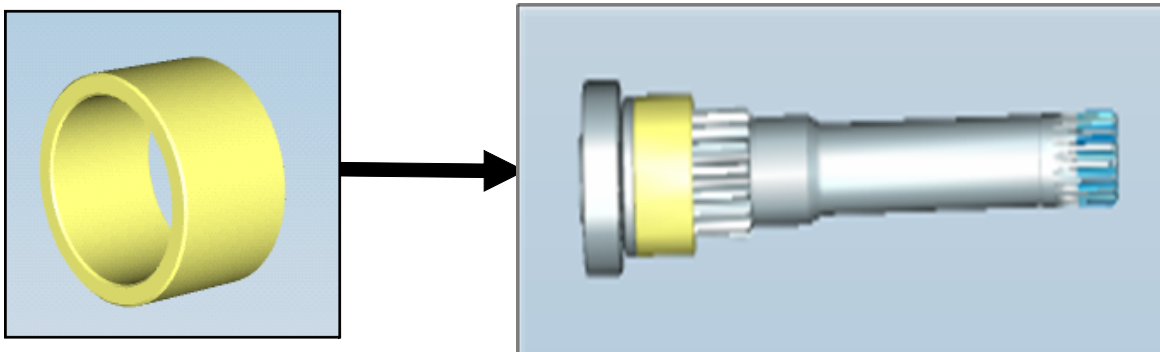
Service manual

SHAFT OUTPUT SUB ASSEMBLY

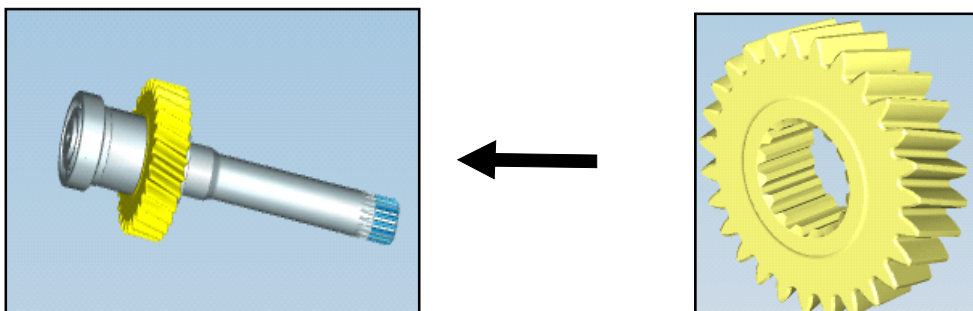
1. Place the driven shaft, front side should be on top
2. Press The Bearing 6205 In Shaft Driven Front Side



3. Rotate The Shaft In 180°
4. Insert The Spacer In Shaft Driven

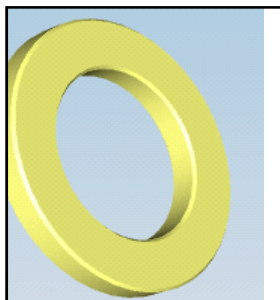
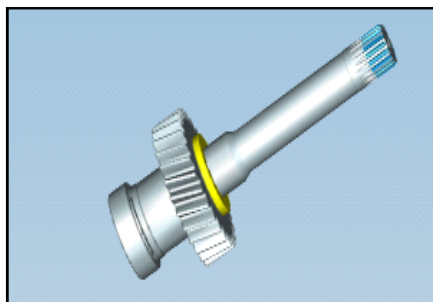


5. Insert The Gear In Shaft Driven

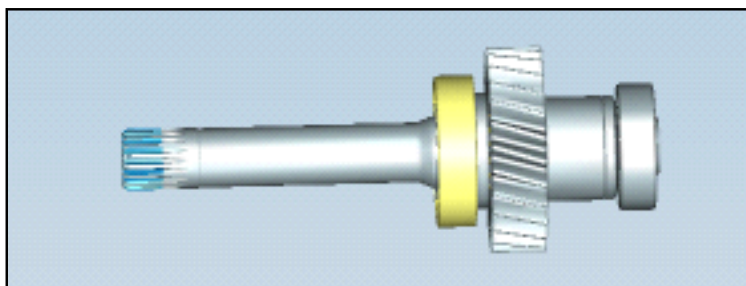
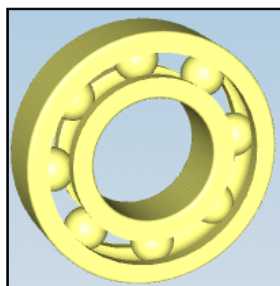


Service manual

6. Insert The Spacer In Shaft Driven

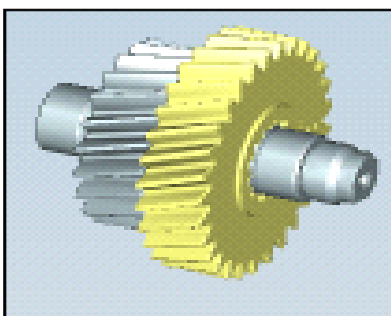
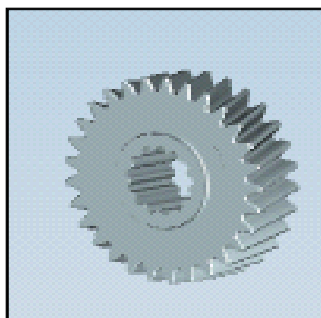


7. Press The Bearing 6206 In Shaft Output

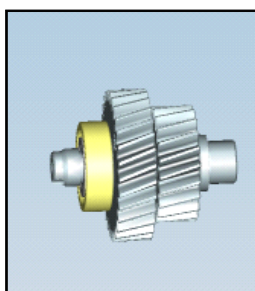
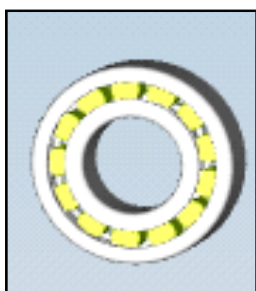


SHAFT COUNTER SUB ASSEMBLY

1. Place the counter shaft
2. Insert the gear in shaft driver

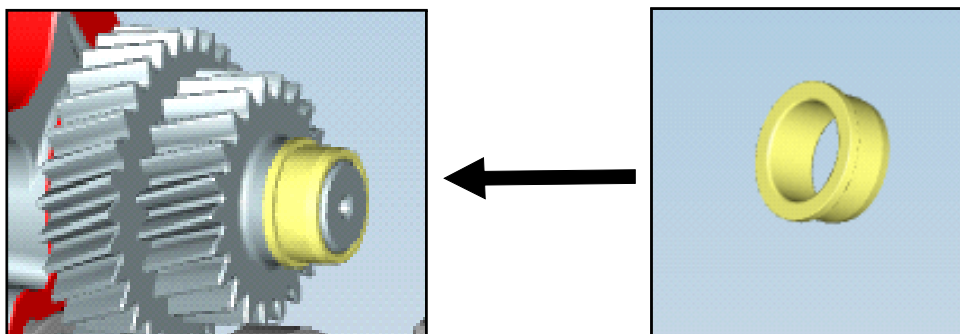


3. Press the bearing nj205 after shaft insertion

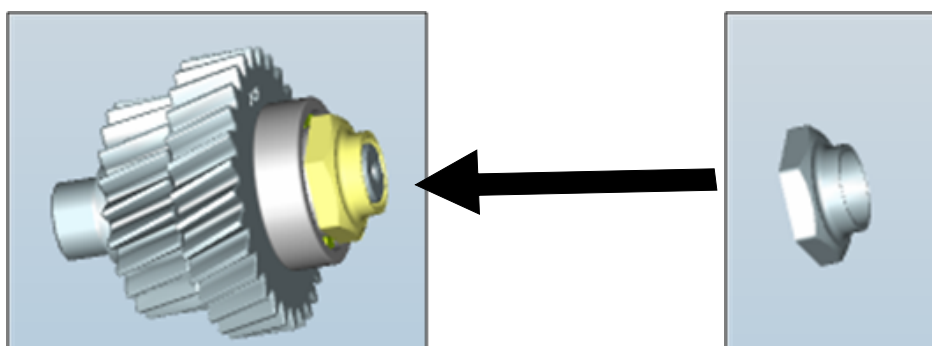


Service manual

4. Tight the nut on counter shaft



5. Torque & crimp the nut on shaft

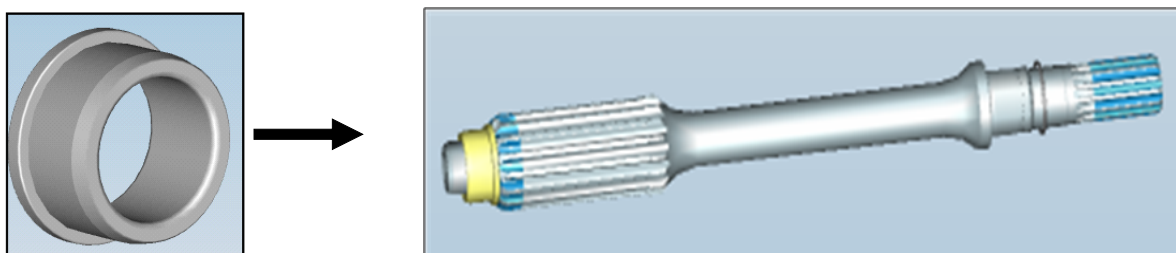


6. Rotate the shaft 180°

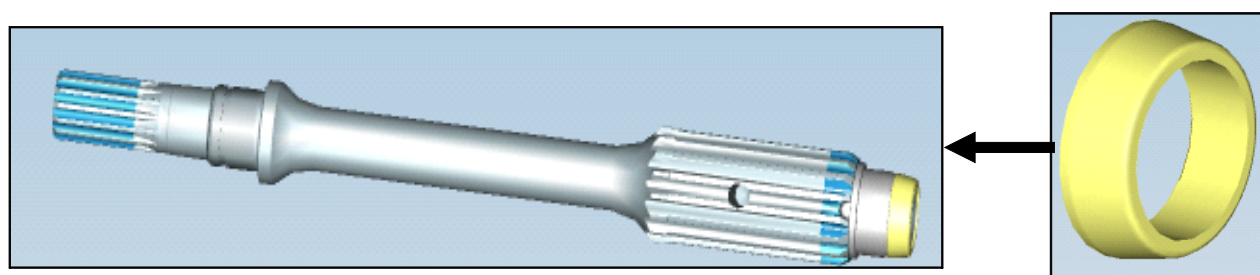
7. "Press the bearing nj205 next generation in shaft"

4WD SHAFT SUB ASSEMBLY

1. Press roller bearing inner race nj204 on 4wd shaft .

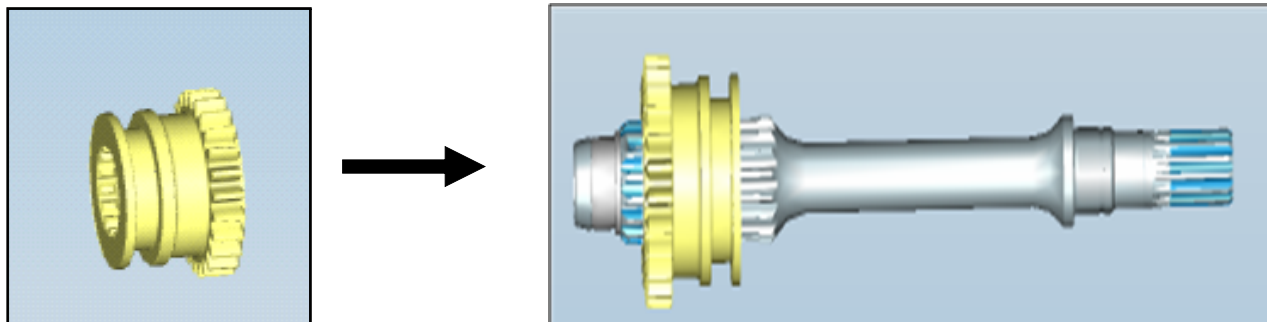


2. Press spacer shaft drop box on 4wd shaft.



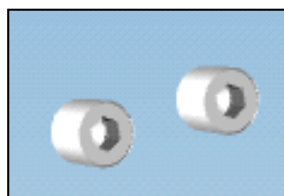
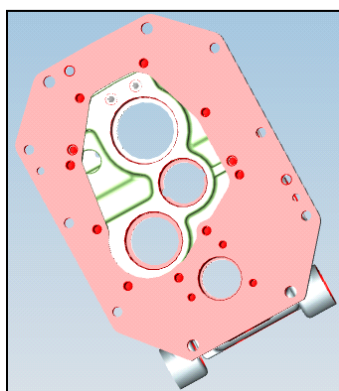
Service manual

3. Place the 4wd shaft on fixture
4. Insert the spring in shaft cavity
5. Place ball in cavity on spring
6. Press the ball and spring with pressing tool and assemble the c gear output 4wd on shaft

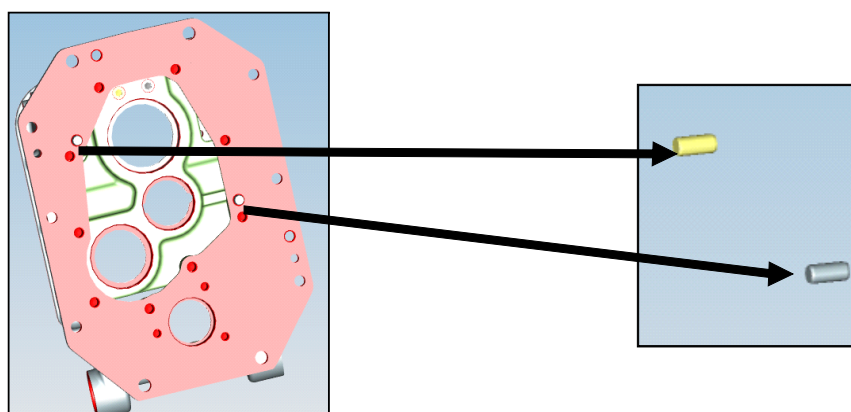


HOUSING PREPARATION

1. Place the housing transmission on fixture
2. Tight the plug 1/4"-18 in housing from front opening upto 0.5mm

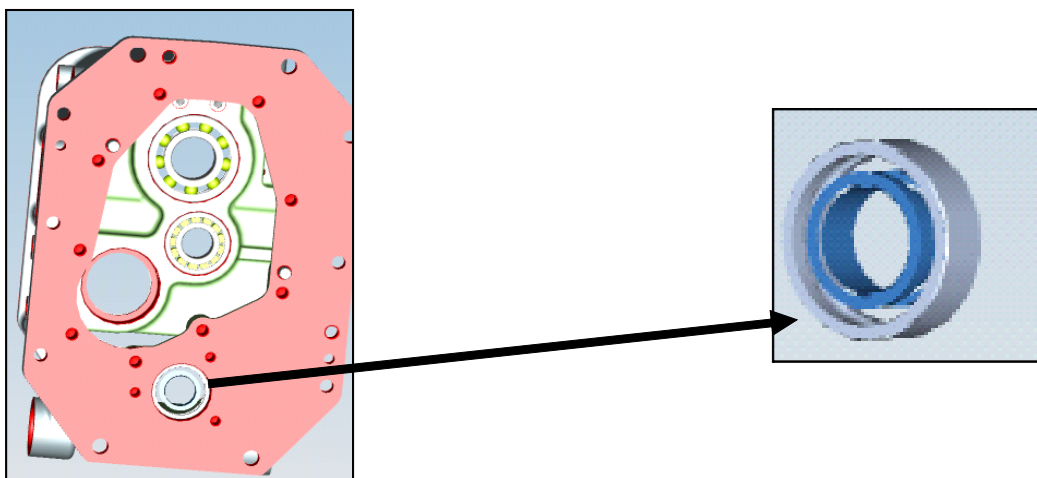


3. Press dowel in front face of housing transmission electric

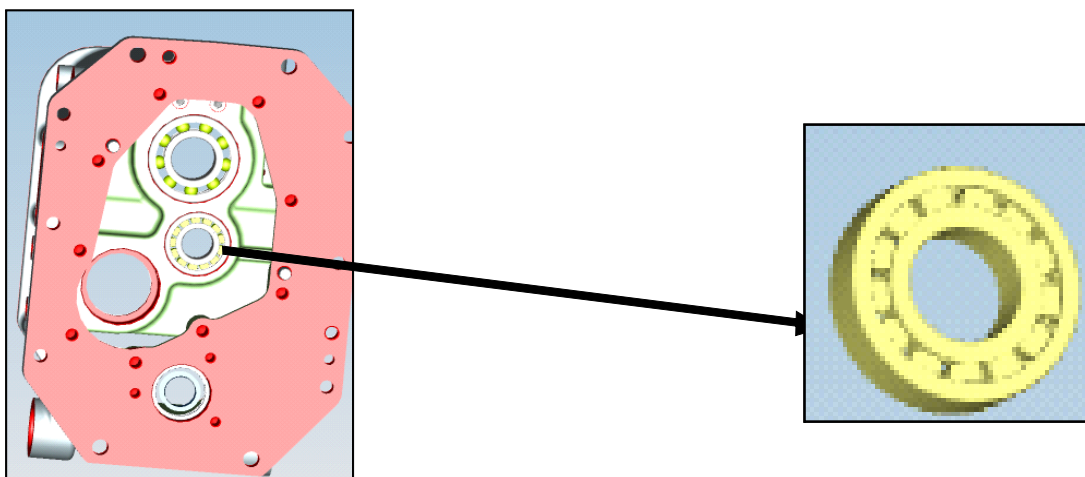


Service manual

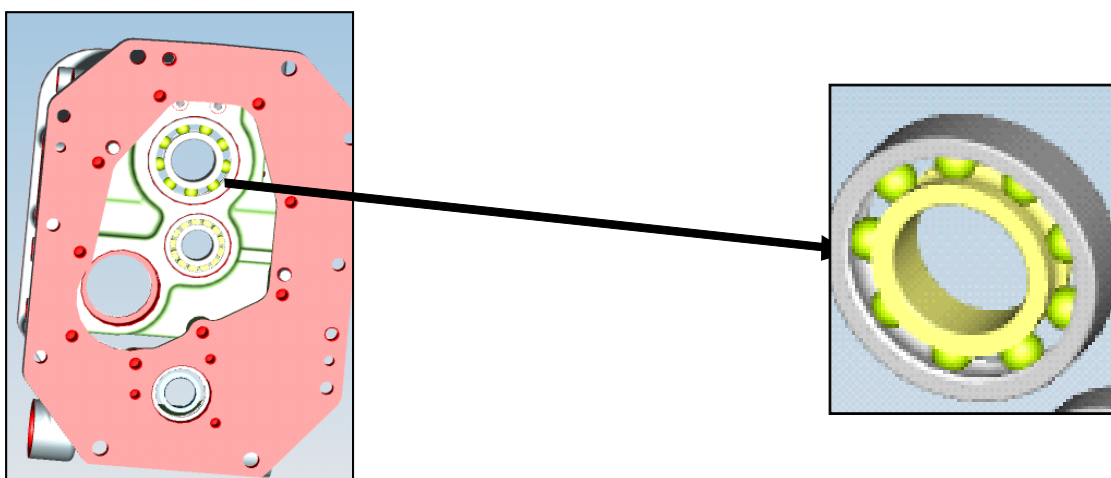
4. Press the ball bearing 6005 in bottom 4wd bore of housing



5. Press the outer race of nj205 in housing tran electric counter shaft bore

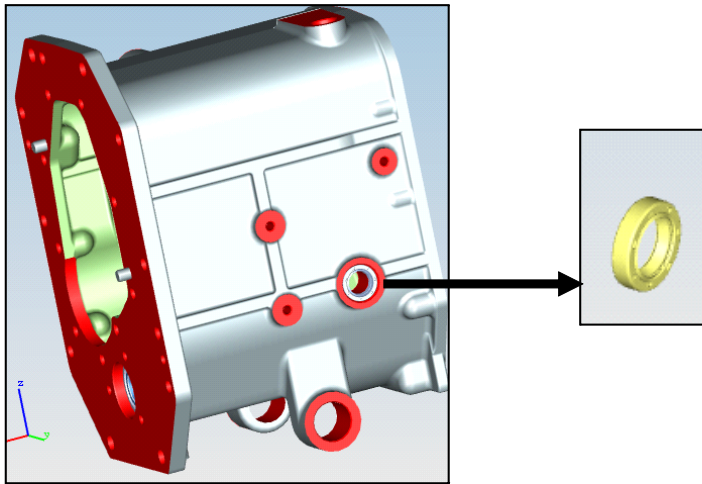


6. Press bearing 6207 in ct housing input shaft bore



Service manual

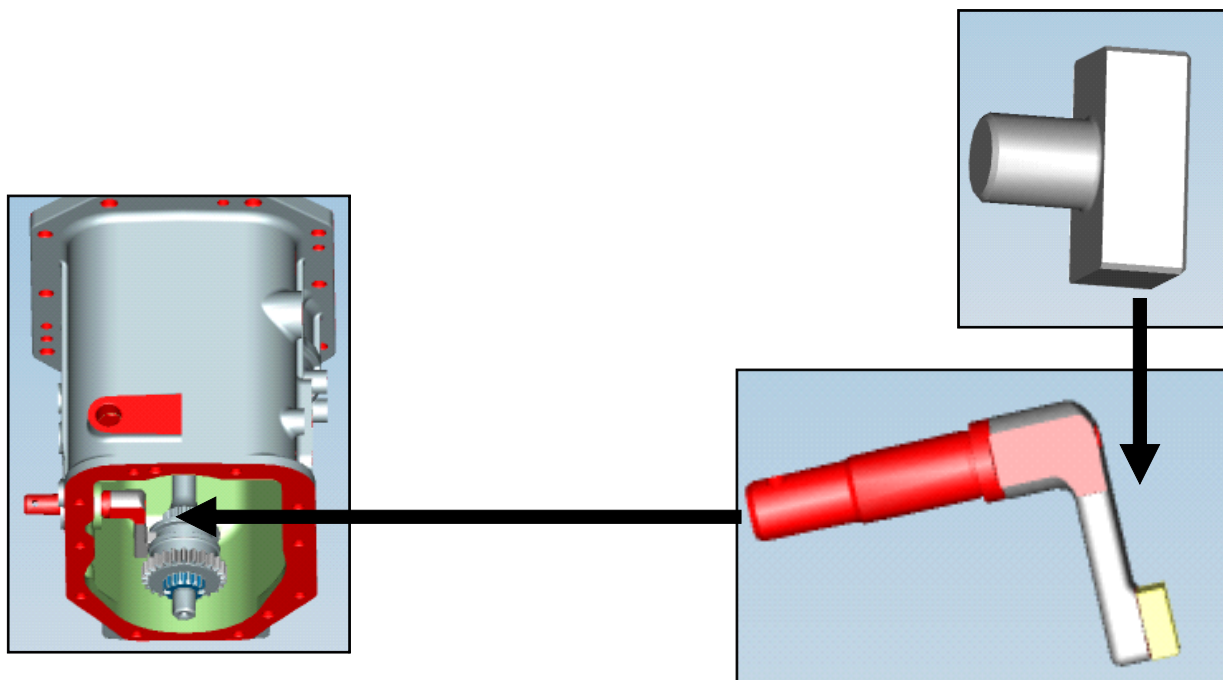
7. Pres the oil seal 20x30x7 in lever 4wd bore in housing



8. Plug the tapered holes on ct housing rear face with plug 1/4 upto 0-0.5 mm.

9. Press the seal in lever 4wd shifter bore.

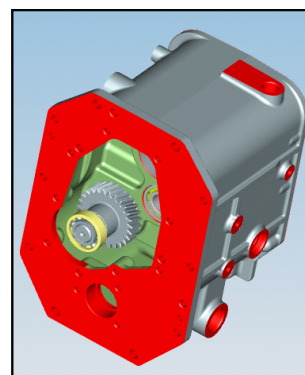
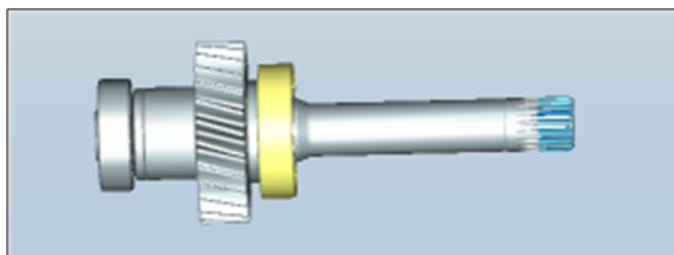
10. Insert the lever 4wd in ct hsg with pin pto shifter.



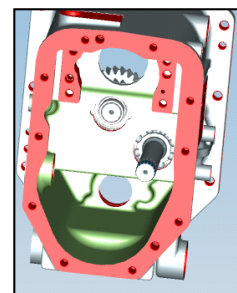
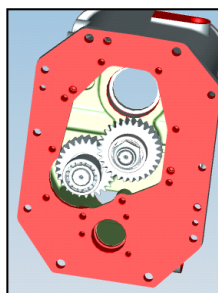
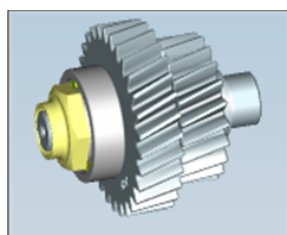
11. Press the 2no. Dowels in ct hsg front face for plate input assembly.

Service manual

1. Insert the shaft output compact sub-assy in housing from front opening.

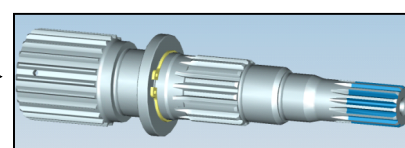
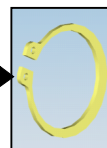
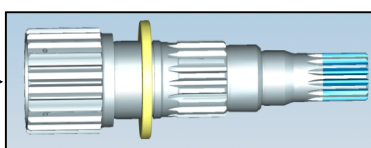
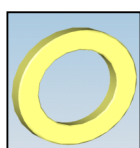


2. Press the shaft with bearing in housng completely
3. Assemble the counter shaft sub assy in housing on nj 205 out race

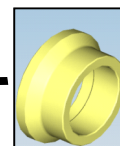
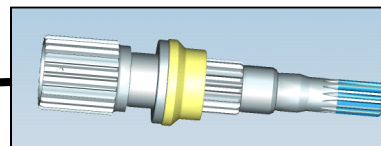
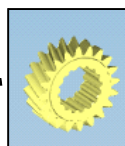
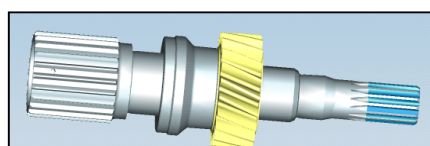


INPUT SHAFT TRANSMISSION ASSEMBLY WITH CT HOUSING

1. Insert the spacer in shaft input from front side and lock the spacer with circlip from front opening.

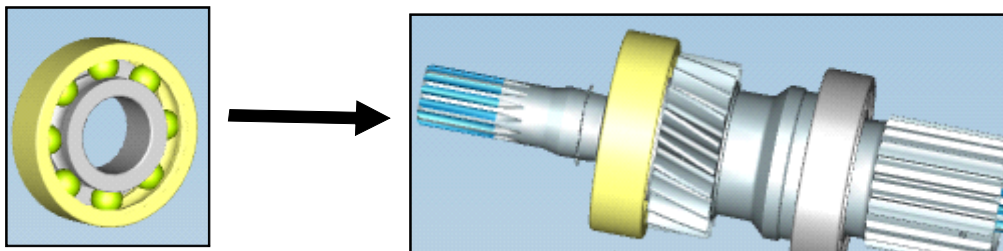


2. Insert the spacer and gear z-20 in shaft input from front side opening



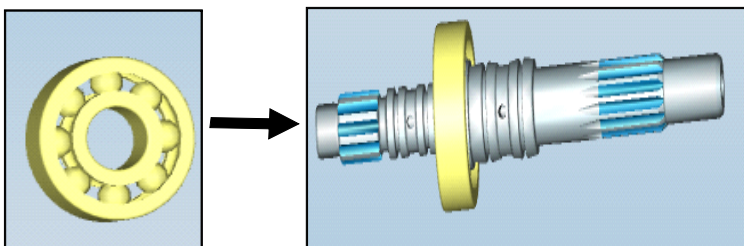
Service manual

3. After gear assy, insert the brg in shaft, keeping shield facing towards outer side.
4. Press the bearing on shaft input electric upto butting of strack

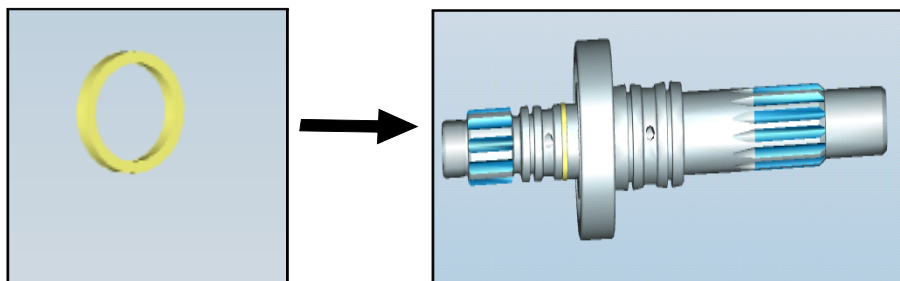


WET PTO CLUTCH SHAFT SUB ASSEMBLY

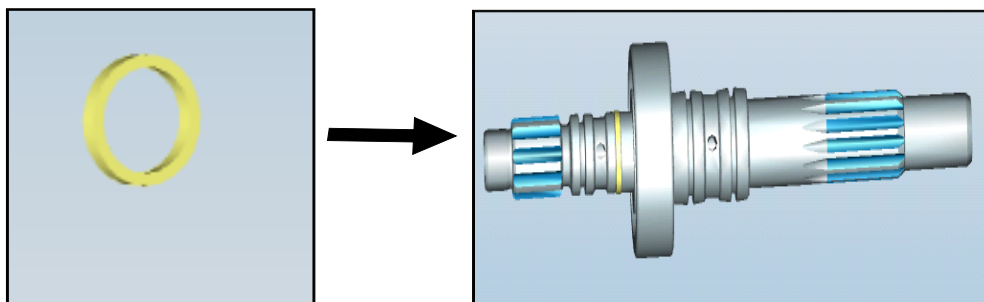
1. Plug the tapped hole of retainer wet pto clutch side with plug & flush with face within 0-0.5mm
2. Place the shaft wet pto clutch output on fixture and press the plug in hole (rear)
3. Press bearing ball 6304 in shaft pto wet clutch output.



4. Assembly ptfе seal on rear side of the output shaft grooves.



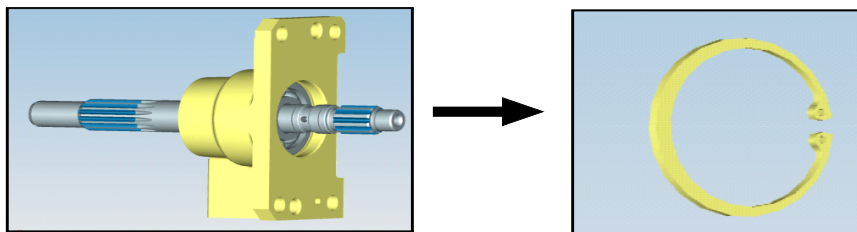
5. Assemble ptfе seal on front side of the outout shaft grooves.



6. Put seal retainers on ptfе seals on shaft to retain the size of ptfе seal

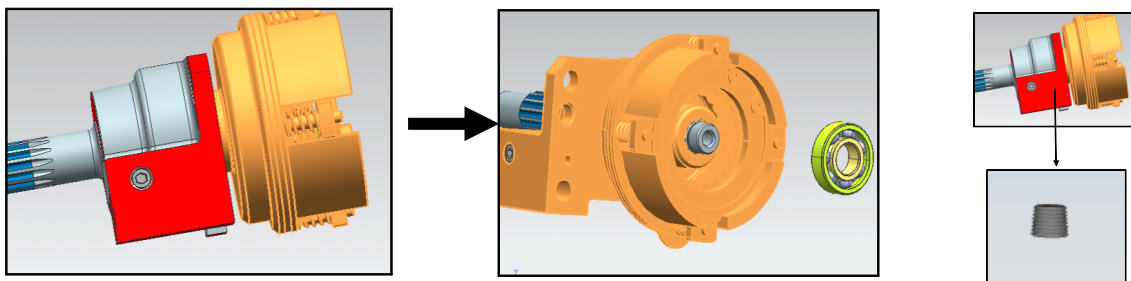
Service manual

7. Remove the seal retainers and assemble the retainer sub assembly and circlip on shaft front.

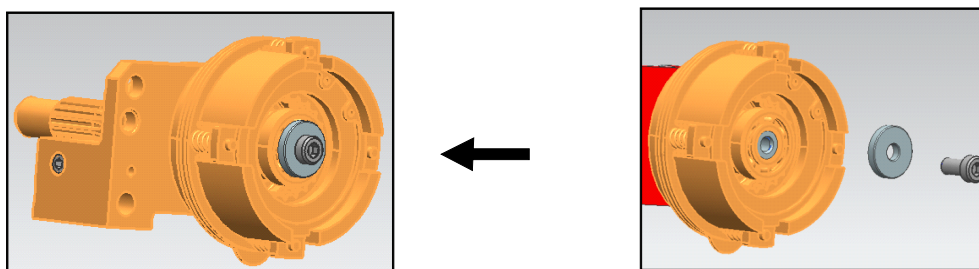


8. Assemble the clutch assembly wet pto on shaft output (hst)

9. Press the bearing 6202 c3 in shaft wet pto clutch

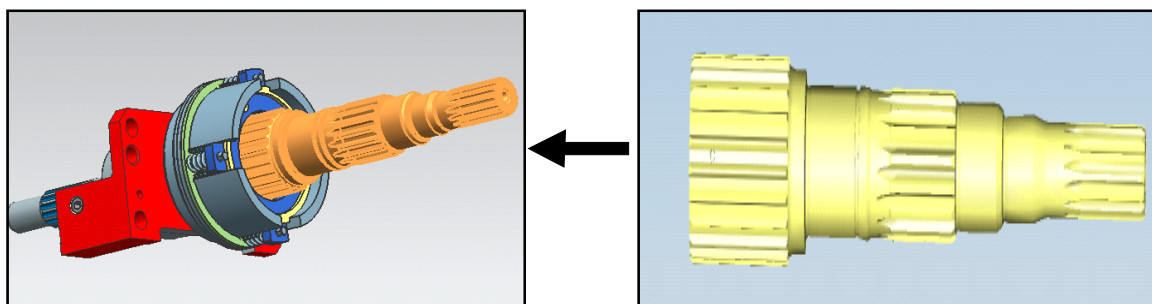


10. Tight the screw in shaft wet pto with washer



11. Torque the screw upto 25-32 nm

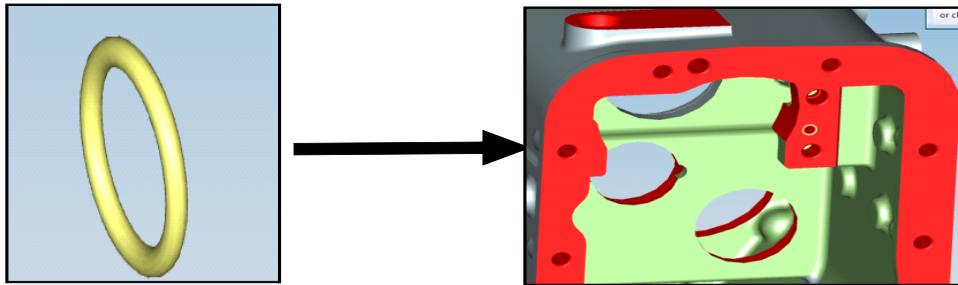
12. Put the shaft input electric transmission in wet pto clutch sub assy



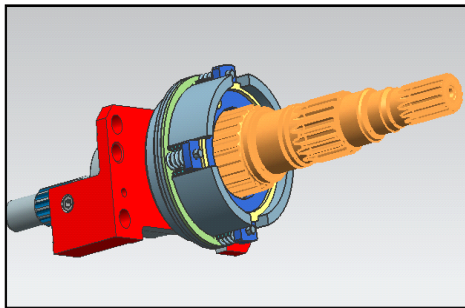
Service manual

WET PTO CLUTCH ASSEMBLY WITH CT HSG

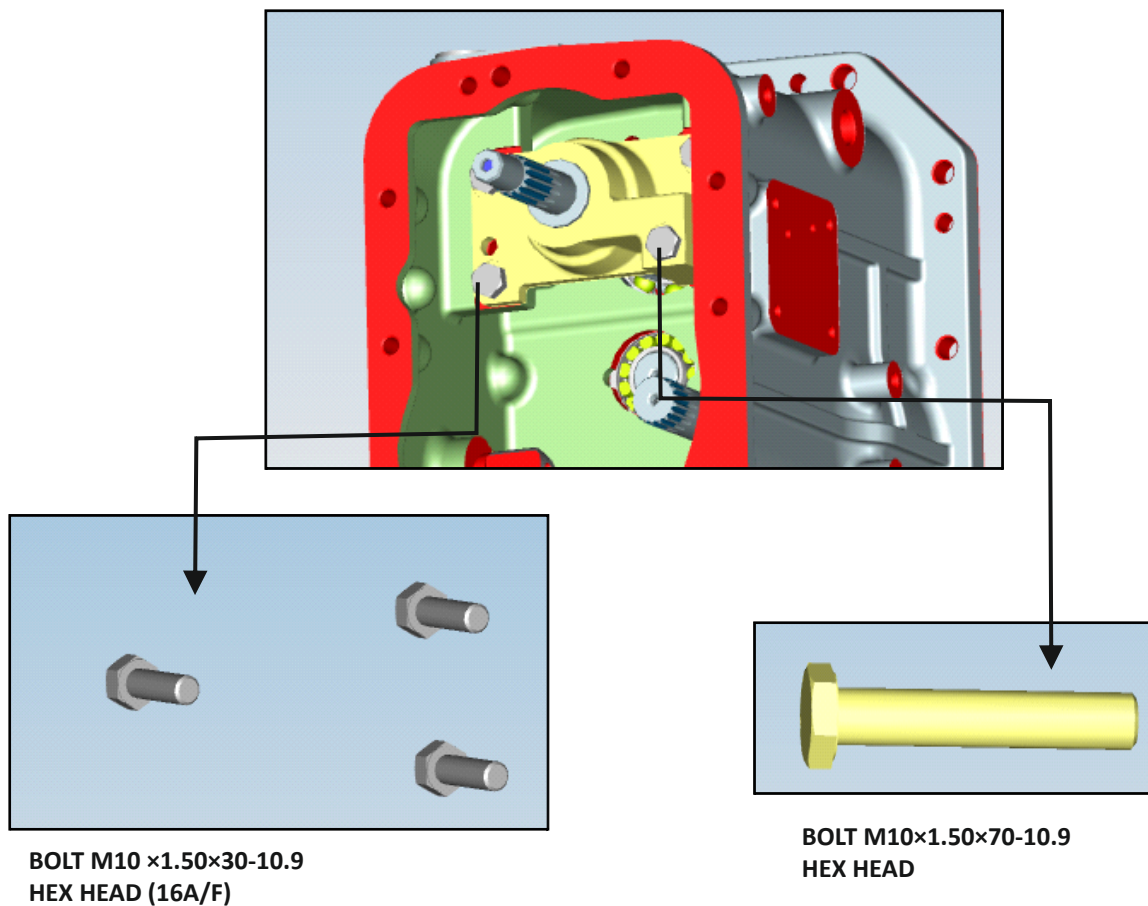
1. Insert the wet pto clutch sub assembly in ct hsg from rear side in dowel
2. Place the o-ring in housing groove



3. Insert the input shaft in wet clutch assy



4. Ensure complete assembly by rotating upto last friction plate
5. Ensure the correct sitting of brake lug in housing
6. Tight & torque the bolts of wet pto clutch retainer in ct housing



Service manual

PLATE & INPUT RETAINER ASSEMBLY WITH CT HSG

1. Assemble the plate in housing from front side
2. Tight the plate in housing with bolts m10x30

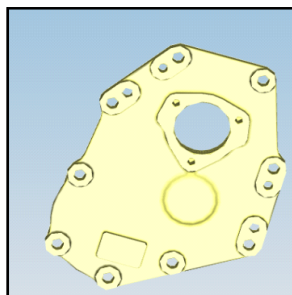
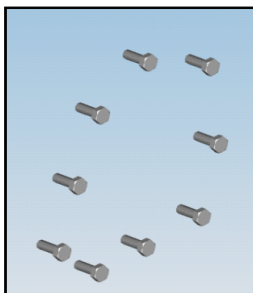
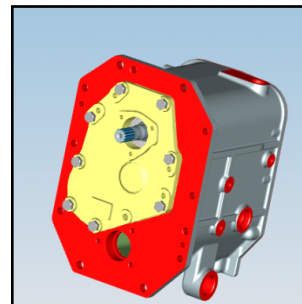


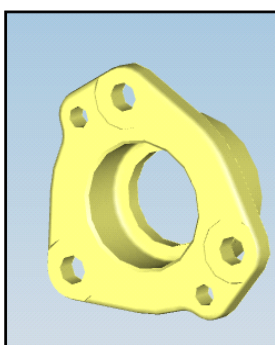
PLATE INPUT TRANSMISSION



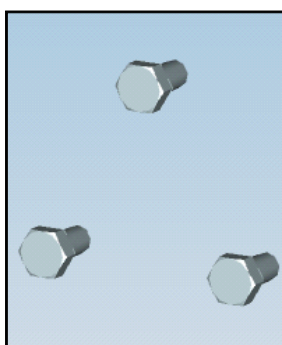
BOLTS M10×1.50×30-10.9
HEX HEAD



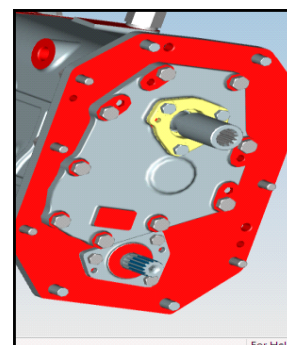
3. Torque the bolts at 55-65nm.



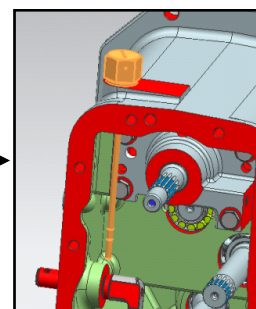
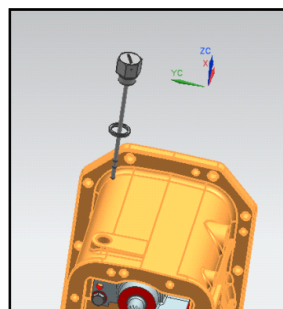
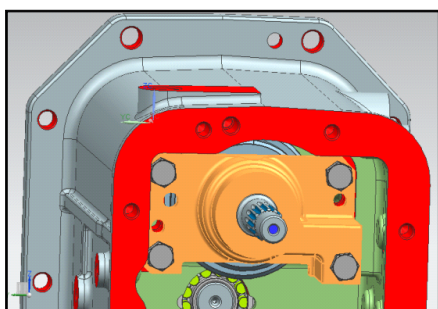
RETAINER



BOLTS M8×1.25×16-8.8



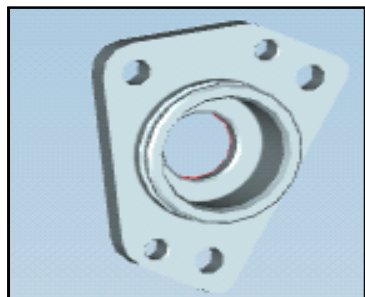
4. Apply loctite-5188 on retainer input shaft butting face
5. Assemble the retainer in input shaft
6. Tight & torque the bolts m8 of retainer with housing.
7. Assemble and tight the indicator oil level and copper washer in housing



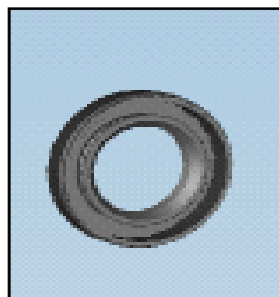
Service manual

RETAINER 4WD & RETAINER INPUT SUB ASSEMBLY

1. Place the retainer drop box.
2. Press oil seal 22x37x7 in retainer drop box.

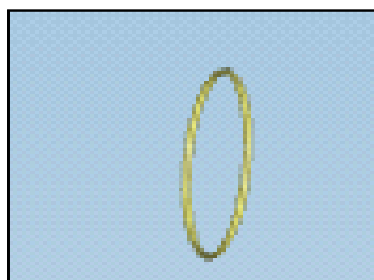
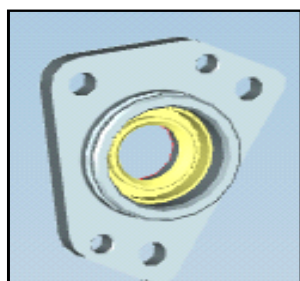


RETAINER 4WD



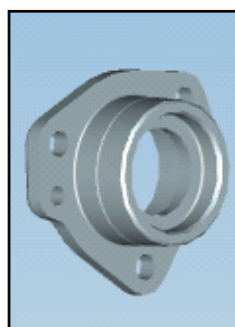
OIL SEAL 22 x37x7

3. Assemble the seal o-ring on retainer drop box groove on od.

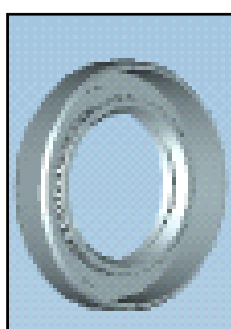


SEAL O-RING 1.78x42.0

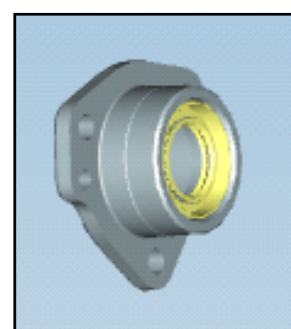
4. Check runout of oil seal seal in retainer.
5. Put the input retainer in fixture.
6. Press the oil seal in retainer input.



RETAINER INPUT



SEAL TRANSMISSION INPUT

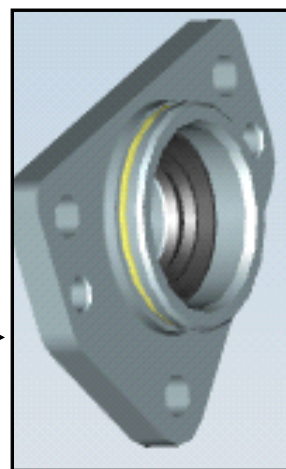
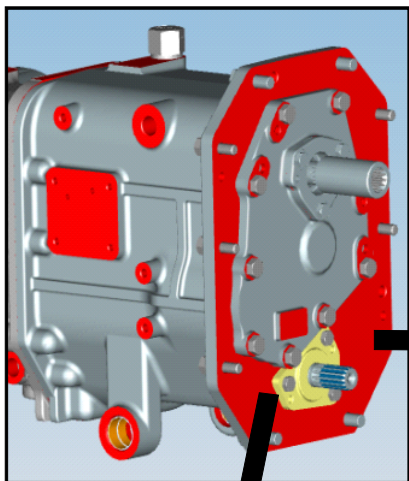


7. Check runout of oil seal seal in retainer.

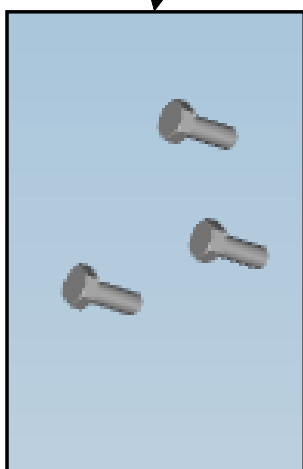
Service manual

RETAINER SUB ASSEMBLY WITH HOUSING

1. Apply loctite 5188 in retainer 4wd
2. Assemble the retainer in ct hsg from front side
3. Tight the retainer with 3 no. Bolts



RETAINER 4WD



BOLT M8×1.25×20-8.8

Torque chart compact

S.NO.	PART DESCRIPTION	SIZE	LENGTH	GRADE	QTY.	TORQUE VALUE (Nm)	REMARK
1	RETAINER TO CLUTCH HOUSING MOUNTING BOLT	M8x1.25	16	8.8	4	14-21	CLUTCH AREA
2	CLUTCH CROSS SHAFT TO FORK MOUNTING BOLT	M8x1.25	40	10.9	2	25-32	
3	CLUTCH TO FLY WHEEL MOUNTING BOLT	M8x1.25	20	10.9	6	25-32	
4	PLUG IN PLACE OF SENSOR	M16x1.5	16	-	1	45-50	
5	SENSOR	-	-	-	1	24.5-34.3	
6	TOP COVER MOUNTING BOLT	M8x1.25	20	8.8	10	21 - 28	SPEED AREA
7	IDLER SHAFT LOCKING BOLT	M8x1.25	59	-	1	10-15	
8	PLUG INTERLOCK	1/4"	18	-	1	20-25	
9	FORK TIGHTENING SCREW	-	-	-	-	27-34	
10	FORK TIGHTENING NUT	3/8"	24	-	2	27-34	
11	INDICATOR TRANSMISSION OIL LEVEL	-	-	-	-	55-65	
12	RETAINER 4WD COVER MOUNTING BOLT	M8x1.25	20	8.8	10	28-35	REAR AXLE AREA
13	INTERMEDIATE PLATE TO REAR HOUSING MOUNTING BOLT	M10x1.50	25	10.9	4	55 - 65	
14	DIFF. RETAINER TO REAR HOUSING MOUNTING BOLT	M8x1.25	25	8.8	12	20-25	TRUMPET SUBASSEMBLY AREA
15	CRIMPING NUT FOR REAR AXLE SHAFT	M30x1.5	-	-	2	60-70	
16	BULL PINION SHAFT BEARING LOCK BOLT	M8x1.25	18	10.9	4	25-32	
17	DRAIN PLUG	M14x1.5	10	-	2	25-32	
18	LH/RH RETAINER TO TRUMPET HOUSING BOLT	M10x1.50	30	10.9	10	55-65	PTO AREA
19	PTO RETAINER TO REAR HOUSING MOUNTING BOLT	M10x1.50	35	10.9	4	55-65	
20	PTO RETAINER TO REAR HOUSING MOUNTING ALLEN BOLT	M10x1.50	25	10.9	4	55-65	
21	PTO RAIL LOCKING SCREW	-	-	-	1	25-33	
22	PTO RAIL LOCKING NUT	M10x1.50	8	-	1	25-33	DIFFERENTIAL AREA
23	CROWN WHEEL MOUNTING BOLTS	M8x1.25	18	10.9	10	25-32	
24	CLUTCH HOUSING TO ENGINE ADAPTOR PLATE MOUNTING BOLT	M10x1.50	35	10.9	13	55-65	BUCKLE UP BOLTS
25	CLUTCH HOUSING TO ENGINE ADAPTOR PLATE MOUNTING BOLT	M10x1.50	95	10.9	1	55-65	
26	CLUTCH AND SPEED HOUSING MOUNTING BOLT	M10x1.50	35	10.9	8	55-65	
27	SPEED HOUSING TO REAR HOUSING MOUNTING BOLT (APPLY LOCTITE 542)	M10x1.50	35	10.9	2	55-65	
28	SPEED HOUSING TO REAR HOUSING MOUNTING BOLT	M10x1.50	70	10.9	8	55-65	
29	TRUMPET HOUSING TO REAR HOUSING MOUNTING BOLT	M10x1.50	70	10.9	20	55-65	
30	TRUMPET HOUSING TO REAR HOUSING MOUNTING BOLT (APPLY LOCTITE 542)	M10x1.50	143	10.9	2	55-65	

CHART LIQUID SEALANT - COMPACT 9+3

S.No.		JOINT LOCATION	Sealant Grade	D Code
1	TRANSMISSION	Clutch Housing to Engine	Locte 5 060	D95010830
2		Input Sha Retainer to Clutch Housing	Locte 5 188	D95013250
3		Clutch Housing to Speed Housing		
4		4WD Shaft retainer to Speed Housing		
5		Speed Housing to Rear Housing		
6		Speed Housing to Top Cover	No Sealant Allowed	Use Solid Gasket

TROUBLESHOOTING - COMPACT 9+3

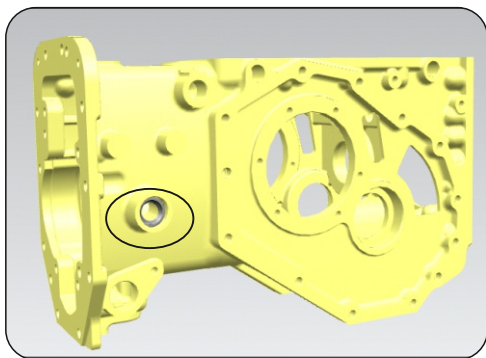
TRANSMISSION	MAIN SPEED GEARS NOT WORKING	Input Shaft Circlip jump out	Replace circlip
	MAIN SPEED GEARS SELECTION NOT SMOOTH	Air vent hole plugged in shifting boot /sand, durt at bush locaons	Clean the parts from any sand or dirt & clear the vent hole in boot.
	SPEED GEAR LEVER DOESN'T SHIFT	Spring Tension Excess	Replace
	TRACTOR STALLS / NOT MOVE AFTER ENGAGING GEAR	Interlock wornout / damaged	Replace
		Coupling speed Range part got missed during service / re-assembly	Check & assemble missing part
		Circlip jump out from Input shaft	Replace circlip
	ABNORMAL NOISE	Oil level below Dipsck lev el	Fill Oil
		Gear worn or broken	Replace
		Bearing worn	Replace
	GEAR JUMP OUT	Detent spring loose / tension insufficient	Replace
		Shifter Sleeve splines damaged/wornout	Replace
		Fork Lugs bent	Replace
	LEAKAGE / SEEPAGE FROM WELCH PLUG	Improper sing of w elch plug in bore	Replace and assemble evenly
	LEAKAGE / SEEPAGE FROM COVER 4WD SHAFT	Seal Damaged	Replace Seal
	LEAKAGE / SEEPAGE FROM 4WD SHIFTING LEVER	Seal Damaged	Replace Seal

SERVICE MANUAL

REAR AXLE

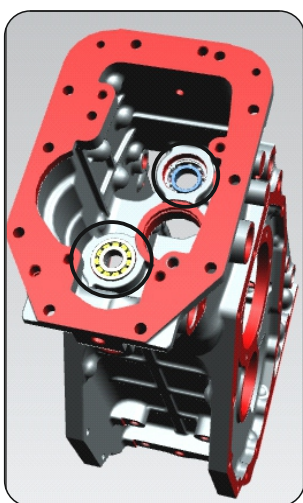
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1. Assembly Process	1
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3. Torque Chart	25
4. Liquid Sealant Chart	26
5. Settings	27
6. Trouble Shooting Chart	33

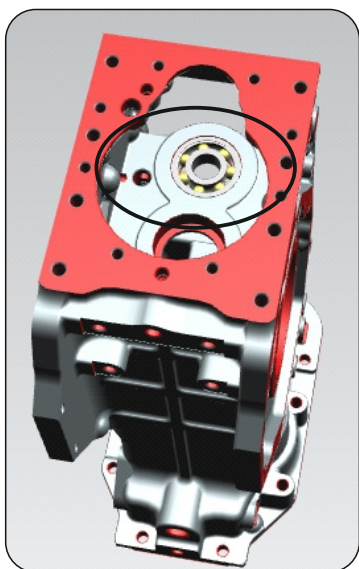


1. Press seal in rear housing.

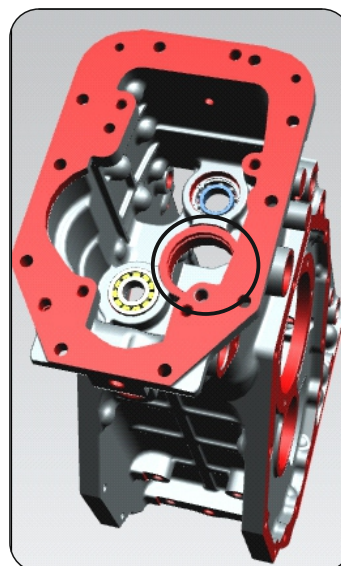
NOTE : Put oil seal in range shaft shifter hole on housing and press it.
Face runout of seal with in 0.1 mm



2. Put the bearing as shown in picture and press it

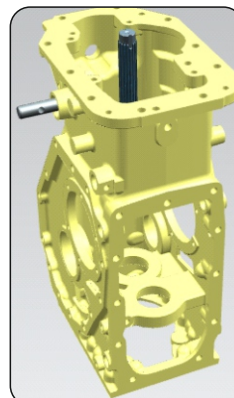


3. Put the bearing in the CH housing from opposite side as show in pic.



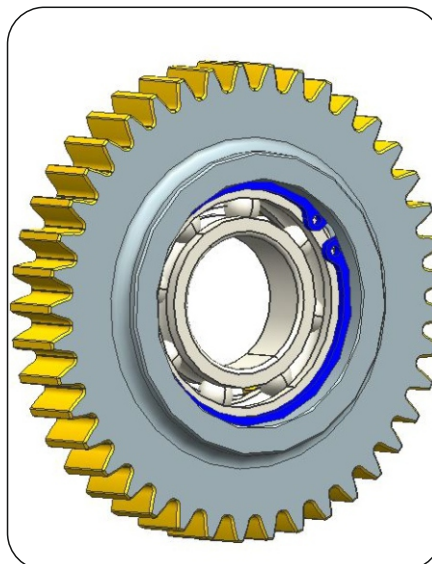
4. In the center of CH housing put the following parts.

- TRB 30206 outer race.
- Spacer.
- Circlip.



5. Assemble pinion shaft in center housing & lock with circlip.

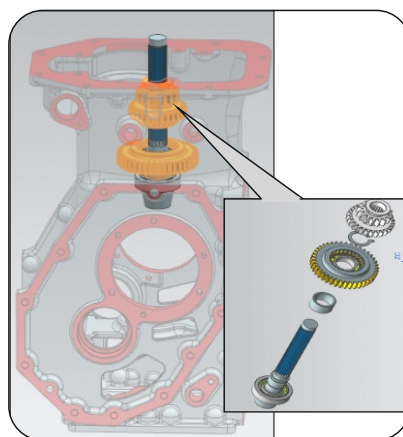
Assemble lever range shifting in center housing.



6. Assemble bearing 6006 in low driver gear & lock with circlip.



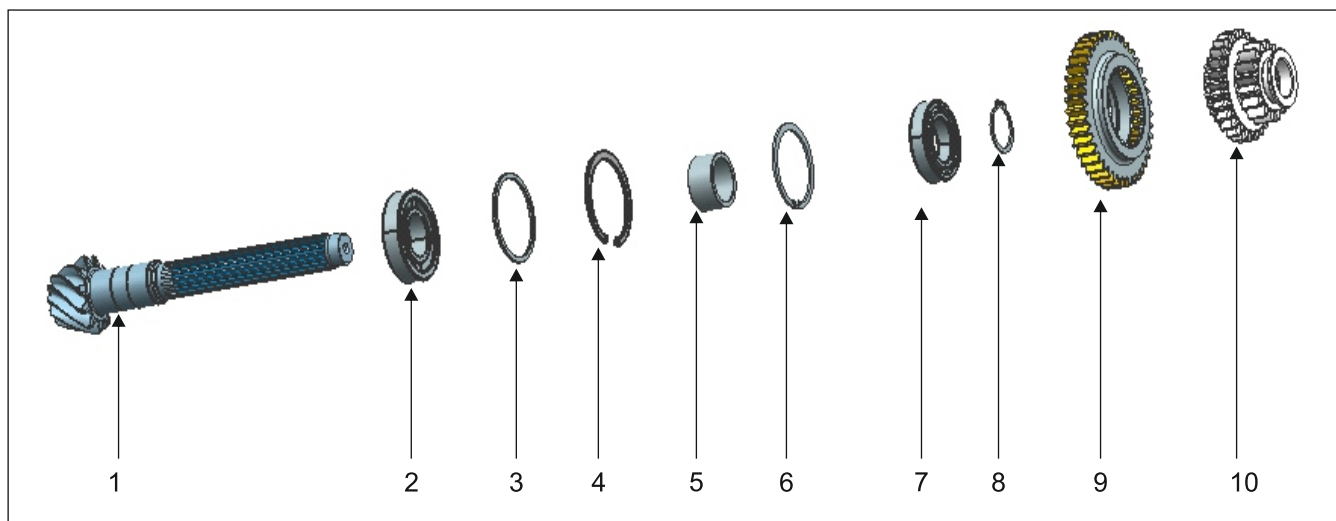
7. Put the intermediate plate on fixture
Press 4WD pin in plate
Press bearing 30205 outer race.
Press Bearing NJ205 outer race in plate.
Lock NJ205 outer race with circlip.



8. Assemble Spacer & low driven gear assembly on pinion shaft & lock with circlip.
Insert the cluster gear (gear driven high / medium range) along with rail & fork assembly range shifting.

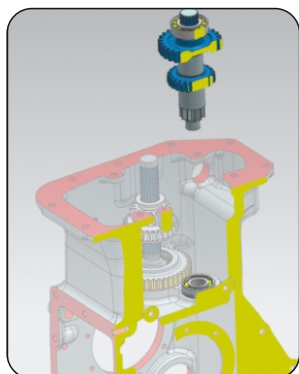
Rear Axle Assembly

Range driven shaft Assembly



1. Shaft bevel pinion rear axle differential
2. Bearing taper roller 30206
3. Spacer graded pinion shaft
4. Circlip B62
5. Spacer tail pinion shaft

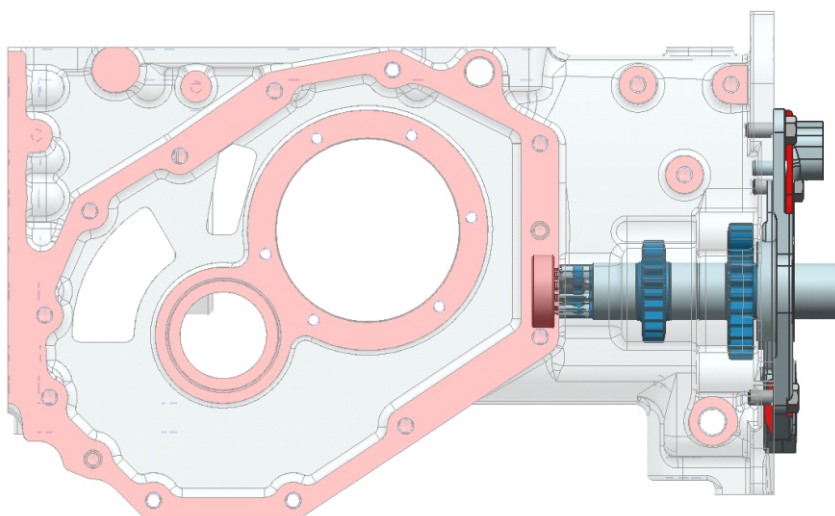
6. Circlip
7. Bearing ball 6006
8. Circlip A30
9. Gear driven low range
10. Gear driven high/medium range



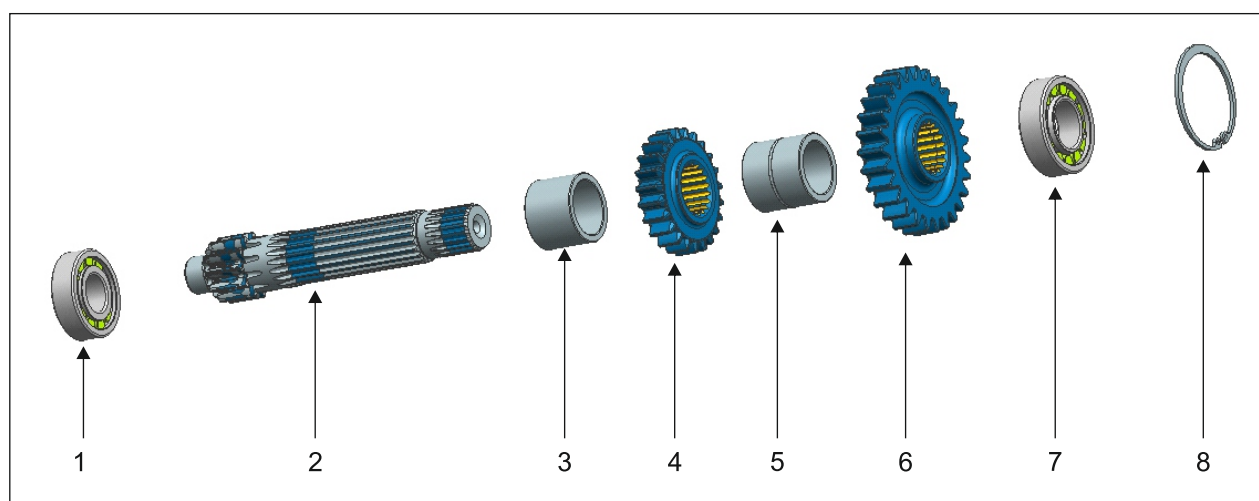
9. Assemble range driven shaft sub assembly in the CH As shown in the pic.

Range driven shaft Assembly

- 1 Insert bearing roller NJ204 in central housing.
- 2 Insert range driving shaft low gear and spacer.
- 3 Insert driving medium gear.
- 4 Insert Spacer driving high gear and insert gear driving high range.
- 5 Align and insert taper roller bearing NJ205 in the CH housing.
- 6 Align the circlip and lock the range drive shaft.



Range drive shaft Assembly

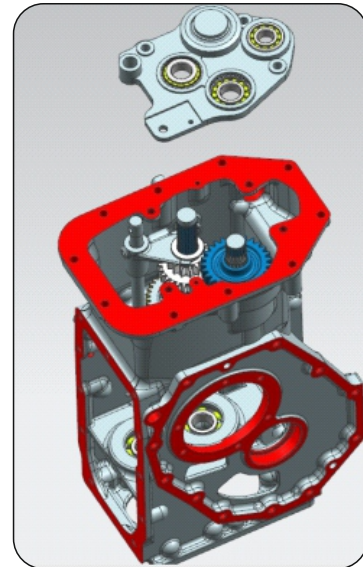
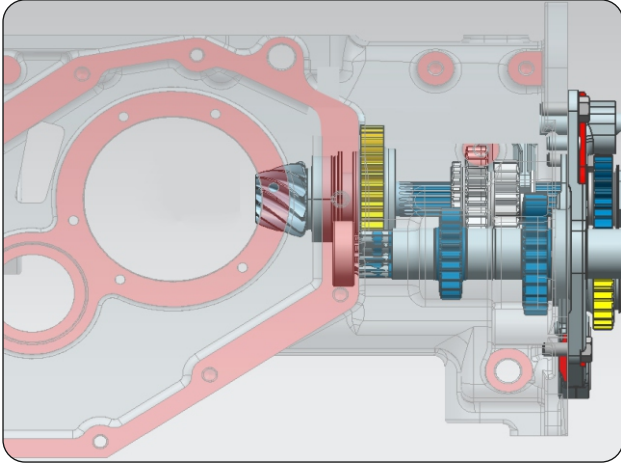


1. Bearing roller NJ204
2. Shaft range low gear
3. Spacer driving low gear
4. Gear driving medium

5. Spacer range driving high gear
6. Gear driving high range
7. Bearing roller NJ205
8. Circlip

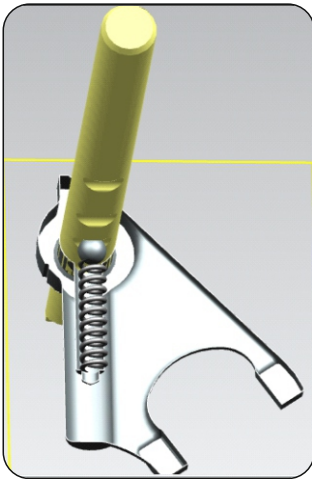
Service manual

Range driven & driving shaft final assembly

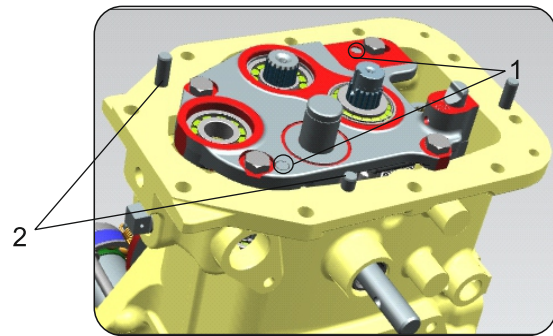


12. Match the hole of rail range shifting & dowel hole in intermediate plate. Assemble plate on center housing.

Range shifting fork assembly

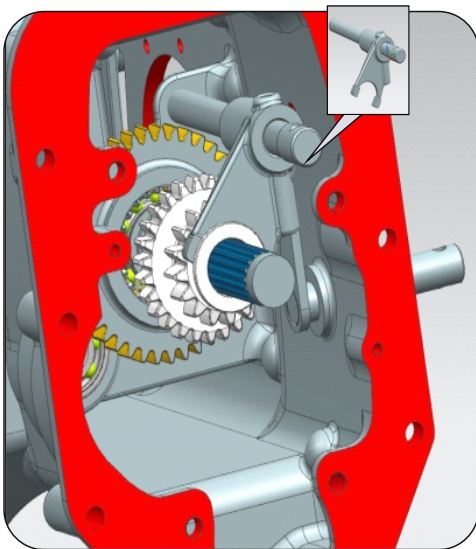


10. Assemble rail range shifting with fork along with Ball & spring. Apply grease on ball and spring before assembly.

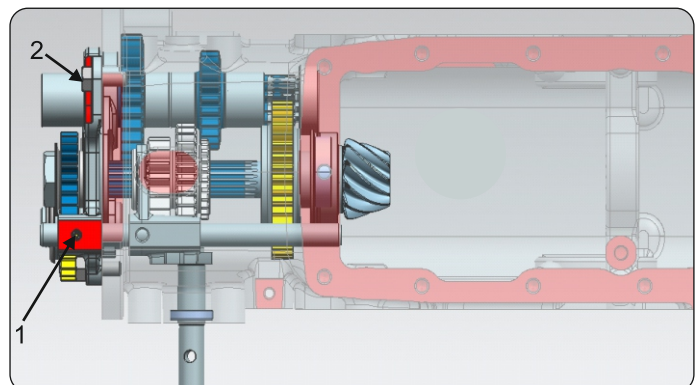


13. Lock the rail range shifting in intermediate, plate through pin spring dowel. Lock plate with bolt.

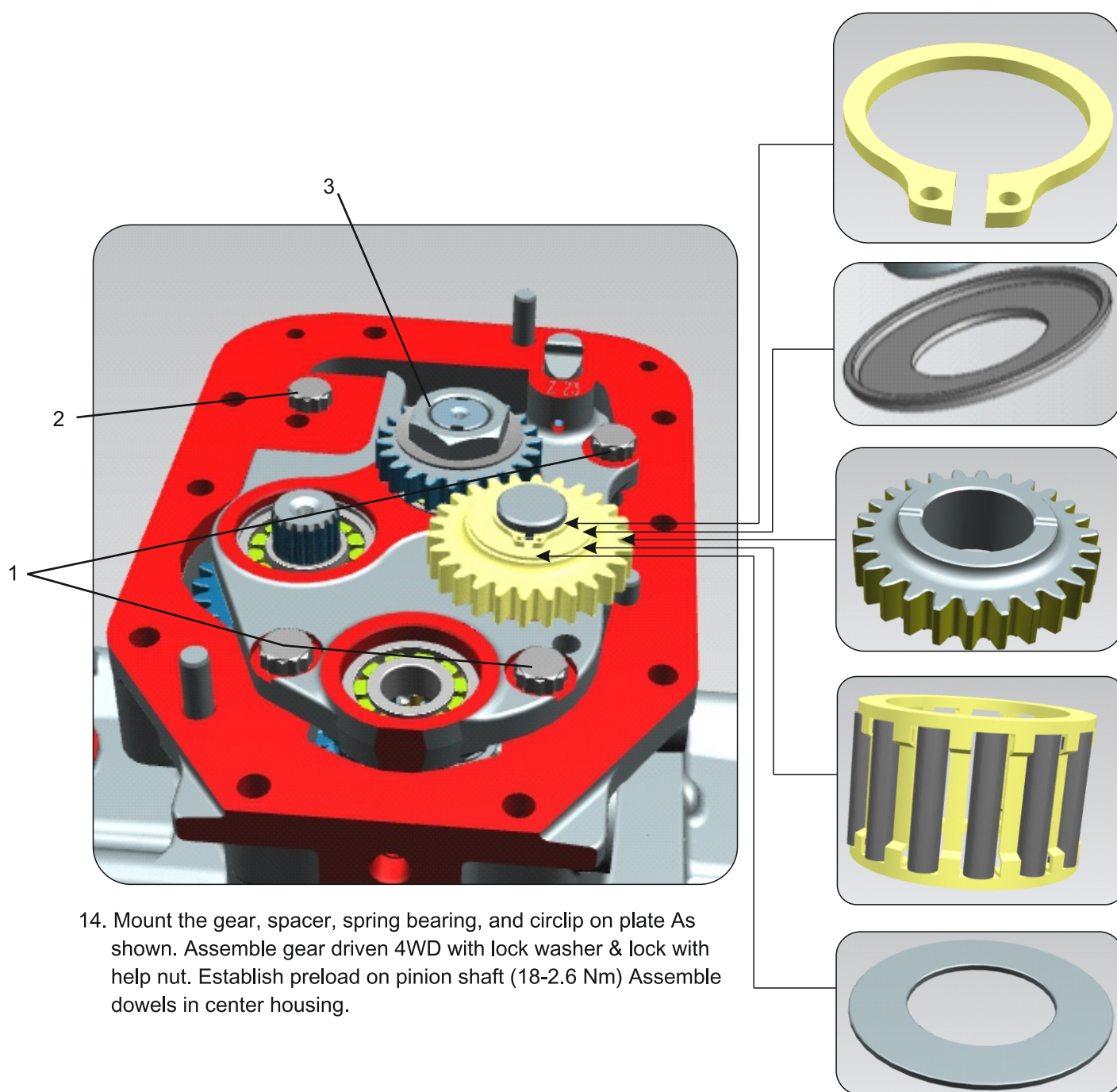
NOTE : press the dowel pin (1) on ch housing front face for intermediate plate assy. Top side (6mm out)
Press the dowel pin (2) on ch housing front face for intermediate plate assy., bottom side (12mm out)



11. Insert rail & fork range sub assembly on cluster gear align with bore in center housing as shown.



1. Pin 10x22 plain dowel 2. Bolt



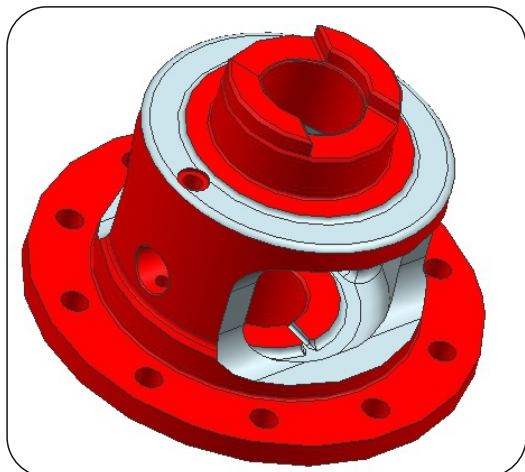
14. Mount the gear, spacer, spring bearing, and circlip on plate As shown. Assemble gear driven 4WD with lock washer & lock with help nut. Establish preload on pinion shaft (18-2.6 Nm) Assemble dowels in center housing.

NOTE : Tighten Intermediate bolts (1) M10x30 (3 nos.) and bolt (2) M10x25 (1 nos.) to torque of 50-65 NM

Chuck nut tighten (3) and adjust the pinion shaft pre loading of 1.8-2.6 NM

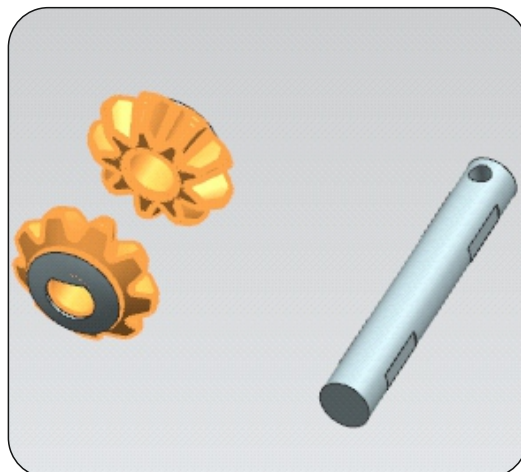
Service manual

Differential Assembly

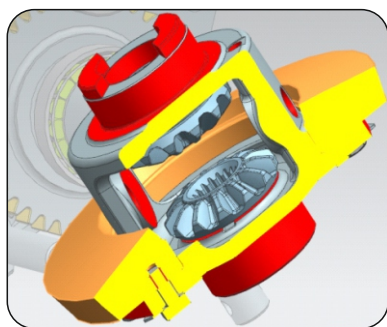


15. Put diffcase on fixture.

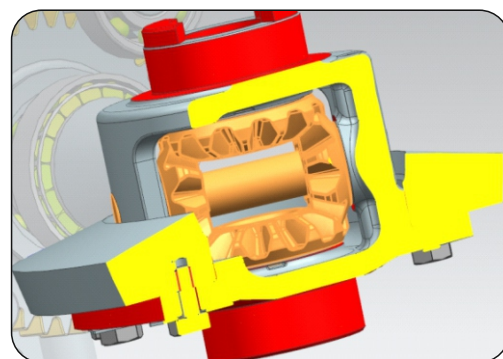
Use guide pin to guide differential case on crown wheel.



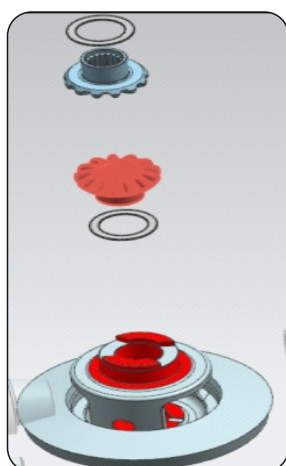
18. Insert the shaft spider differential case



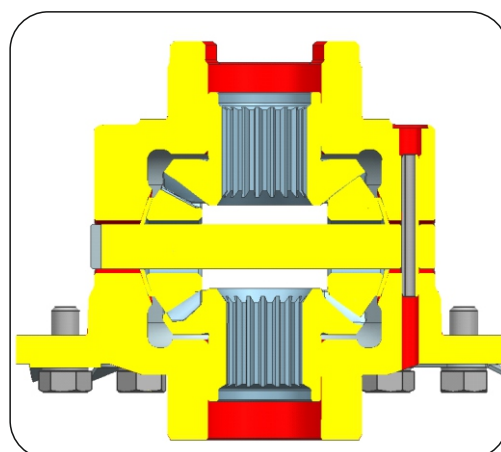
16. Insert the 2 planet gears on the sides of diffcase, matching with other 2 planet gears, along with washer and shaft spider & MOS2 grease.



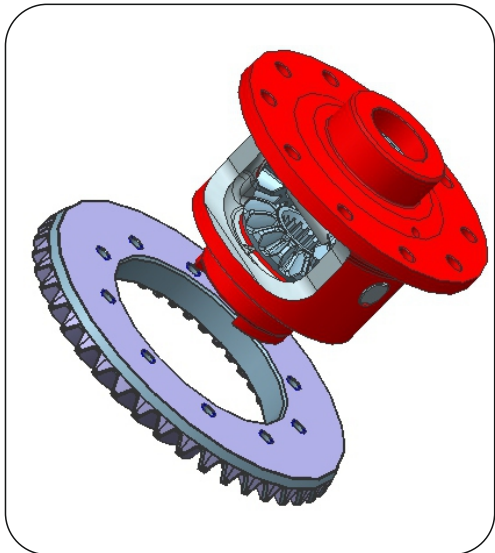
19. Lock the shaft spider differential case with pin spring dowel.



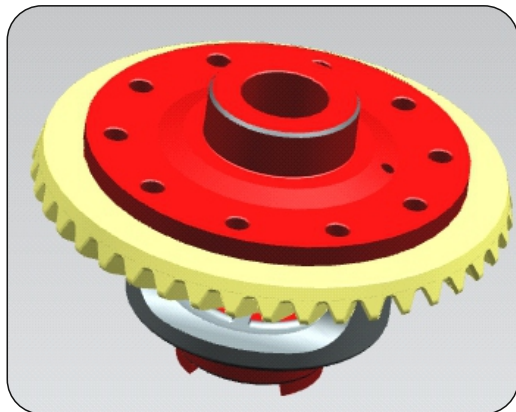
17. Insert the planet gears, fitted axially to the pinion side along with washers.



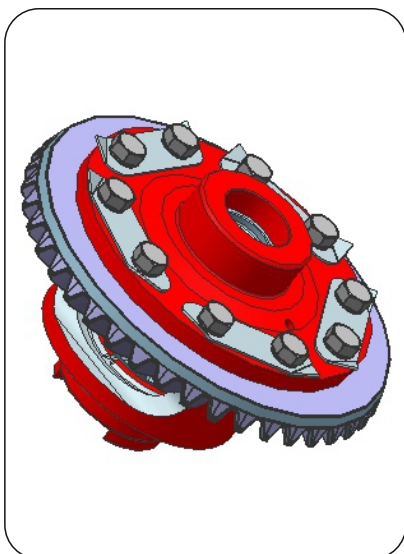
20. Ensure flushing of pin 5x40 spring dowel depth up to counterbore step shown.



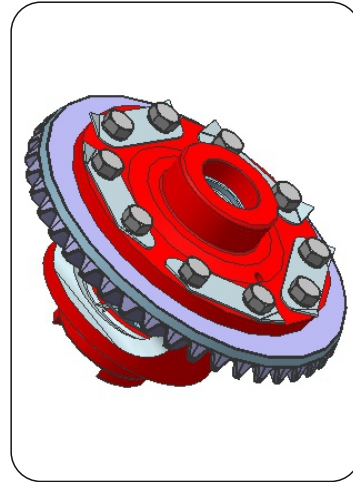
21. Press differential case housing on crown wheel



22. Applying loctite 638 on flange of differential case

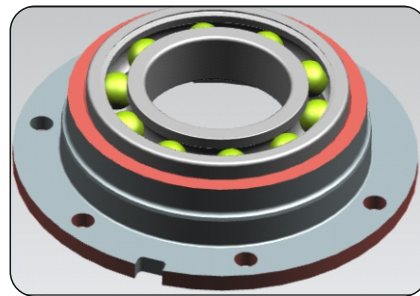


23. Place the crown wheel & diffcase assy on fixture.
Assemble the M8 bolts 10 no.s along with washer & lock washer on differential case.

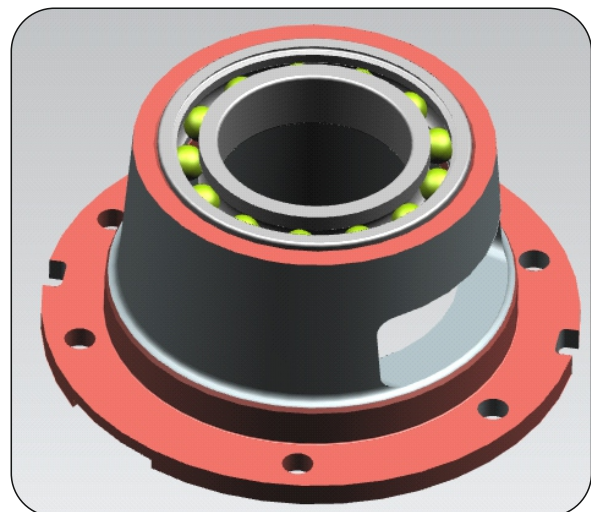


24. Tight all the bolts with pneumatic gun
Lock the bolts with lock washers by bending it completely along that edge & not at corner .

NOTE : Crown wheel & diffcase bolt torque- 25-32 NM



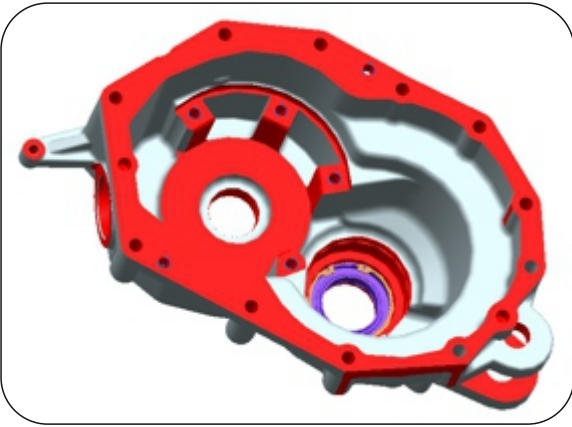
25. Place the retainer diffcase LHS on the hydraulic press fixture
Mount the ball BRG 6211 on pressing ram.
Press the ball bearing on retainer bearing differential LH.



26. Place the retainer diffcase RHS on the hydraulic press fixture. Press BRG 6011 in retain differential case RHS

Service manual

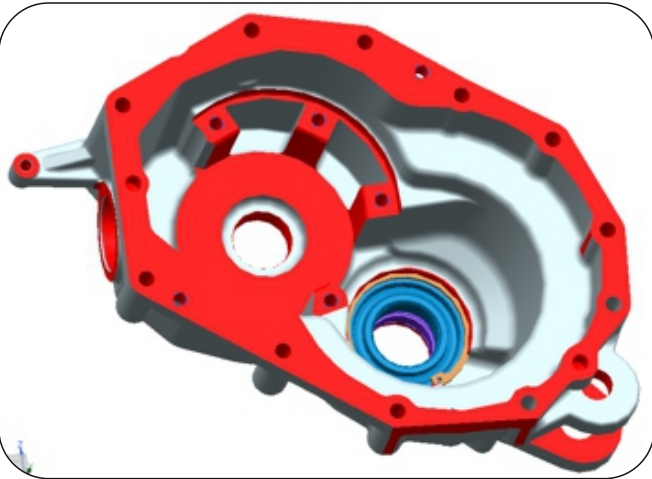
Rear Axle Assembly



27. Assemble oil seal on rear axle housing RH/LH as shown.

Assemble circlip in housing to lock position of oil seal in housing

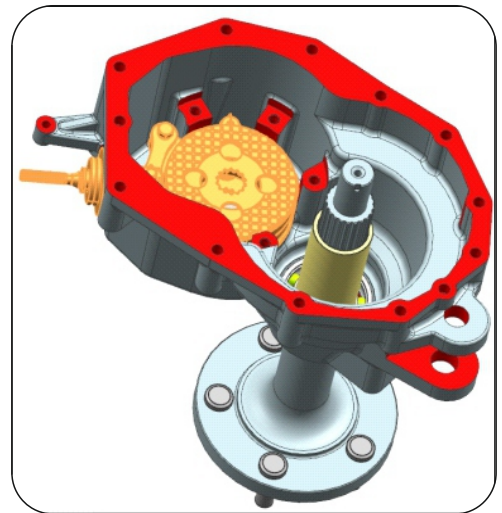
Note : Use oil to moisturize seal & o-rings before assembly.
Proper pressing of sealing on housing
seal run out 6.45- 6.55 MM



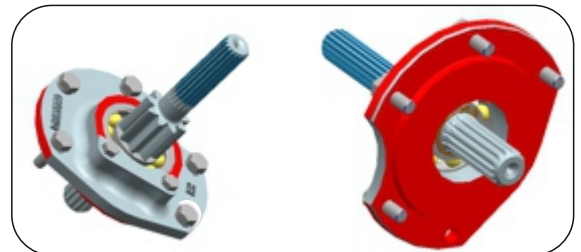
28. Press the ball bearing 6209 on rear axle house LH/RH
Put circlip to lock the bearing in rear axle housing LH/RH



29. Assemble axle shaft LH/RH as shown assembly with bolt in rear axle shaft.

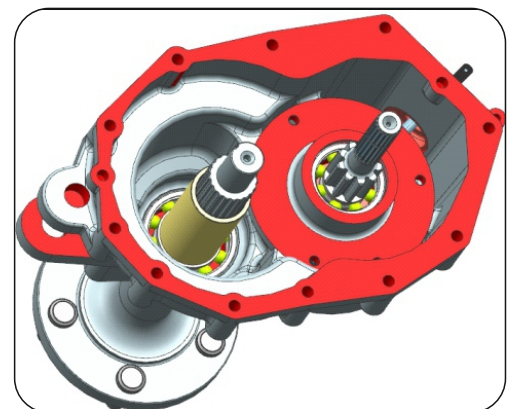


30. Assemble spacer LH/RH side on axle shaft.
Assemble friction disc & steel plate & actuator assembly in rear axle housing LH/RH.



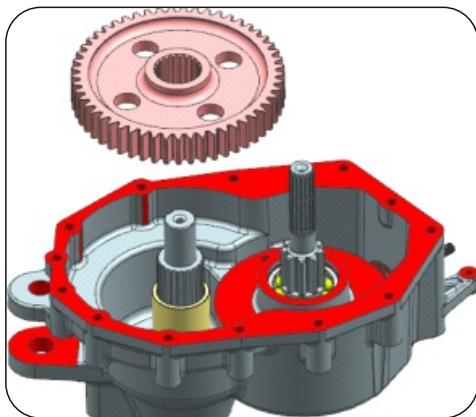
31. Assemble bull pinion shaft LH/RH with bearing & lock it with circlip
Assemble bull pinion shaft assembly in brake housing LH/RH & lock with washer & Screw.

NOTE : Torque the housing break inner 50-60 NM.
Torque the bull pinion shaft screw 25-30 NM.

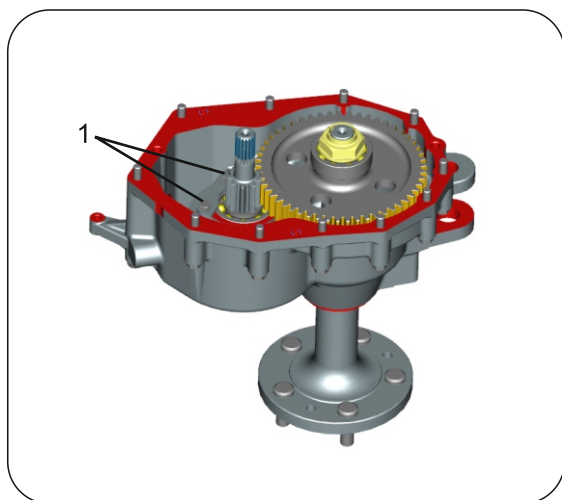


32. Assemble brake housing LH/RH assemble in rear axle housing LH/RH & tighten with bolts 5 nos.

NOTE : Torque the housing break inner to 50-60 NM

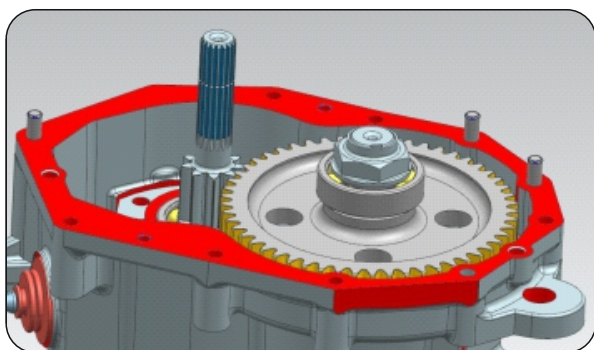


33. Assemble bull gear on rear axle shaft LH/RH as shown.

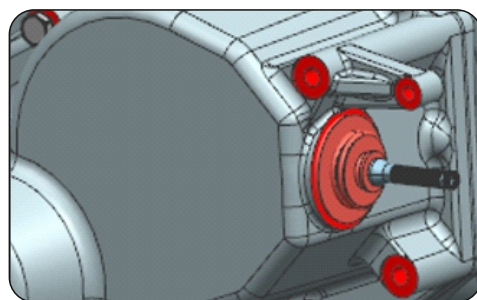


34. Assemble bearing on bull gear
press bearing 6306 on axle shaft.

NOTE : Torque the nut (1) crimping m30 screw
60-70 NM

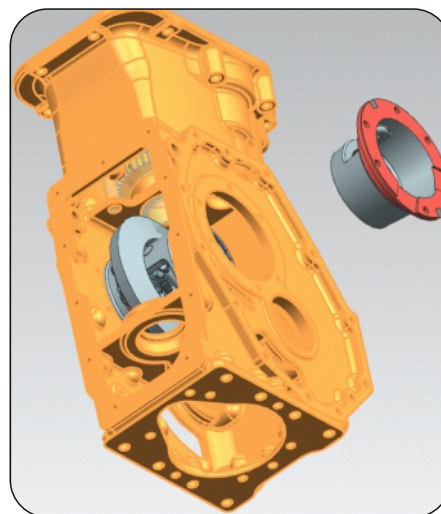


35. Lock tight the axle shaft assembly with lock nut M30.
Perform the shim selection of axle shaft with the help
of measuring gauge Place the shim as per the shimming
chart on axle shaft bearing face.



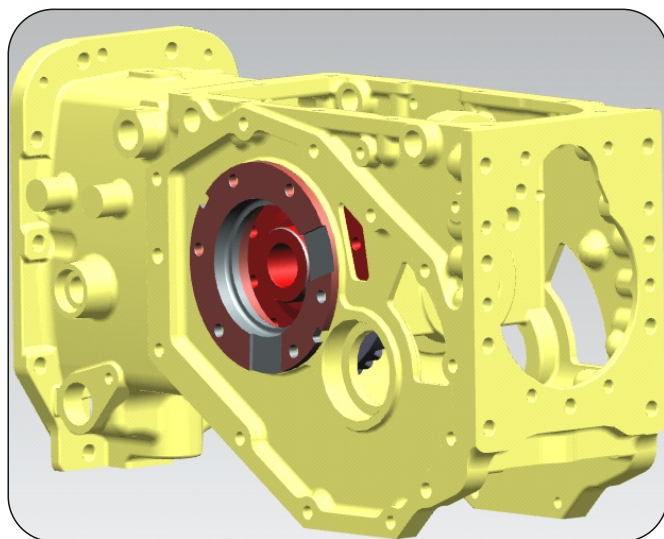
36. Apply loctite 515 in rubber boot
Assemble the rubber boot in HSG RH

Centre Housing Assembly

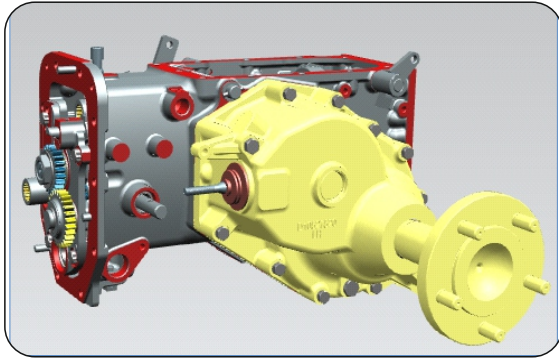


37. Assemble retainer sub assembly RH on CH
housing with bolts & washers.

NOTE : Run-out of the crown face with diffcase
MAX. 0.1MM

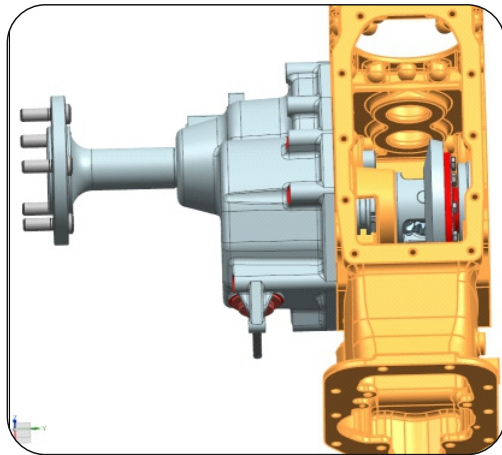


38. Assemble the differential case assembly in CH housing
Assemble retainer differential LH subassembly CH
housing & tighten bolts & washer.



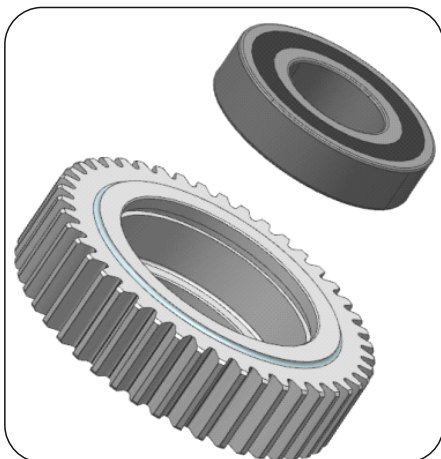
39. Assemble the rear axle housing lh, along with shim, on ch housing by applying loctie 5188 on CH housing face.

- Tight the ch housing with bolts m10 (11 nos.) and washer m10 (11 nos.)
- Tight the drain plug along with washer on rear axle housing rh

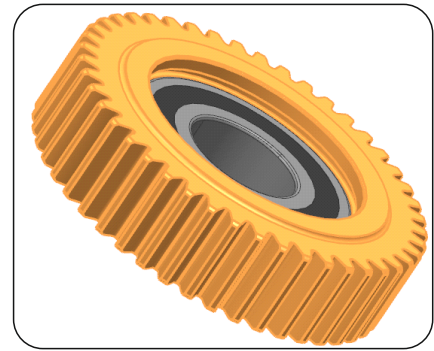


40. Assemble the rear axle housing rh along with shim, on ch housing and difflock sleeve & by applying loctie 5188 on CH housing face.
Tight the ch housing with bolt m10 (11 nos) and washer m10 (11 nos)

PTO Assembly



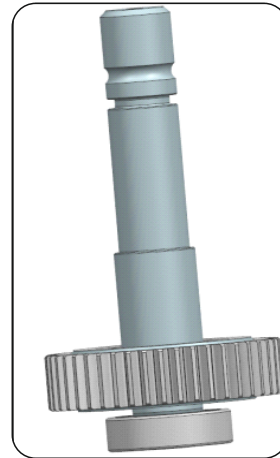
41. Place the gear driven (Z- 49/ Z-51) on fixture. Put the bearing on ram



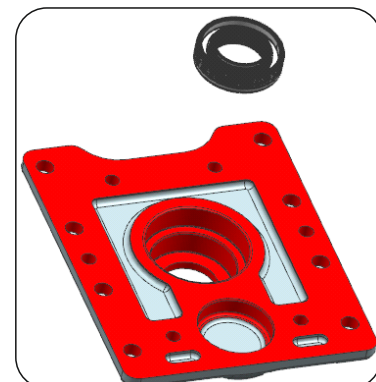
42. Press it to the gear
Put a circlip to lock it



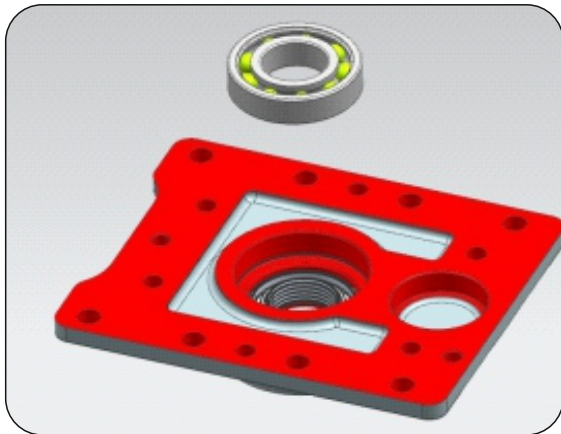
43. Assemble gear driven assembly Z-51 on PTO output shaft & lock with ciclip.



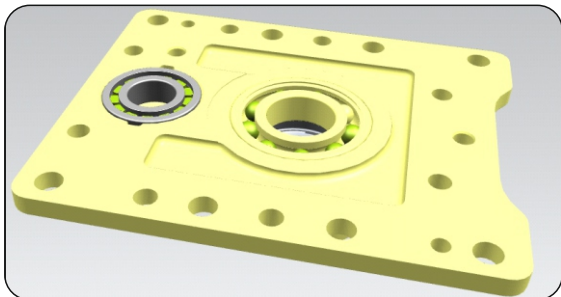
44. Assemble bearing 6305 on PTO output shaft as shown.



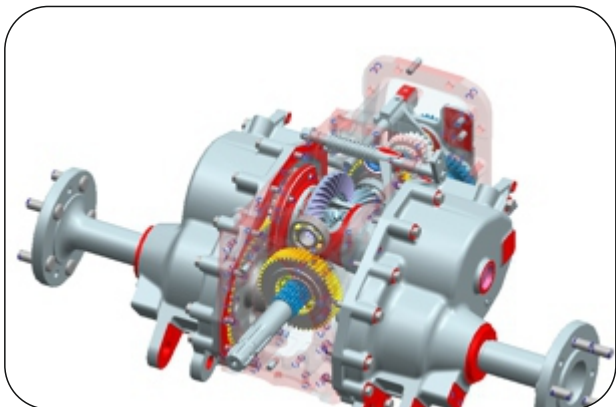
45. Assemble seal in PTO retainer as shown.



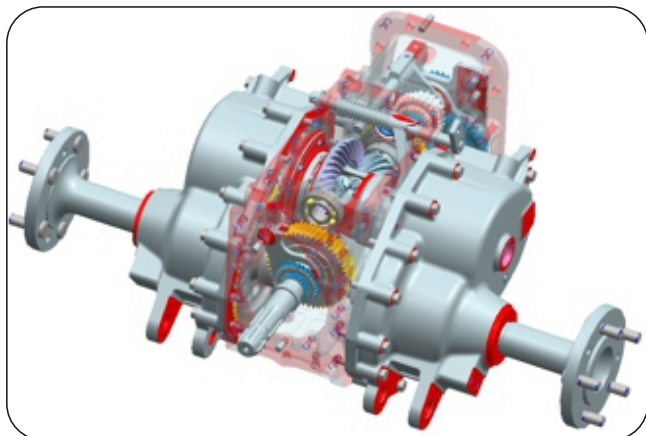
46. Press bearing 6207 in PTO retainer plate.



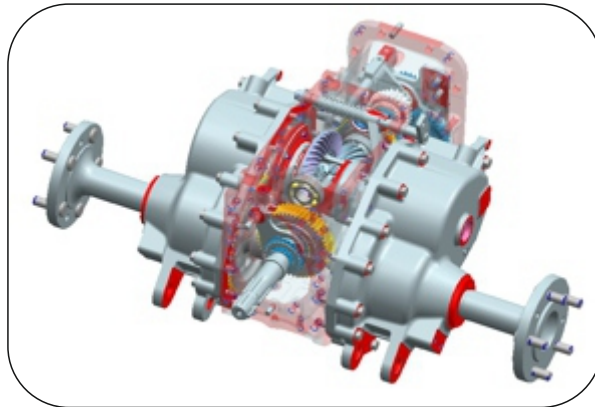
47. Press bearing NJ205 in PTO retainer plate



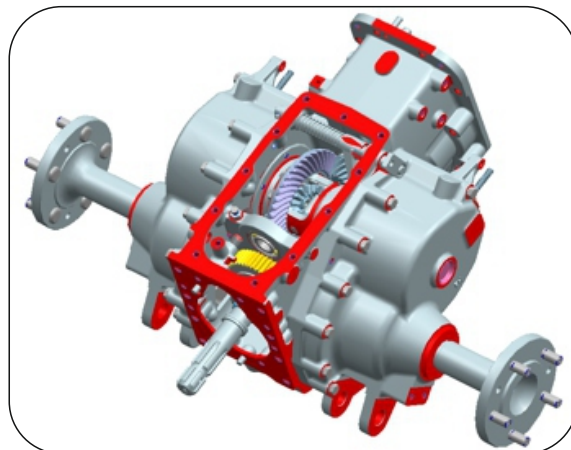
48. Assemble the PTO output shaft sub. Assembly with ch housing (bottom bar)



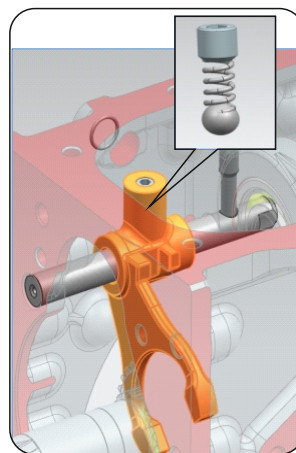
49. Insert sleeve & fork pto shifting on pto shaft output



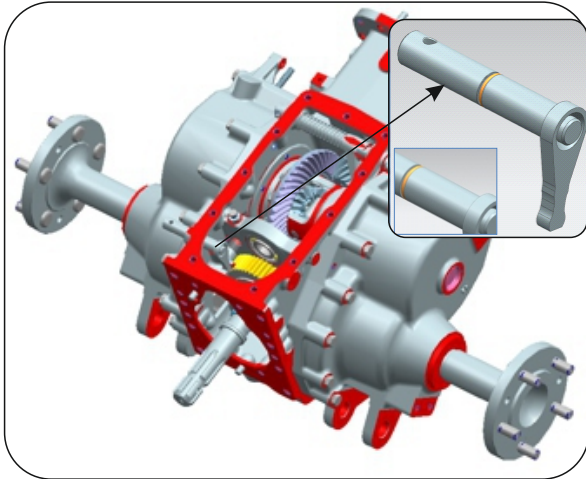
50. Insert rail PTO shifting from rear side of ch housing, passing through fork PTO shifting and assemble in CH housing front PTO wall.
Lock the rail PTO shifting in ch housing with nut (m10) and screw PTO rail lock. Tight nut and screw.



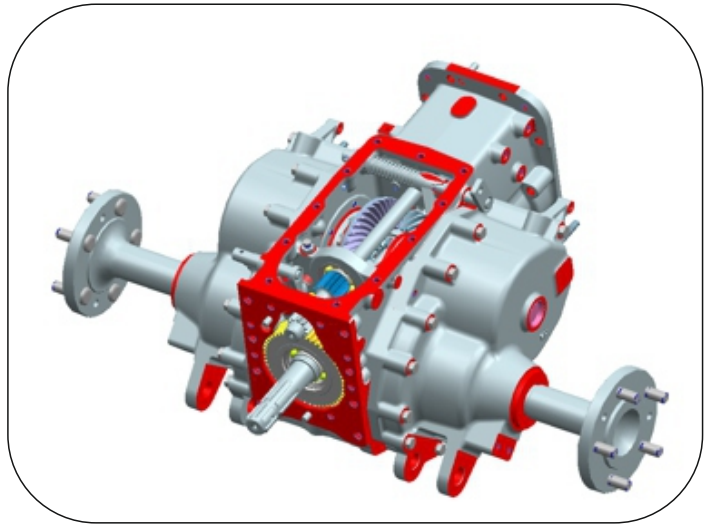
51. Tight the grub screw M10 in fork to flush up to the top face of fork.



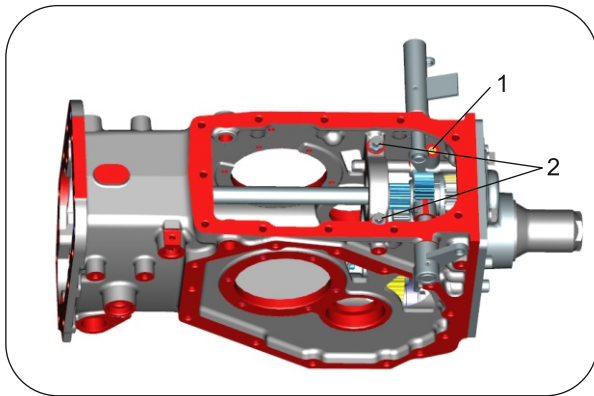
52. Assemble ball & spring in PTO fork
And apply grease before assembly.



53. Put O-ring on PTO shifting lever groove
Pull the lever in ch housing and engaged with fork PTO shifting.

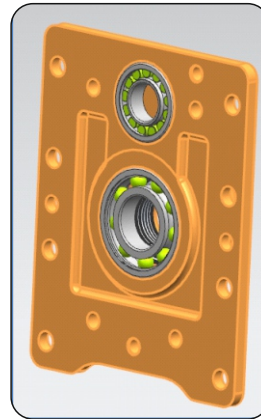


55. Assemble shaft input TO (Z 13/11) in center housing top bore from rear side.

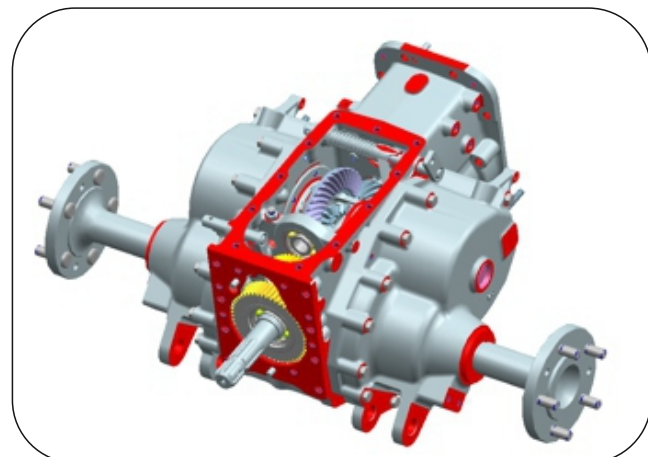


NOTE : Ensure proper flushing of dowel with lever od.
(Outer diameter)

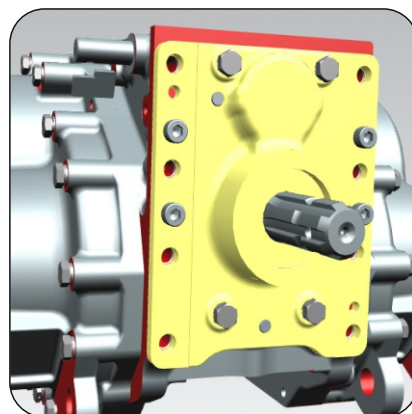
Tight the grub screw (2) m10 in fork to flush up to the top face of fork
Flush the grub screw upto top face with one gram of grease.



56. Apply loctie 5188 on cover PTO.



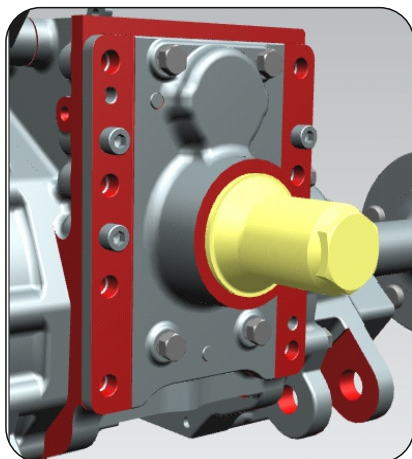
54. Assemble gear PTO (Z-51) on PTO output shaft.



57. Assemble PTO & retainer plate with 4 nos. Allen bolt & 4 No. Hex head bolts.

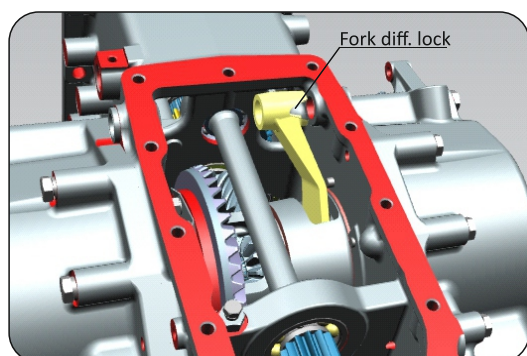
NOTE : Check the PTO shaft smooth rotation or smooth rotation of PTO shaft to be checked.

Press the dowel (2 nos) from the rear side of ch housing for pto retainer, 12mm out

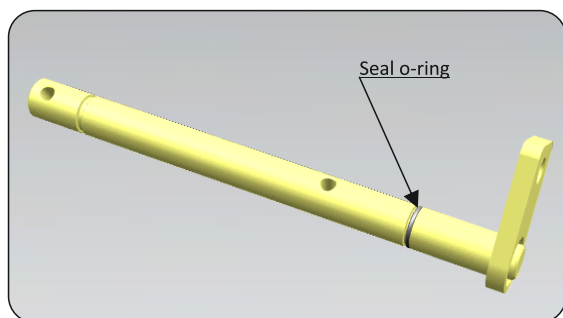


58. Put pto cover on output shaft

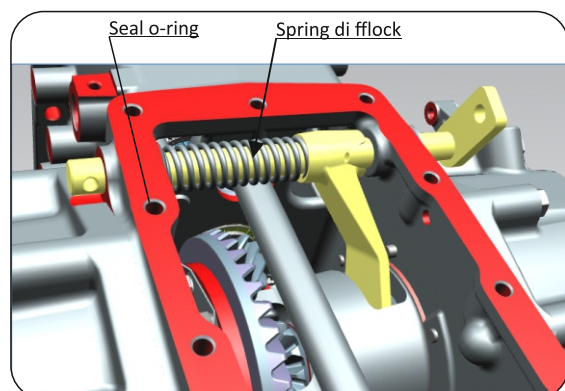
Differential lock assembly



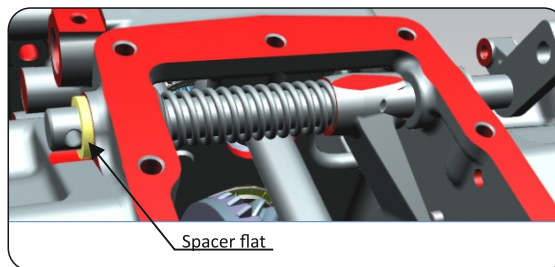
59. Place the fork diff. lock on slave diff. Lock



60. Assemble o-ring on shaft diff lock (ver side)

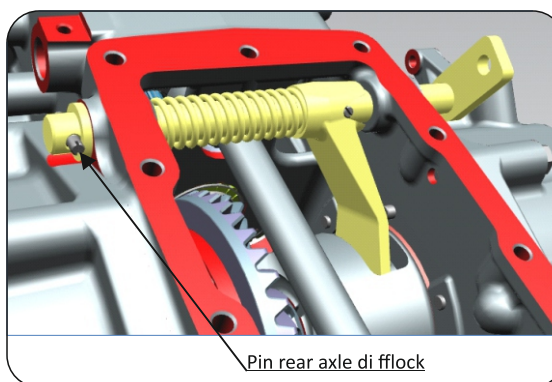


61. Insert the shaft assembly diff. lock ich
HOUSING AND PASS THROUGH FORK DIFF. LOCK



62. Put o-ring with oil on leading end of diff. lock shaft
over Insert spring between ch housing and fork diff.
lock Push the shaft diff. lock completely to other end
of ch housing (passing through)

Place the spacer flat on di fflock shahaft (out side CH
housing lhs)



63. Lock the position of shaft and spacer with
pin diff lock on outer side.
Push the fork diff. lock towards LHS.
Tight the pin rear axle diff. lock and release the fork.

Rear Axle Dis-assembly

- Take out Roller pin.
- Open Pinion shaft nut using 36 no. socket.
- Remove washer and gear.
- Remove circlip and washer from both side of the gear.

NOTE: Rounded teeth of gear should be outside and flat toward inside.

Range Driver Shaft

- NJ 204 bearing in rear side and NJ 205 bearing in forward side.
- Cut part of the rail should be always down.

Trumpet Housing

- Open with 11 bolts with 16 no. socket.
- Use two jumping bolt to open housing.
- Remove the crimp.
- Use 46 no. socket to remove main nut of trumpet housing.
- Hit on axle shaft bring out bearing washer, bull gear and spacer.

Differential Lock Lever

- Remove Screw bolt one from opposite side and one from inside and washer also.
- Spring and fork will come out.
- Coupler is only in right hand side.

Rear Braking Housing

- Open 4 bolts to open brake assy. completely.
- wheel side two plates rest outside.

PTO Retainer Plate

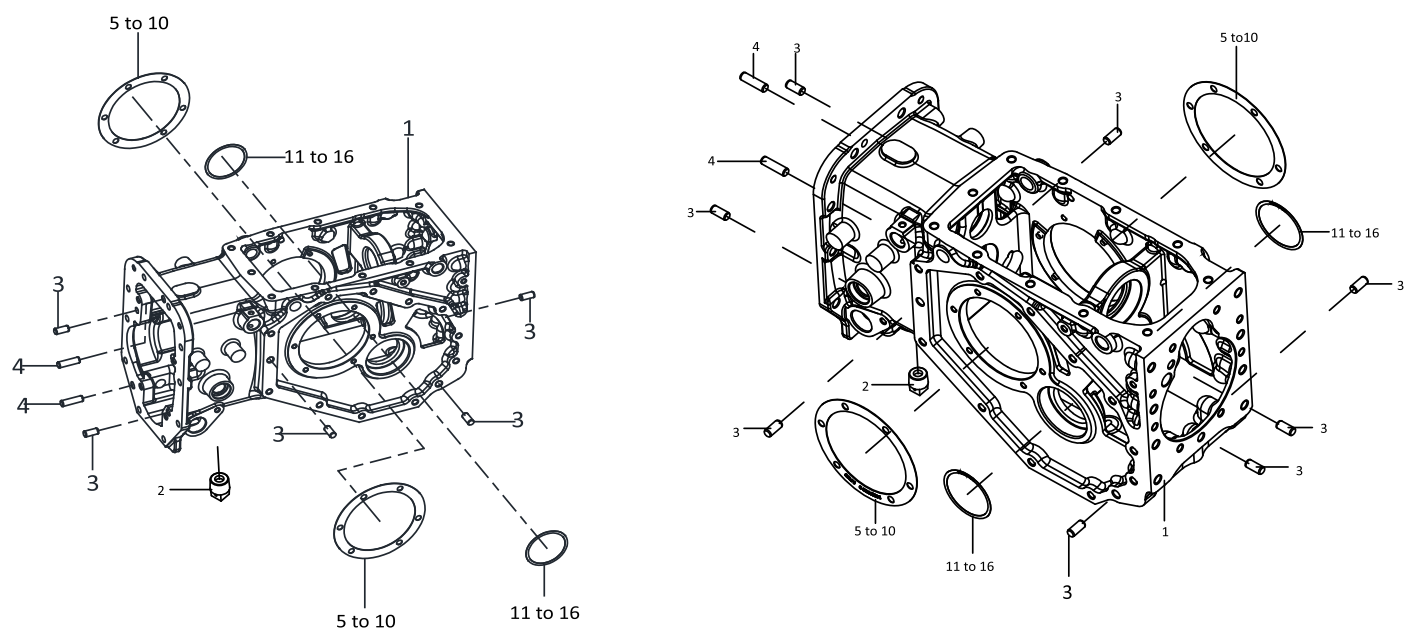
- Open 8 bolts(4 hexa type & 4 Allen key) and washer to open retainer plate.
- Two jumping bolt to open PTO retainer.
- PTO shaft will come out.
- NJ205, NJ605 and Nj6305 bearing in PTO retainer assembly.
- Z51 centre mark gear.
- Z49 have no marks.
- Remove the rail nuts.
- Remove spring roller pin to remove fork.
- Remove the screw, spring to remove fork.
- Z49 gear both side circle
-

Differential Case Retainer

- Open 6 bolts of differential retainer case with 13 no. of socket.

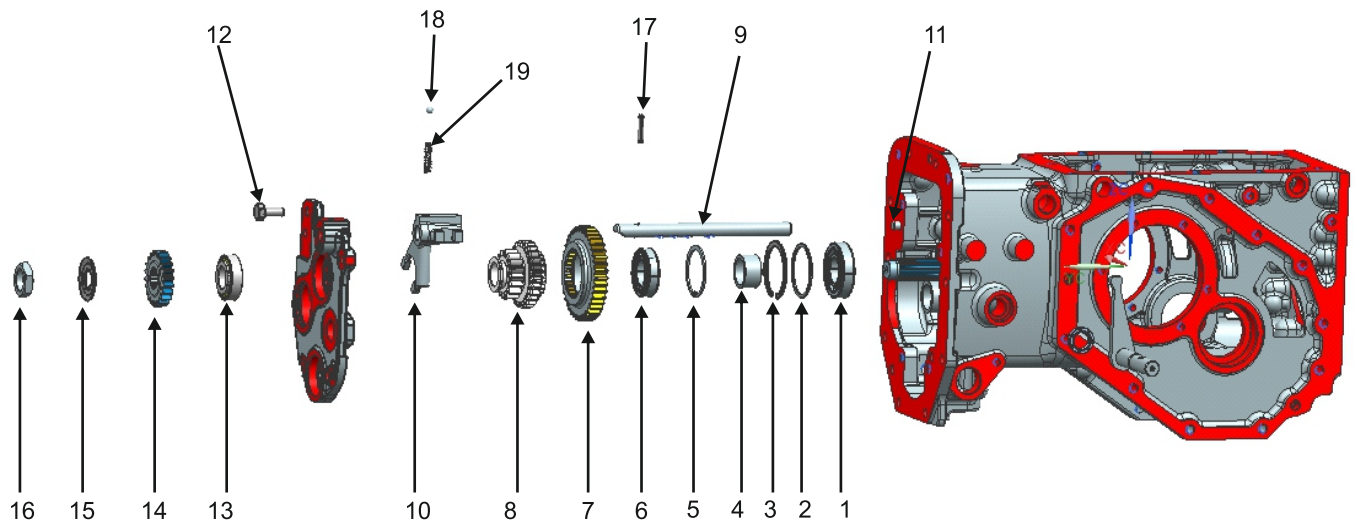
Pinion Shaft

- To remove shaft 1st remove circlip.
- Spacer and clip comes out.



Housing Rear Axle Centre Subassembly

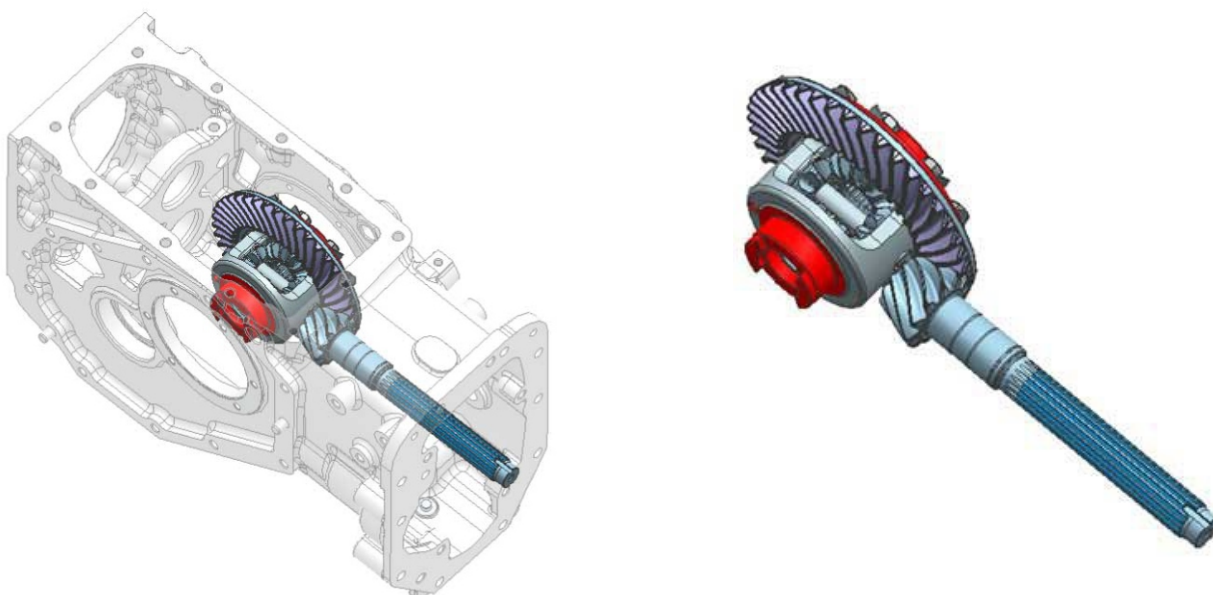
Fig. No.	Description	Qty
1	HOUSING REAR COMPACT 9+3	1
2	PLUG DRAIN 3/4-14 NPTF (MAGNETIC)	1
3	PIN 10X22 PLAIN DOWEL	8
4	PIN 10X35 PLAIN DOWEL	2
5	SHIM RETAINER DIFFERENTIAL (0.075 MM)	AR
6	SHIM RETAINER DIFFERENTIAL (0.125 MM)	AR
7	SHIM RETAINER DIFFERENTIAL (0.2285 MM)	AR
8	SHIM RETAINER DIFFERENTIAL (0.4065 MM)	AR
9	SHIM RETAINER DIFFERENTIAL (0.5335 MM)	AR
10	SHIM RETAINER DIFFERENTIAL (0.7875 MM)	AR
11	SHIM REAR AXLE SHAFT (0.075 MM)	AR
12	SHIM REAR AXLE SHAFT (0.125 MM)	AR
13	SHIM REAR AXLE SHAFT (0.2285 MM)	AR
14	SHIM REAR AXLE SHAFT (0.4065 MM)	AR
15	SHIM REAR AXLE SHAFT (0.5335 MM)	AR
16	SHIM REAR AXLE SHAFT (0.7875 MM)	AR



Centre Housing Driven Shaft

1. Bearing taper roller bearing 30206
2. Spacer graded pinion shaft
3. Circlip
4. Spacer tail pinion
5. Circlip
6. Bearing ball 6006
7. Gear driven low range Z41
8. Gear driven high medium range
9. Rail range shifting
10. Fork range shifting

11. 10.22 plain dowel
12. Bolt
13. Taper roller bearing 30205
14. Gear driver 4WD
15. Washer tablock
16. Nut M24
17. Pin 10x22 plain dowel
18. Ball
19. Spring



Gear And Differential Rear Axle Subassembly

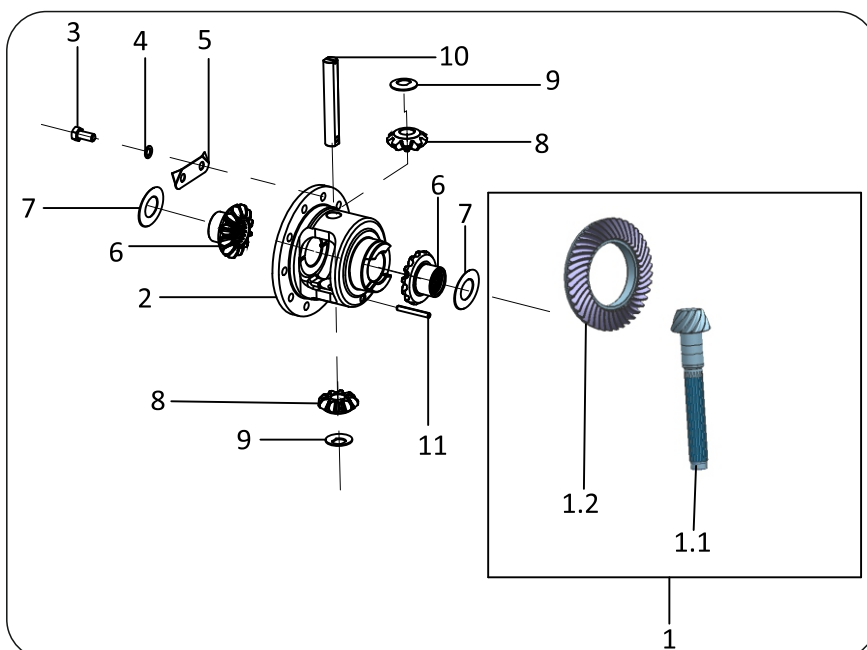
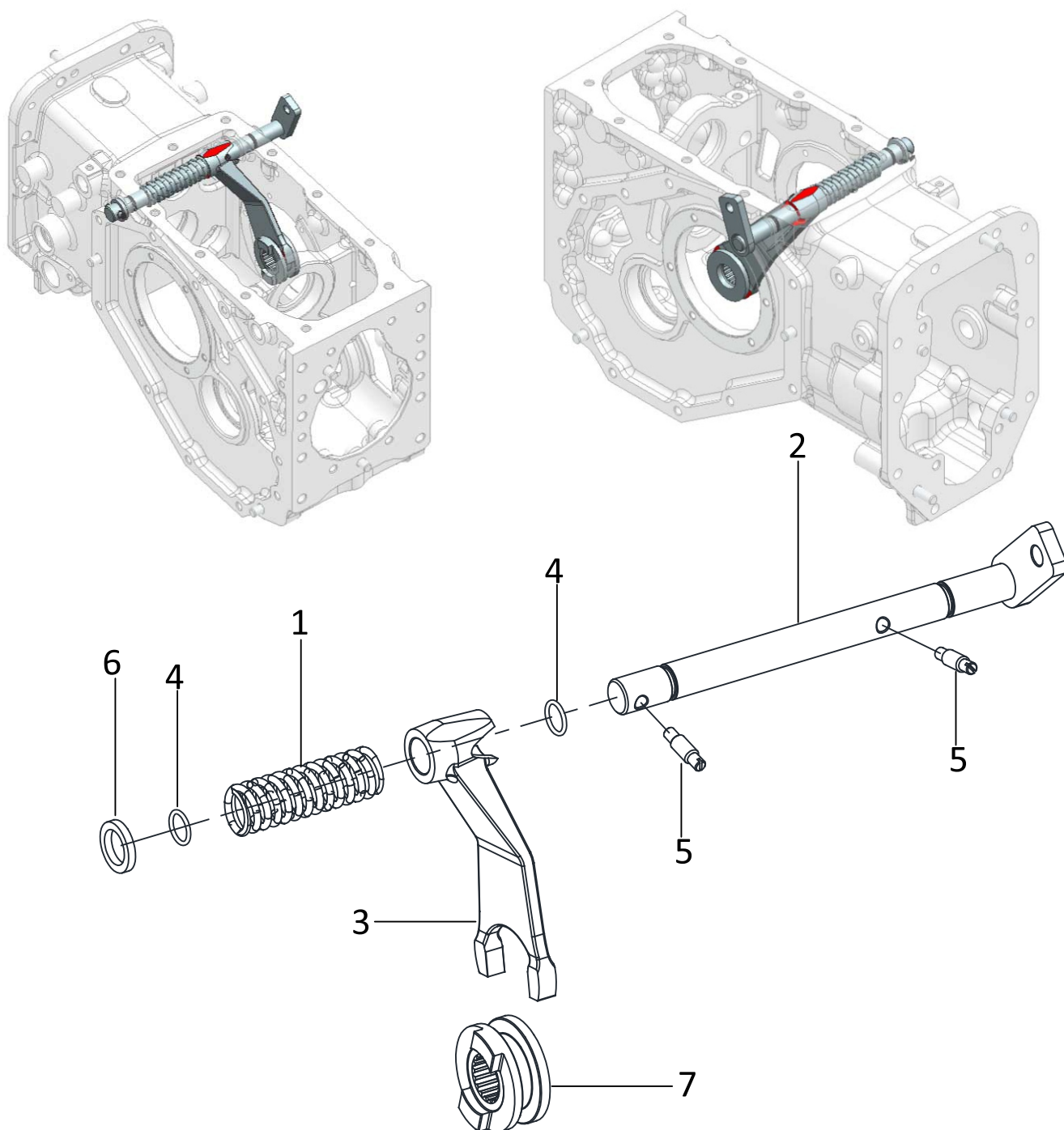
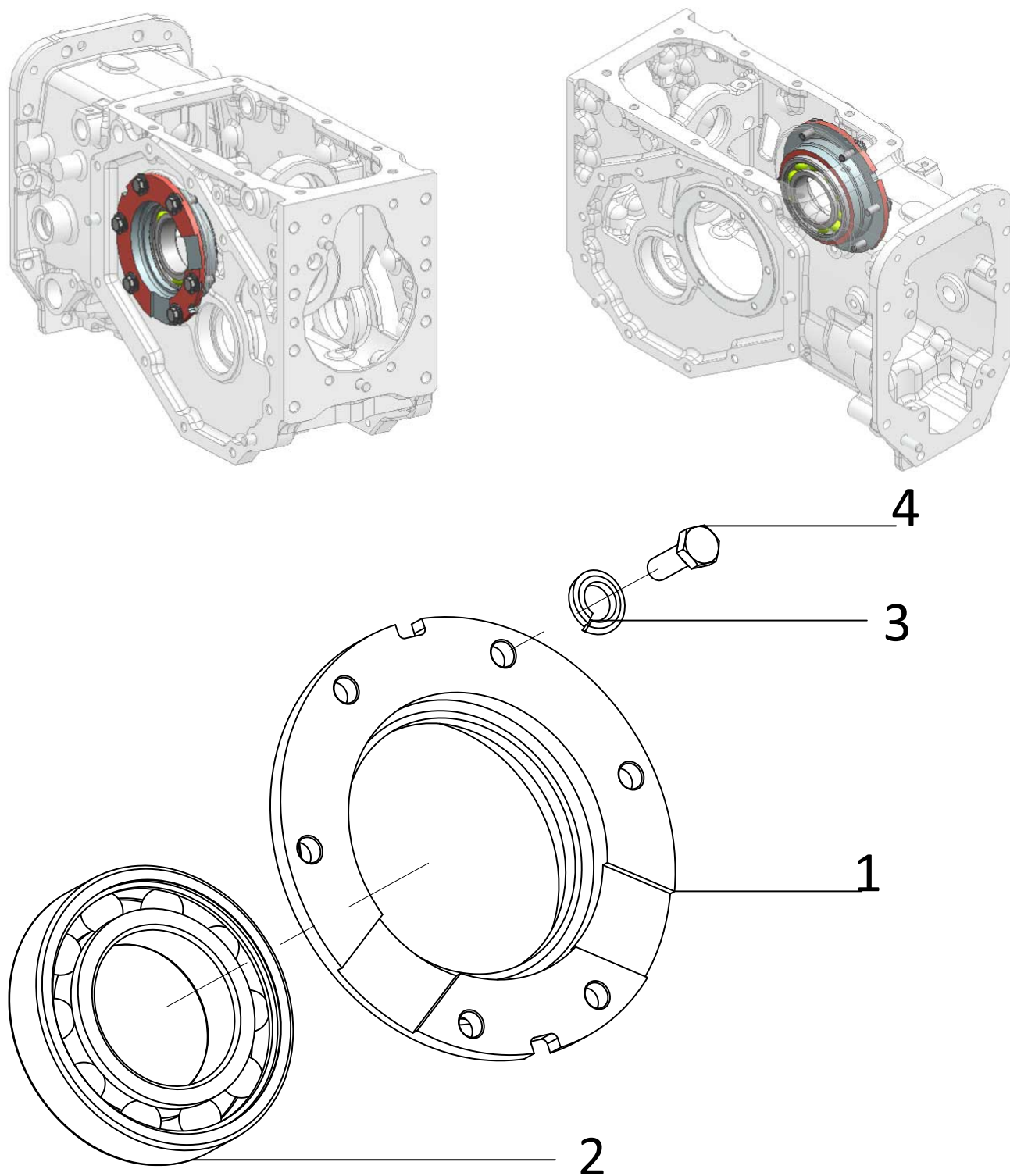


Fig. No.	Description	Qty
1	GEAR SET BEVEL PINION AND CROWN WHEEL REAR AXLE Z-41/11	1
1.1	SHAFT BEVEL PINION REAR AXLE DIFFERENTIAL Z-11	1
1.2	GEAR DRIVEN REAR AXLE DIFFERENTIAL Z-41	1
2	CASING DIFFERENTIAL REAR AXLE	1
3	SCREW M8X1.25X18-10.9 HEX HEAD	10
4	WASHER 8.1X13X1.0 FLAT	10
5	WASHER LOCK DIFFERENTIAL CROWN WHEEL GEAR	5
6	BEVEL SIDE GEAR DIFFERENTIAL Z-13	2
7	WASHER REAR AXLE DIFFERENTIAL THRUST	2
8	PINION GEAR DIFFERENTIAL Z-9	2
9	WASHER REAR AXLE DIFFERENTIAL PINION	2
10	SPIDER REAR AXLE DIFFERENTIAL	1
11	PIN 5X40 SPRING DOWEL	1
12	GREASE	AR



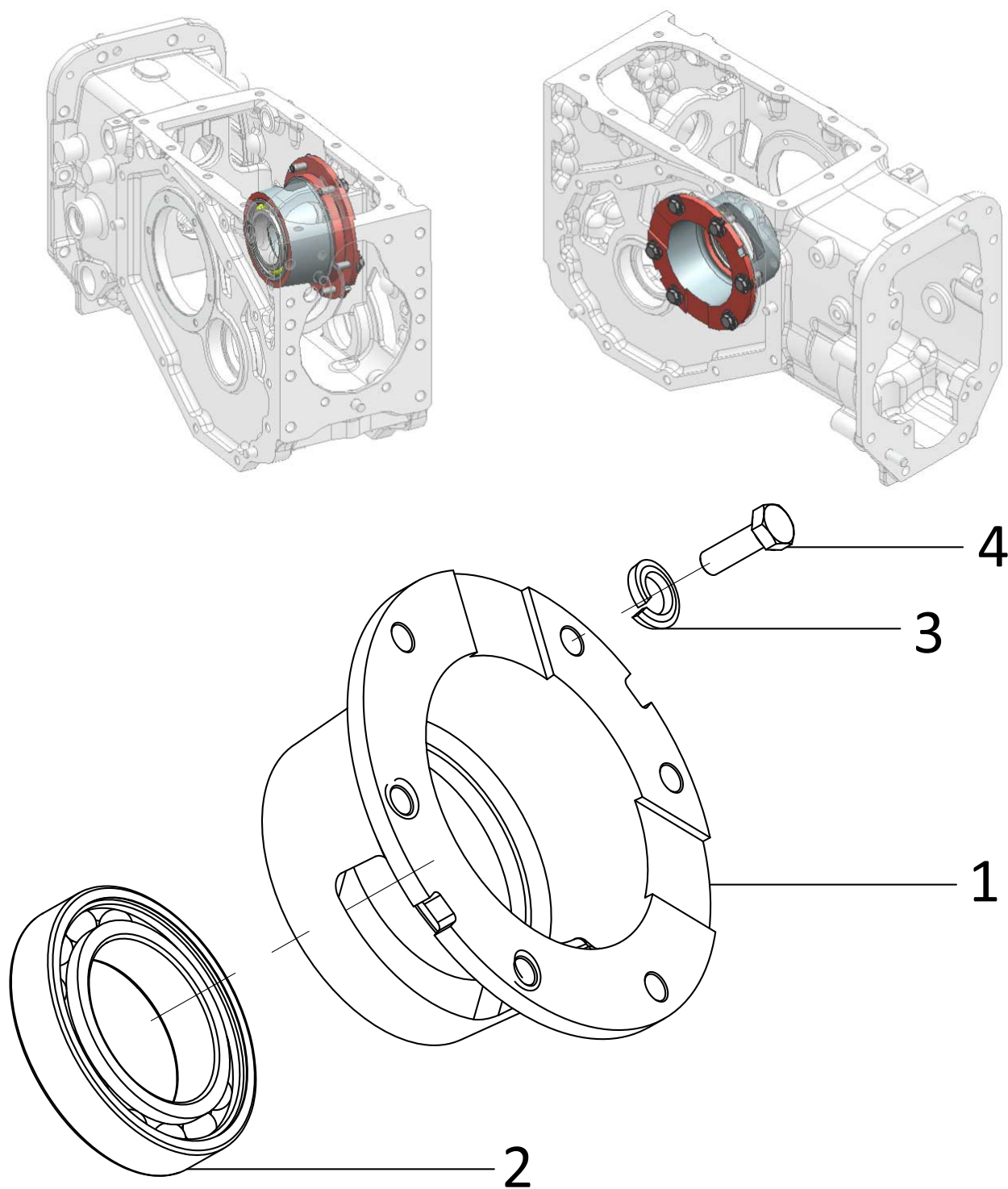
Differential Lock Subassembly

Fig. No.	Description	Qty
1	SPRING REAR AXLE DIFFERENTIAL LOCK	1
2	SHAFT AND LEVER ASSEMBLY REAR AXLE DIFFERENTIAL LOCK	1
3	FORK DIFFERENTIAL LOCK	1
4	SEAL O RING 2.00X14.00	2
5	PIN REAR AXLE DIFFERENTIAL LOCK SHAFT	2
6	SPACER 18X26X4.0 FLAT	1
7	SLEEVE REAR AXLE DIFFERENTIAL LOCK	1



Retainer Bearing Differential Subassembly LH

Fig. No.	Description	Qty
1	RETAINER BEARING DIFFERENTIAL LH	1
2	BALL BEARING 6211 CN	1
3	WASHER M8 SPRING LOCK	6
4	SCREW M8X1.25X25-8.8 HEX HEAD	6



Retainer Bearing Differential Subassembly RH

Fig. No.	Description	Qty
1	RETAINER BEARING DIFFERENTIAL RH	1
2	BEARING BALL 6011	1
3	WASHER M8 SPRING LOCK	6
4	SCREW M8X1.25X25-8.8 HEX HEAD	6

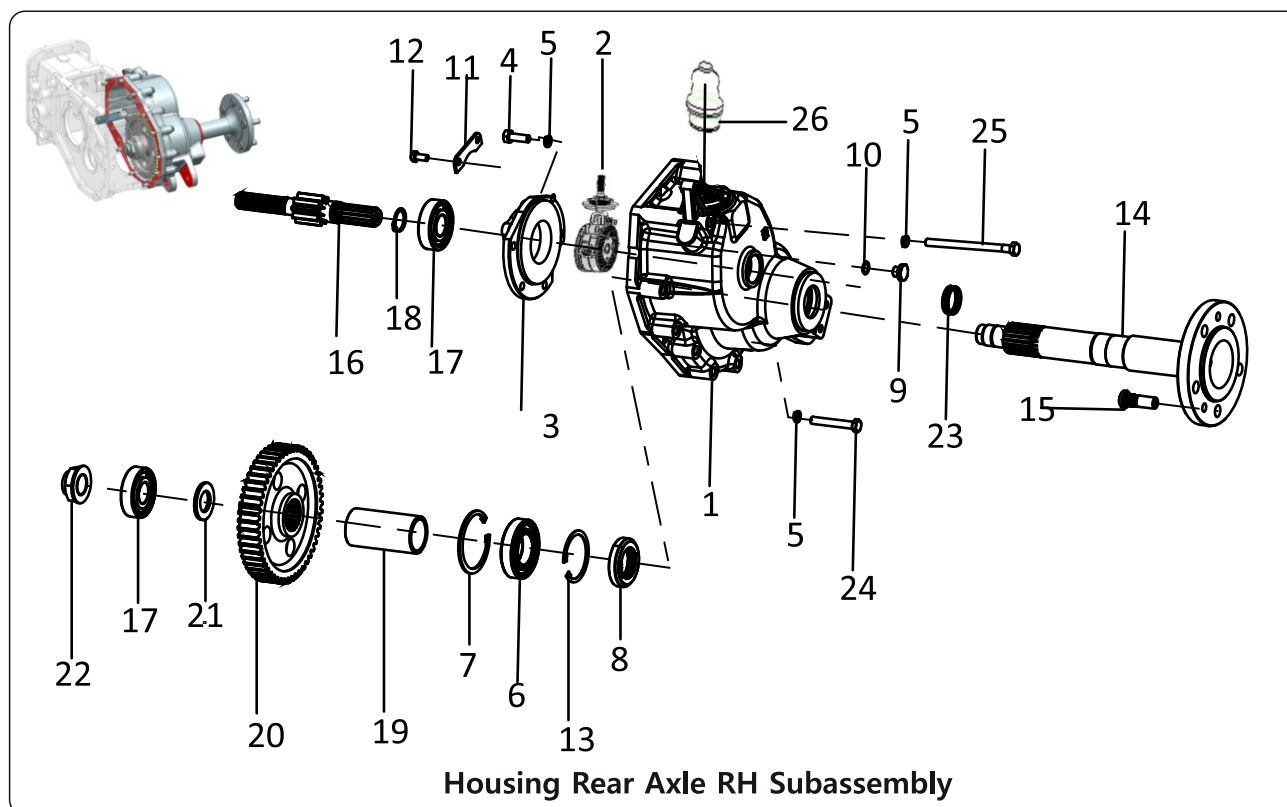
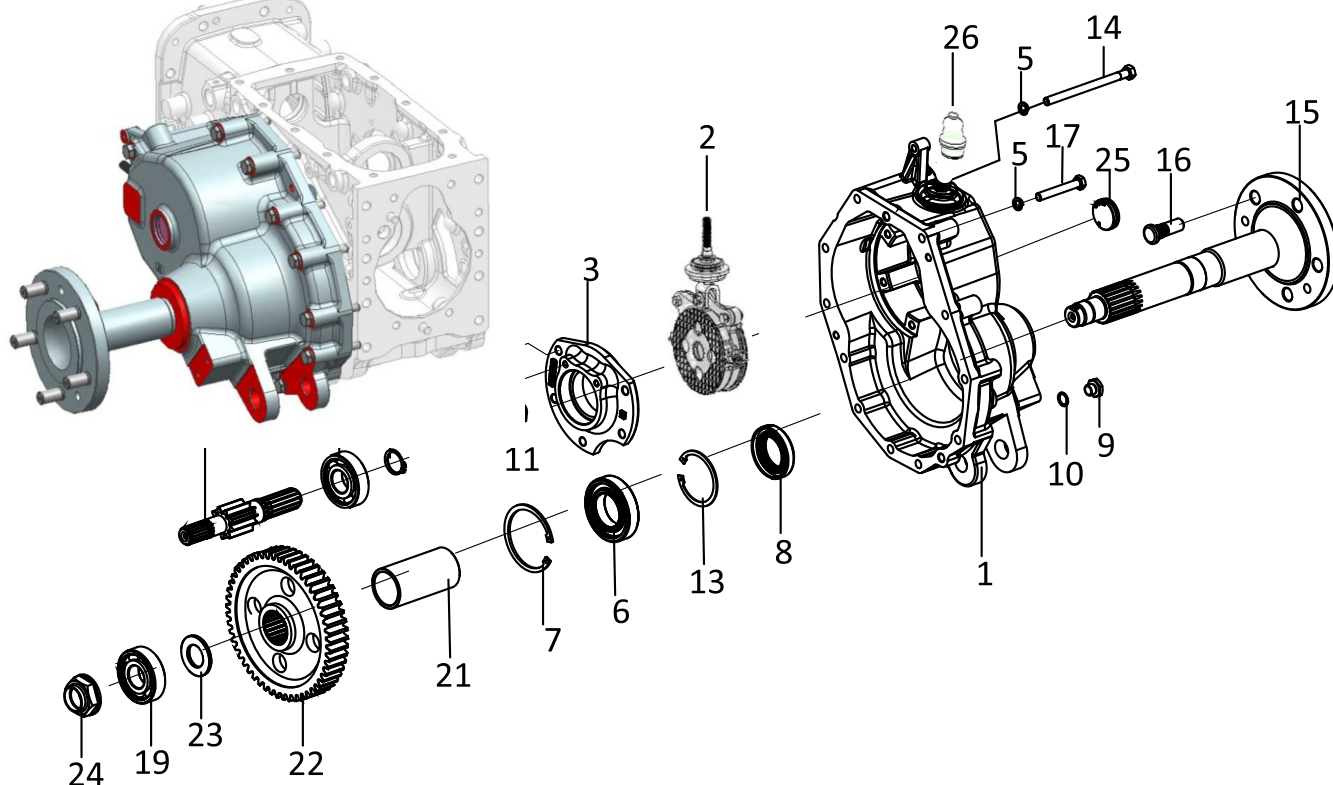


Fig. No.	Description	Qty
1	HOUSING REAR AXLE RH	1
2	BRAKE ASSEMBLY REAR WHEEL 4.5" (WET TYPE)	1
3	HOUSING BRAKE INNER RH	1
4	BOLT M10X1.50X30-10.9 HEX HEAD (16 A/F)	5
5	WASHER M10 SPRING LOCK	16
6	BEARING BALL 6209 CN	1
7	CIRCLIP B85X2.5 N	1
8	SEAL OIL 45X70X14.0	1
9	PLUG DRAIN M14X1.5X10	2
10	WASHER BONDED SEAL 14.7X22.0X1.5	2
11	WASHER LOCK BULL PINION SHAFT BEARING	1
12	SCREW M8X1.25X18-10.9 HEX HEAD	2
13	CIRCLIP B70X1.5 N	1
14	SHAFT AXLE REAR	1
15	BOLT M16X1.5X48-10.9 REAR WHEEL	5
16	SHAFT BULL PINION RH (Z-9)	1
17	BEARING BALL 6306	2
18	CIRCLIP A30.0X2.0 H	1
19	SPACER BULL GEAR LOCKING	1
20	GEAR DRIVEN FINAL DRIVE REDUCTION (Z-53)	1
21	SPACER AXLE SHAFT INNER	1
22	NUT CRIMPING M30X1.5	1
23	PLUG AXLE HOUSING REAR	1
24	BOLT M10X1.50X70-10.9 HEX HEAD	10
25	BOLT M10X1.50X143-10.9 HEX HEAD (16 A/F)	1
26	BOOT EXTERNAL REAR WHEEL BRAKE LINKAGE (DIA 50)	1
27	SEALANT LIQUID ANAEROBIC (HIGHER STRENGTH)	AR
28	GREASE	AR

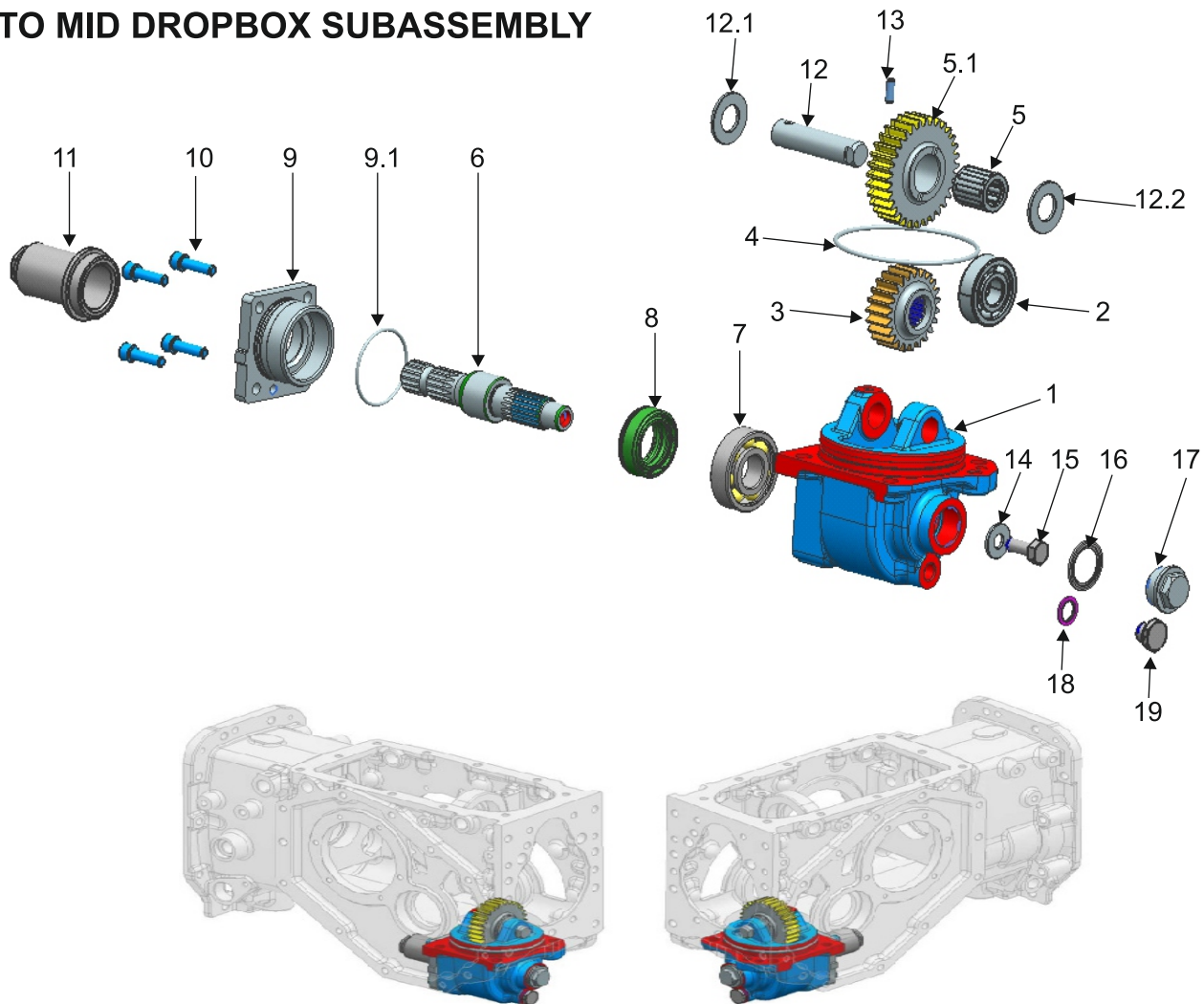


Housing Rear Axle LH Subassembly

Fig. No.	Description	Qty
1	HOUSING REAR AXLE LH	1
2	BRAKE ASSEMBLY REAR WHEEL 4.5" (WET TYPE)	1
3	HOUSING BRAKE INNER LH	1
4	BOLT M10X1.50X30-10.9 HEX HEAD (16 A/F)	5
5	WASHER M10 SPRING LOCK	16
6	BEARING BALL 6209 CN	1
7	CIRCLIP B85X2.5 N	1
8	SEAL OIL 45X70X14.0	1
9	PLUG DRAIN M14X1.5X10	2
10	WASHER BONDED SEAL 14.7X22.0X1.5	2
11	WASHER LOCK BULL PINION SHAFT BEARING	1
12	SCREW M8X1.25X18-10.9 HEX HEAD	2
13	CIRCLIP B70X1.5 N	1
14	BOLT M10X1.50X143-10.9 HEX HEAD (16 A/F)	1
15	SHAFT AXLE REAR	1
16	BOLT M16X1.5X48-10.9 REAR WHEEL	5
17	BOLT M10X1.50X70-10.9 HEX HEAD	10
18	SHAFT BULL PINION LH (Z-9)	1
19	BEARING BALL 6306	2
20	CIRCLIP A30.0X2.0 H	1
21	SPACER BULL GEAR LOCKING	1
22	GEAR DRIVEN FINAL DRIVE REDUCTION (Z-53)	1
23	SPACER AXLE SHAFT INNER	1
24	NUT CRIMPING M30X1.5	1
25	PLUG AXLE HOUSING REAR	1
26	BOOT EXTERNAL REAR WHEEL BRAKE LINKAGE (DIA 50)	1
27	SEALANT LIQUID ANAEROBIC (HIGHER STRENGTH)	AR
28	GREASE	

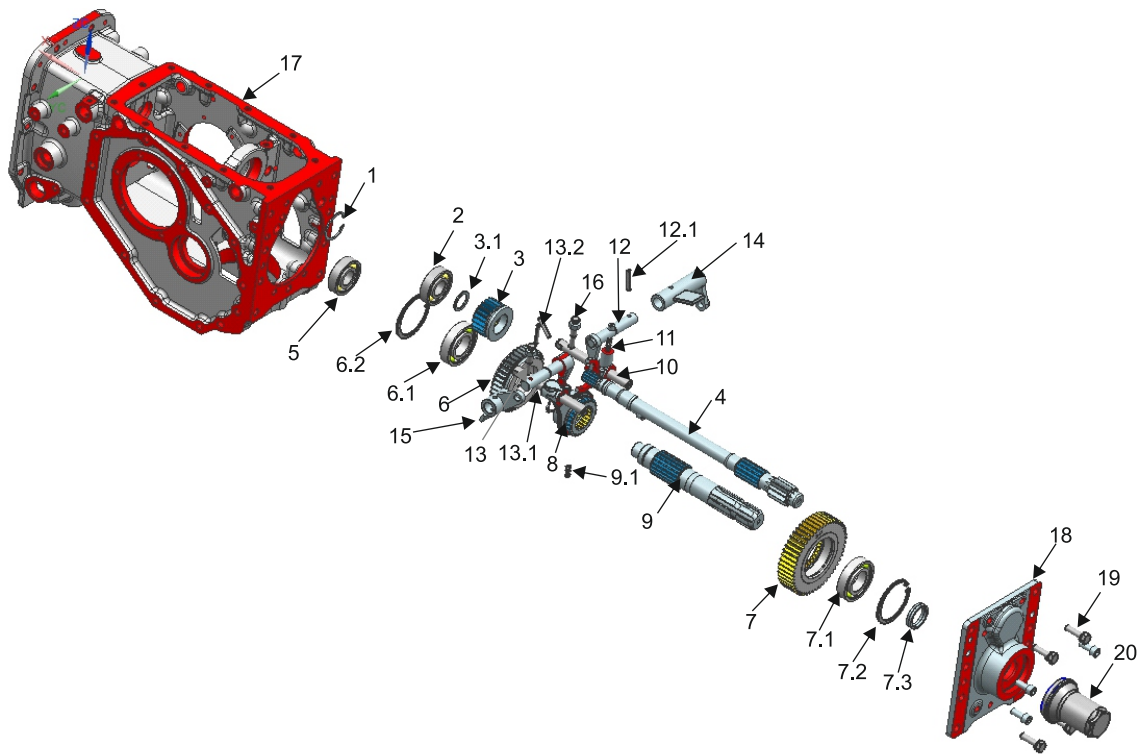
Service manual

PTO MID DROPBOX SUBASSEMBLY



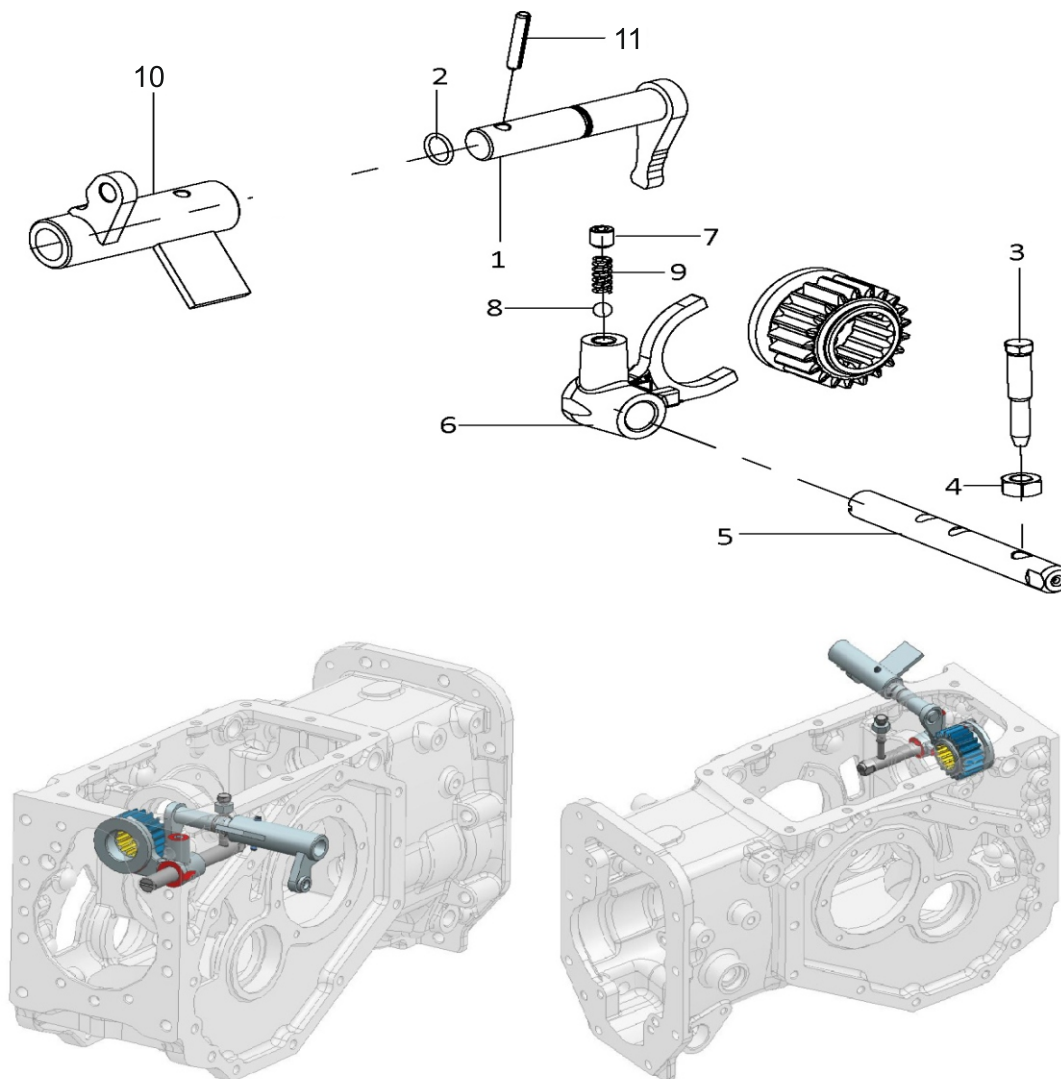
S.No.	DESCRIPTION
1.	HOUSING DROP BOX MID PTO
2.	BEARING BALL 6304
3.	GEAR MID PTO DRIVEN
4.	SEAL O RING 3.53 X 104.37
5.	CAGE NEEDLE ROLLER BEARING
5.1	GEAR MID PTO
6.	SHAFT MID PTO OUTPUT
7.	BEARING BALL 6305
8.	SEAL OIL 35x60x14.5 PTO OUTPUT SHAFT
9.	RETAINER SEAL MID PTO
9.1	SEAL OIL 35x60x14.5 PTO OUTPUT SHAFT
10.	SCREW M8x1.25x30 ALLEN (25-32 NM)
11.	Mid PTO CAP
12.	SHAFT GEAR MID PTO
12.1, 12.2	SPACER GEAR MID PTO
13.	PIN 6.0x18.0 SPRING DOWEL
14.	WASHER 11x27x3.0
15.	BOLT M10x1.50x25 - 10.9 HEX HEAD (55-65 NM)
16.	WASHER SEALING M30
17.	PLUG M30x1.50x12 WELCH (79-85 NM)
18.	WASHER BONDED SEAL 14.7x22.0x1.5
19.	PLUG DRAIN M14x1.5x10 (25-32 NM)

GEAR AND SHAFT PTO SUBASSEMBLY



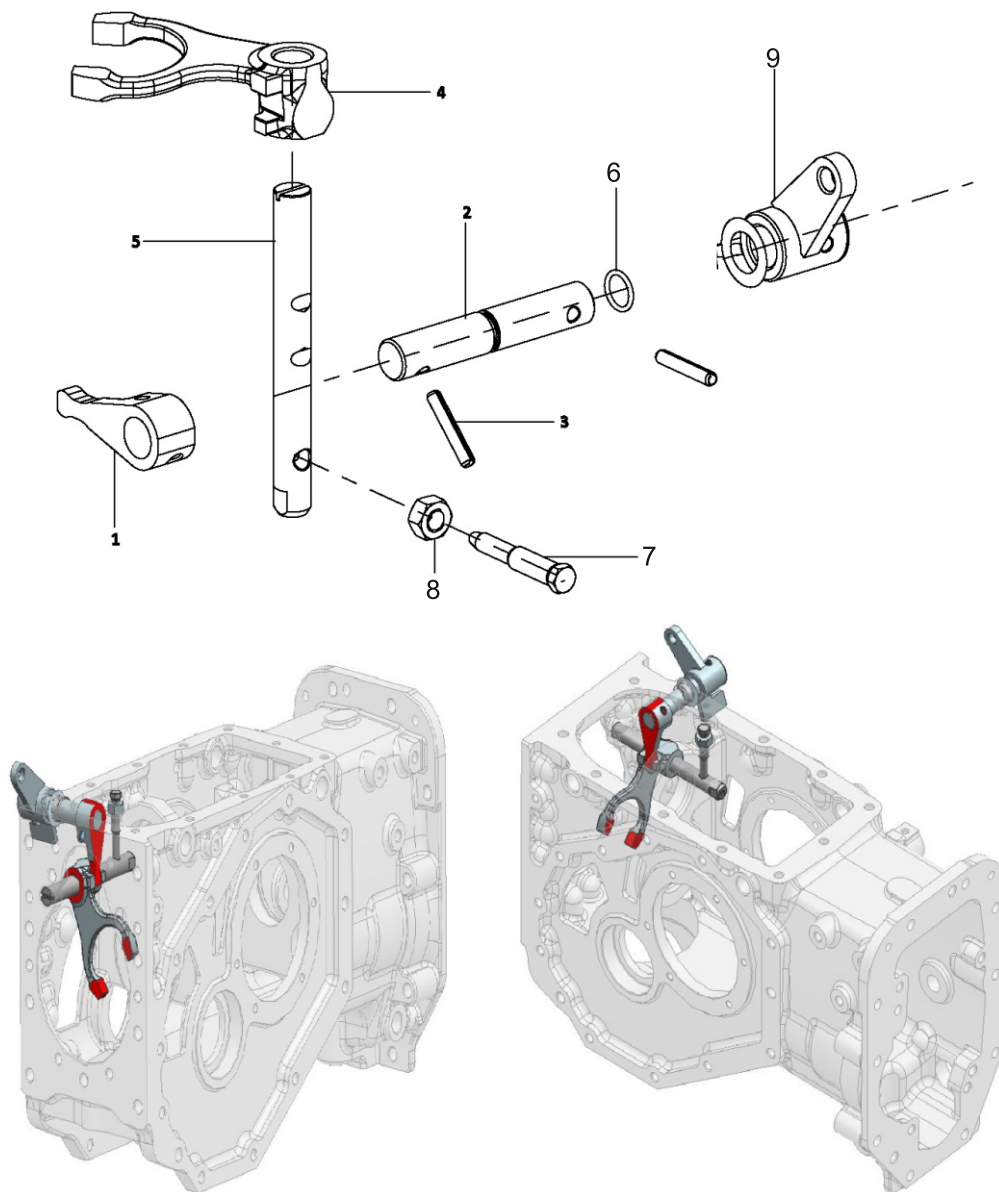
S.No.	DESCRIPTION
1.	CIRCLIP
2.	BEARING BALL 6305
3.	HUB,
3.1	WASHER
4.	PTO INPUT SHAFT
5.	BEARING 6305
6.	GEAR MID PTO OUTPUT
6.1.	BEARING PTO COUNTER SHAFT
6.2	CIRCLIP
7.	GEAR MID PTO IDLER,
7.1	BEARNG PTO SHAFT COUNTER
7.2	CIRCLIP
7.3	OIL SEAL
8.	SLEEVE PTO SHIFTING
9.	PTO OUTPUT SHAFT
9.1	BALL & SPRING
10.	RAIL GEAR SHIFTING
11.	SHIFTER CONNECTOR
12.	SHAFT GEAR MID PTO
12.1.	DOWEL
13.	LEVER
13.1.	FORK
13.2.	DOWEL
14.	CONNECTOR SHIFTER RH
15.	CONNECTOR SHIFTER LH
16.	SPRING, BALL, SCREW
17.	CENTRE HOUSING REAR AXLE
18.	PTO PLATE
19.	SCREW & BOLT
20.	COVER PTO OUTPUT SHAFT

PTO MID SHIFTING SUBASSEMBLY



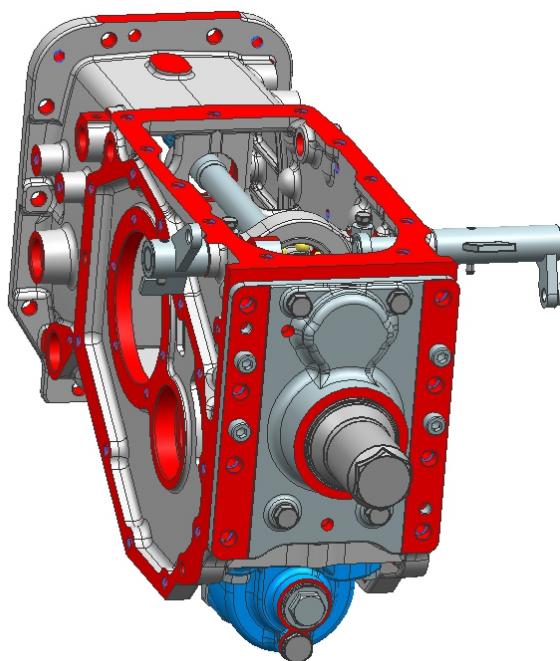
S.No.	DESCRIPTION
1	LEVER PTO SHIFTING
2	SEAL O RING 2.00X14.00
3	SCREW PTO RAIL LOCK
4	NUT M10X1.50-8 HEX
5	RAIL MID PTO SHIFTER
6	FORK MID PTO SHIFTER
7	SCREW GRUB M10X1.5X10 - 45H
8	BALL 5/16" SNAP LOCK
9	SPRING PTO SHIFTING
10	LEVER AND HUB ASSEMBLY GEAR SHIFTING TRANSMISSION (MID PTO)
11	PIN 6.0X35 SPRING DOWEL COMBINATION TYPE
12	GREASE

PTO REAR SHIFTING SUBASSEMBLY



S.No.	DESCRIPTION
1	LEVER REAR PTO COMPACT
2	SHAFT REAR PTO LEVER COMPACT
3	PIN 6.0X35 SPRING DOWEL COMBINATION TYPE
4	FORK REAR PTO SHIFTER
5	RAIL MID POT SHIFTER
6	SEAL O RING 2.00X14.00
7	SCREW PTO RAIL LOCK
8	NUT M10X1.50-8 HEX
9	LEVER AND HUB ASSEMBLY GEAR SHIFTING TRANSMISSION (PTO)

ORIENTATION OF MID & REAR PTO SHIFTING RAIL SUBASSEMBLY



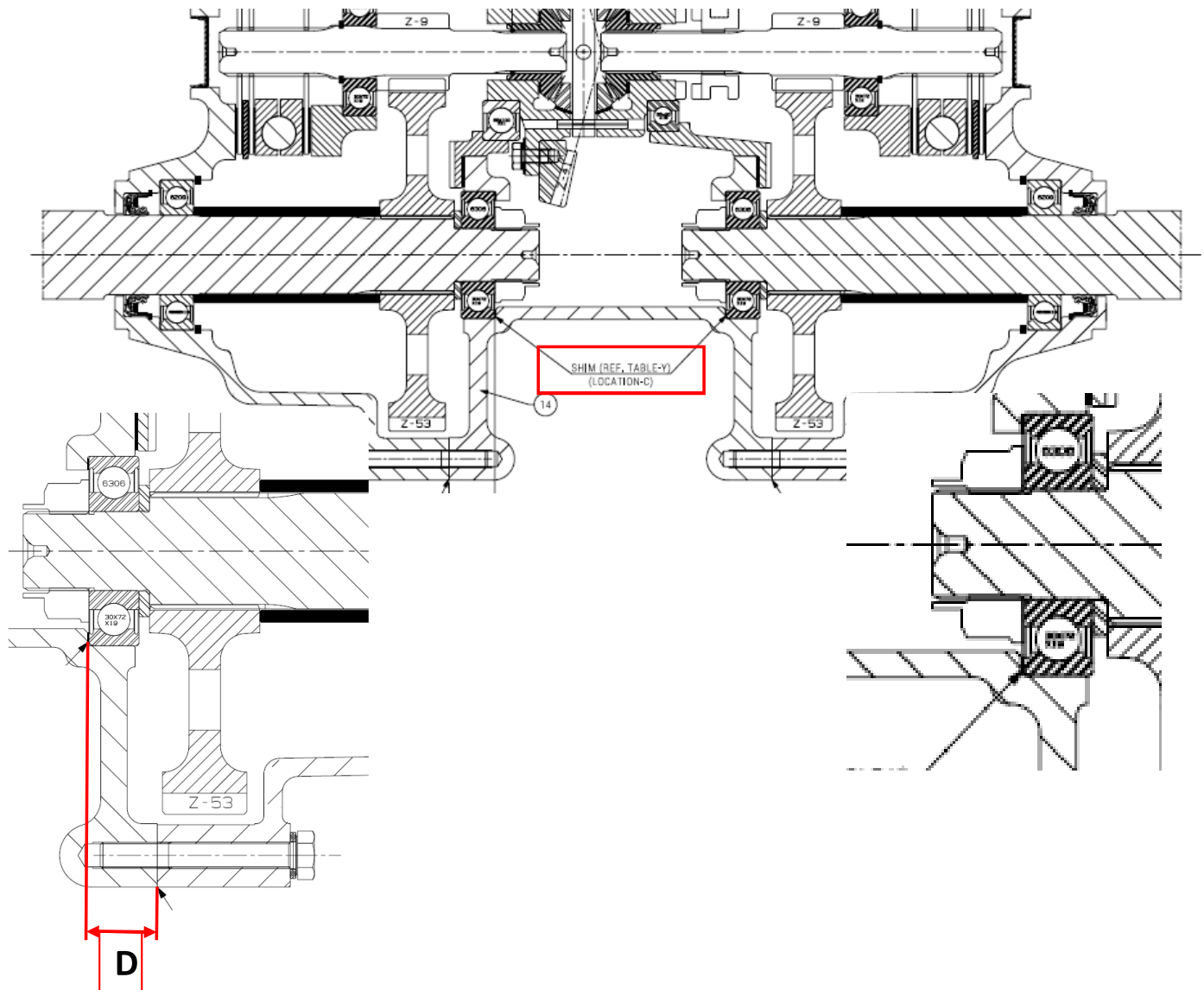
TORQUE CHART COMPACT

S.NO.	PART DESCRIPTION	SIZE	LENGTH	GRADE	QTY.	TORQUE VALUE (Nm)	REMARK
1	RETAINER TO CLUTCH HOUSING MOUNTING BOLT	M8x1.25	16	8.8	4	14-21	CLUTCH AREA
2	CLUTCH CROSS SHAFT TO FORK MOUNTING BOLT	M8x1.25	40	10.9	2	25-32	
3	CLUTCH TO FLY WHEEL MOUNTING BOLT	M8x1.25	20	10.9	6	25-32	
4	PLUG IN PLACE OF SENSOR	M16x1.5	16	-	1	45-50	
5	SENSOR	-	-	-	1	24.5-34.3	
6	TOP COVER MOUNTING BOLT	M8x1.25	20	8.8	10	21 - 28	SPEED AREA
7	IDLER SHAFT LOCKING BOLT	M8x1.25	59	-	1	10-15	
8	PLUG INTERLOCK	1/4"	18	-	1	20-25	
9	FORK TIGHTENING SCREW	-	-	-	-	27-34	
10	FORK TIGHTENING NUT	3/8"	24	-	2	27-34	
11	INDICATOR TRANSMISSION OIL LEVEL	-	-	-	-	55-65	REAR AXLE AREA
12	RETAINER 4WD COVER MOUNTING BOLT	M8x1.25	20	8.8	10	28-35	
13	INTERMEDIATE PLATE TO REAR HOUSING MOUNTING BOLT	M10x1.50	25	10.9	4	55 - 65	
14	DIFF. RETAINER TO REAR HOUSING MOUNTING BOLT	M8x1.25	25	8.8	12	20-25	
15	CRIMPING NUT FOR REAR AXLE SHAFT	M30x1.5	-	-	2	60-70	
16	BULL PINION SHAFT BEARING LOCK BOLT	M8x1.25	18	10.9	4	25-32	TRUMPET SUBASSEMBLY AREA
17	DRAIN PLUG	M14x1.5	10	-	2	25-32	
18	LH/RH RETAINER TO TRUMPET HOUSING BOLT	M10x1.50	30	10.9	10	55-65	
19	PTO RETAINER TO REAR HOUSING MOUNTING BOLT	M10x1.50	35	10.9	4	55-65	
20	PTO RETAINER TO REAR HOUSING MOUNTING ALLEN BOLT	M10x1.50	25	10.9	4	55-65	
21	PTO RAIL LOCKING SCREW	-	-	-	1	25-33	PTO AREA
22	PTO RAIL LOCKING NUT	M10x1.50	8	-	1	25-33	
23	CROWN WHEEL MOUNTING BOLTS	M8x1.25	18	10.9	10	25-32	DIFFERENTIAL AREA
24	CLUTCH HOUSING TO ENGINE ADAPTOR PLATE MOUNTING BOLT	M10x1.50	35	10.9	13	55-65	BUCKLE UP BOLTS
25	CLUTCH HOUSING TO ENGINE ADAPTOR PLATE MOUNTING BOLT	M10x1.50	95	10.9	1	55-65	
26	CLUTCH AND SPEED HOUSING MOUNTING BOLT	M10x1.50	35	10.9	8	55-65	
27	SPEED HOUSING TO REAR HOUSING MOUNTING BOLT (APPLY LOCTITE 542)	M10x1.50	35	10.9	2	55-65	
28	SPEED HOUSING TO REAR HOUSING MOUNTING BOLT	M10x1.50	70	10.9	8	55-65	
29	TRUMPET HOUSING TO REAR HOUSING MOUNTING BOLT	M10x1.50	70	10.9	20	55-65	
30	TRUMPET HOUSING TO REAR HOUSING MOUNTING BOLT (APPLY LOCTITE 542)	M10x1.50	143	10.9	2	55-65	

CHART LIQUID SEALANT - COMPACT 9+3

S.No.		JOINT LOCATION	Sealant Grade	D Code
1	REAR AXLE	Rear Housing to Hydraulic Mounting	Loctite 5188	D95013250
2		Rear Housing To PTO Retainer		
3		Rear Housing to Trumpet Mounting - LH/RH		
4		On Rear Axle Seal Outer Dia. - LH/RH	Loctite 577	D95000130
5		Screws -Trumpet Housing (2 Nos. each Side)	Loctite 542	D95004560
6		Crown Wheel to Differential Casing	Loctite 638	D95002100

REAR AXLE SHAFT FLOAT SHIM SELECTION



SHIMMING PROCEDURE OF REAR AXLE HOUSING ASSEMBLY :-

D-DISTANCE BETWEEN AXLE SHAFT BEARING 6306 TO AXLE HOUSING MOUNTING FACE

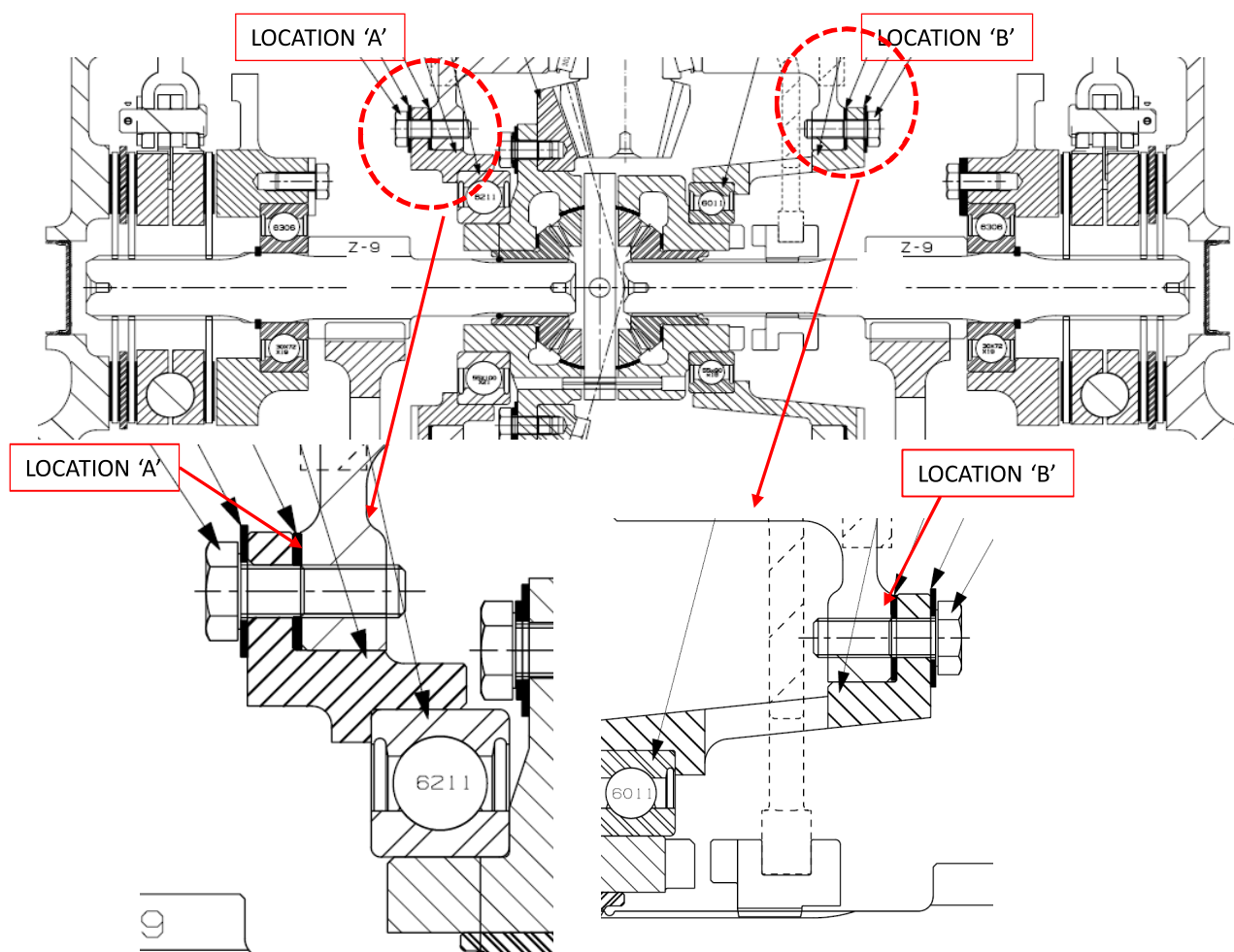
-SELECT SHIM AT LOCATION 'C SUCH THAT

SHIM THICKNESS 'T' + 'D'=26.35 TO 26.40

AXLE SHAFT AXIAL FLOAT SHOULD NOT EXCEED 0.4MM AFTER

TABLE-Y	
P'ART NO.	T (THICKNESS)
D1053780	0.075
D10537810	0.125
D10537820	0.2285
D10537830	0.4065
D10537840	0.5335
D10537850	0.7875

DIFFERENTIAL FLOAT SHIM SELECTION



SHIMMING PROCEDURE OF DIFFERENTIAL ASSEMBLY : -

SELECT SHIMS AT LOCATION 'A' AND 'B' FOR BACKLASH & FLOAT ADJUSTMENT

OF TP/CWPS, DIFFERENTIAL ASSEMBLY RESPECTIVELY

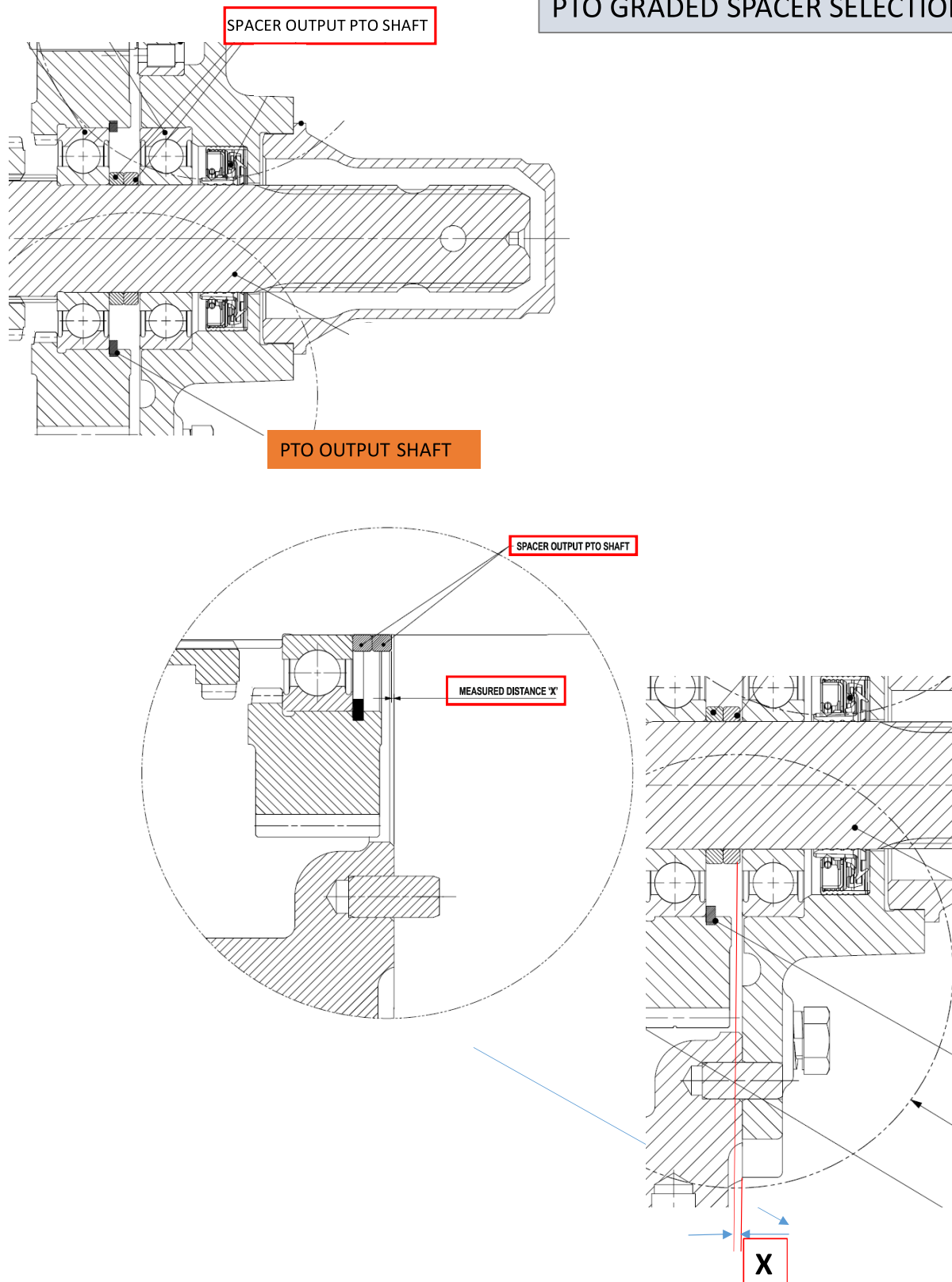
DIFFERENTIAL ASSEMBLY FLOAT VALUES TO BE MAINTAINED BETWEEN 0.150-0.200 mm.

BACKLASH BETWEEN BEVEL PINION AND CROWN GEAR S 0.15 TO 0.30 mm.

TABLE-Z

P'ART NO.	T (THICKNESS)
D10541130B	0.075
D10541140B	0.125
D10541150B	0.2285
D10541160B	0.4065
D10541170B	0.5335
D10541180B	0.7875

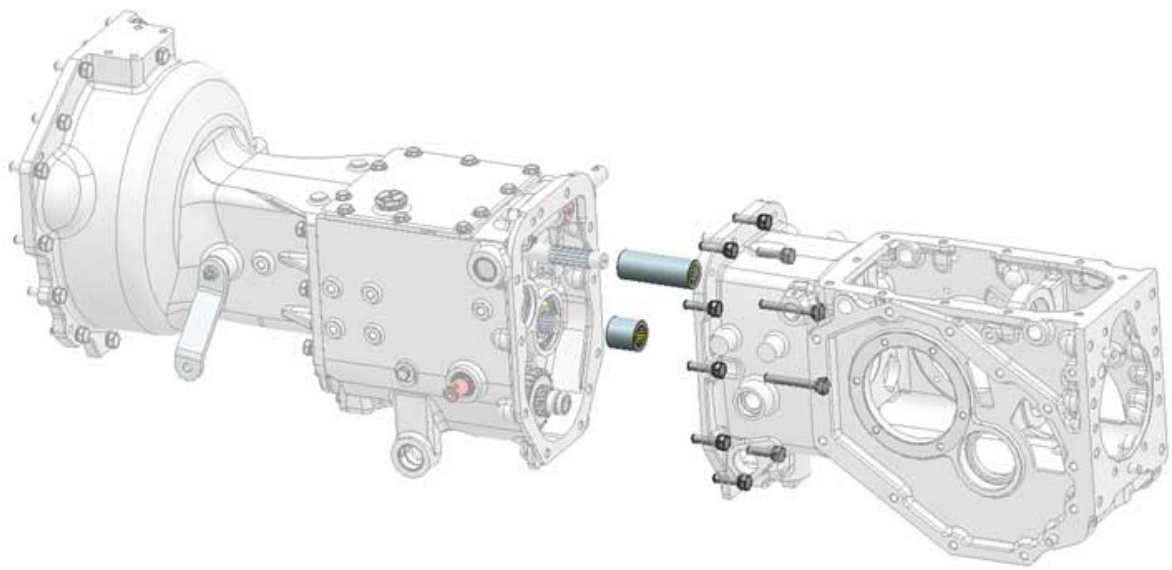
PTO GRADED SPACER SELECTION



SPACER SELECTION PROCEDURE:-

X-MEASURE DISTANCE B/W CENTER HOUSING MOUNTING FACE TO SPACER BY USING DEFAULT SPACER 4.7+4.7 (2 NOS)
SELECT SPACER COMBINATION SO THAT DISTANCE 'X' = $0.1 < X < 0.2$

D10590350	SPACER PTO OUTPUT SHAFT (4.7 MM)
D10590360	SPACER PTO OUTPUT SHAFT (4.8 MM)
D10590370	SPACER PTO OUTPUT SHAFT (4.9 MM)
D10590380	SPACER PTO OUTPUT SHAFT (5.0 MM)
D10590390	SPACER PTO OUTPUT SHAFT (5.1 MM)



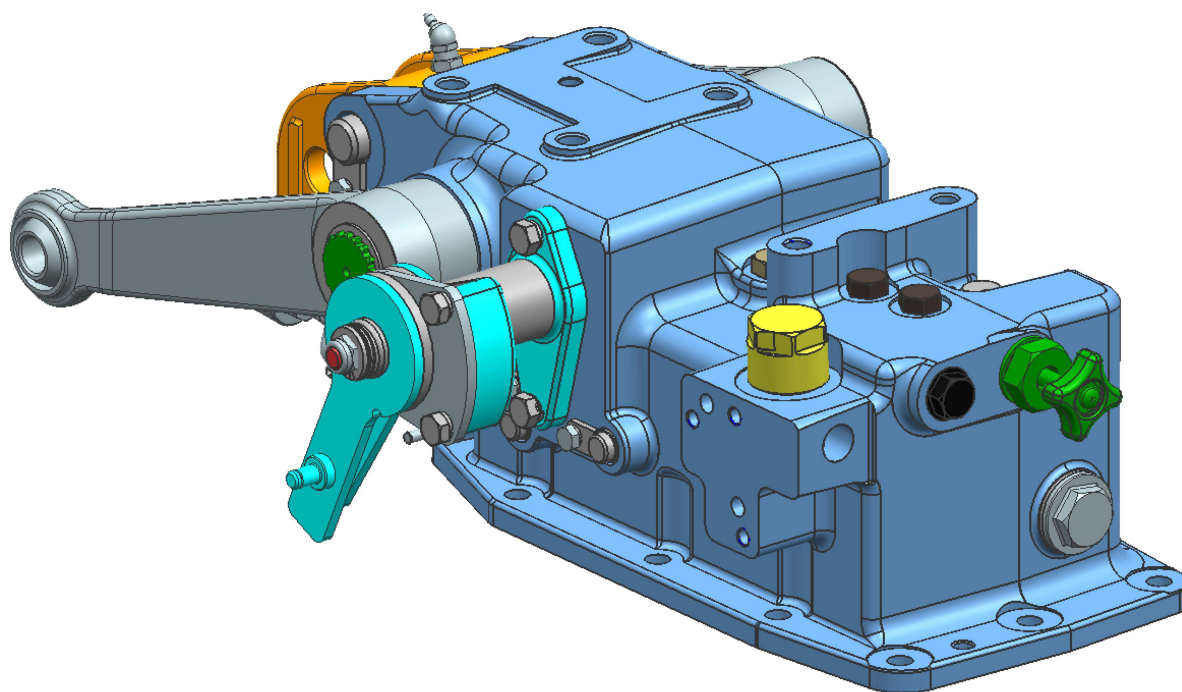
Hardware Buckle Up Transmission And Rear Axle Subassembly

Fig. No.	Description	Qty
1	BOLT M10X1.50X35-10.9 HEX HEAD (16 A/F)	8
2	BOLT M10X1.50X70-10.9 HEX HEAD	2
3	WASHER M10 SPRING LOCK	10
4	COUPLING PTO INPUT SHAFT	1
5	COUPLING COUNTERSHAFT SPEED AND RANGE	1
6	SEALANT LIQUID ANAEROBIC (HIGHER STRENGTH)	AR

TROUBLESHOOTING CHART

REAR AXLE	ABNORMAL NOISE	Improper backlash between Crown Wheel Gear & Pinion Shaft	Adjust
		Excess float in Differential Assembly	Adjust
		Improper backlash between Differential Pinion and Side Gear	Replace and Adjust
		Differential Assembly Bearing wornout / rubbing with Diff Casing Casting	Replace failed component
	NOISE WHILE TURNING	Differential washers wornout	Replace
		Differential pinions gear or Side gears worn or damaged	Replace
		Bull Gear / Pinion Shaft Teeth damage	Replace
		Differential Lock doesn't come out	Refer Below
	DIFFERENTIAL LOCK CAN NOT BE SET	Differential lock fork bent / damaged	Replace
		Differential lock shifter sleeve splines damaged	Replace
	DIFFERENTIAL LOCK PEDAL DOESN'T RETURN	Differential lock fork guiding pin profile damaged / wornout	Replace Fork and Pin
		Rust in Differential Lock Linkage	Remove Rust or Replace
	LEAKAGE FROM REAR AXLE	Seal Damaged	Replace Seal with Sealant on OD
BRAKE	LEAKAGE FROM PTO SEAL	Seal Damaged	Replace Seal
	LEAKAGE / SEEPAGE FROM WELCH PLUG	Improper sitting of welch plug in bore	Replace and assemble evenly
	LEAKAGE FROM PTO SHIFTING LEVER	Seal O Ring Damaged	Replace Seal O Ring
	ABNORMAL NOISE DURING BRAKING	Insufficient Oil	Refill Oil
		Incorrect Oil Grade	Replace Oil
		Water Ingress in Oil	Replace Oil + Brake Friction Disc
	UNEVEN BRAKING FORCE	Uneven Brake Pedal Freeplay	Adjust
		Brake disc wornout	Replace
		Actuator Assembly damage / wornout	Replace
	HIGH BRAKING FORCE REQUIRED TO STOP	High Freeplay in brake pedal	Adjust
		Brake disc worn-out	Replace
		Actuator Assembly damage / wornout	Replace
	BRAKE DRAGS	Less Pedal Freeplay	Adjust
		Actuator Ball Cam profile faulty / wornout	Replace
		Brake pedal return spring weaken or broken	Replace

COMPACT IN -HOUSE HYDRAULIC LIFT,
INSTRUCTION MANUAL



S.NO.	CONTENTS	PAGE NO.
1.	Hydraulic System – Schematic	1
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3.	Valves in the Lift Cylinder Assy.	3
4.	Adjustments	4
5.	Lift Assembly Installation Removal	6
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7.	Position Control	11
8.	Assembly	12
9.	Cover Assembly	12
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11.	Quadrant Housing Dis-Assembly	14
12.	Cylinder DisAssembly	15
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15.	Oil Flow when Lowering	20
16.	Problem, Causes & Remedy	22

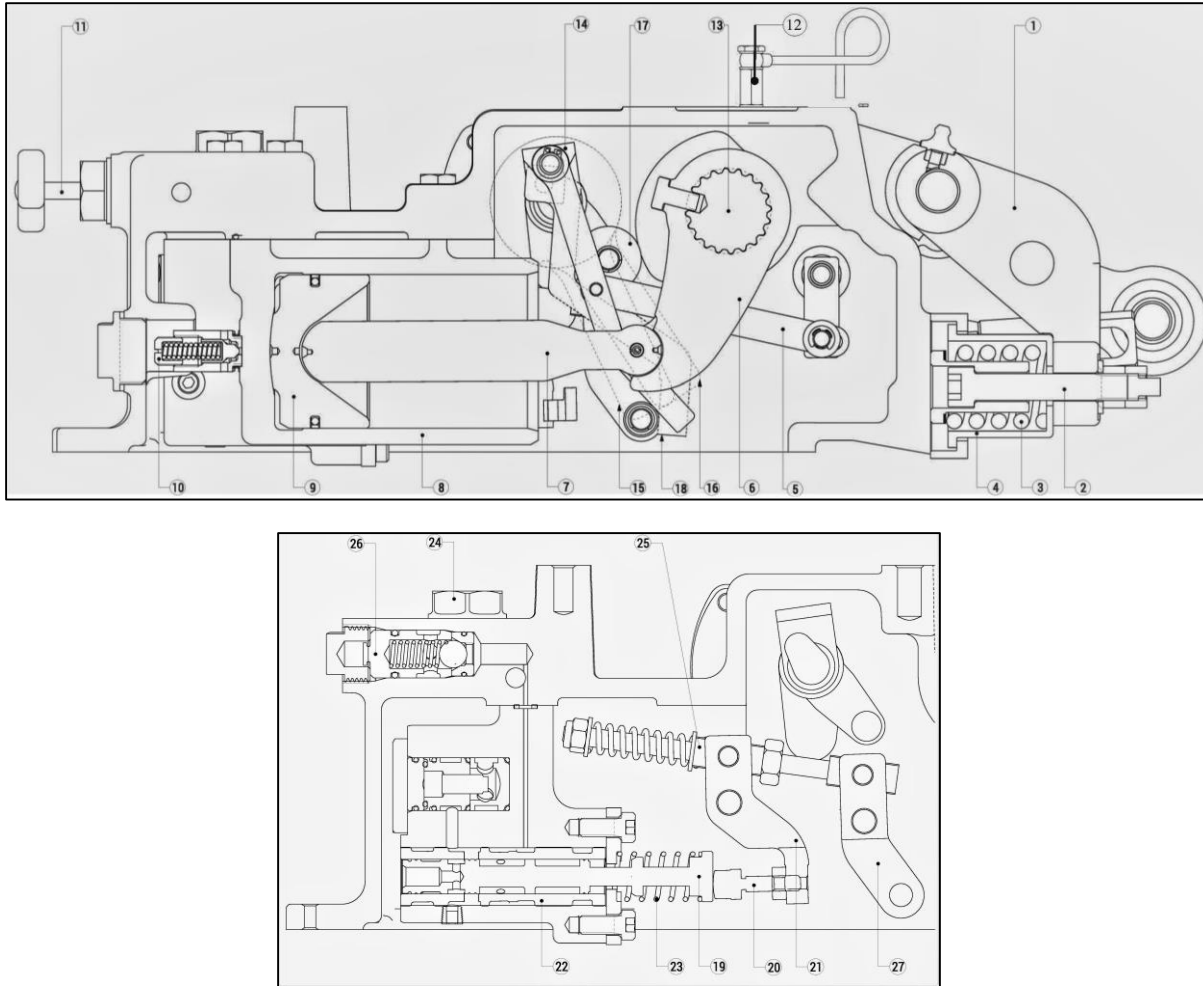


Figure 1
Hydraulic System – Schematic

- | | |
|---|---|
| 1. ROCKER TOP LINK SENSING ASSEMBLY | 15. LEVER HYDRAULIC LIFT POSITION CONTROL |
| 2. BOLT M12x1.75x75-10.9 ALLEN | 16. LEVER HYDRAULIC LIFT DRAFT CONTROL |
| 3. SPRING HPL DRAFT CONTROL MAIN | 17. LEVER HYDRAULIC LIFT POSITION CONTROL |
| 4. HOUSING HYDRAULIC DRAFT CONTROL SPRING | 18. LINK HYDRAULIC LIFT POSITION CONTROL |
| 5. LINK HYDRAULIC LIFT DRAFT CONTROL | 19. VALVE HYDRAULIC LIFT CONTROL |
| 6. ARM HYDRAULIC LIFT RAM | 20. ACTUATOR HYDRAULIC LIFT CONTROL VALVE |
| 7. ROD HYDRAULIC LIFT CONNECTING | 21. LINK HYDRAULIC LIFT SPOOL VALVE |
| 8. CYLINDER HYDRAULIC LIFT | 22. BUSHING CONTROL VALVE HYDRAULIC LIFT |
| 9. PISTON HYDRAULIC LIFT CYLINDER | 23. SPRING HYDRAULIC LIFT CONTROL VALVE |
| 10. VALVE ASSEMBLY HYDRAULIC LIFT SAFETY | 24. VALVE ASSEMBLY HYDRAULIC LIFT PUMP RELIEF |
| 11. TRANSPORT LOCK ASSEMBLY | 25. LINK SWIVEL ASSEMBLY HYDRAULIC LINKAGE |
| 12. BREATHER ASSEMBLYHYDRAULIC LIFT OIL | 26. HYDRAULIC LIFT CHECK VALVE |
| 13. SHAFT SERRATED HYDRAULIC LIFT | 27. LINK HYDRAULIC LIFT CONTROL VALVE ACTUATING |
| 14. SHAFT ASSEMBLY HYDRAULIC LIFT DRAFT | |

1. EXTERNAL CONTROLS

LIFT CONTROL LEVERS

This lift has two lever control system. The two-lever control system incorporates separate levers for draft and position control

situated at the right-hand side of the operator's seat.

The system enables operator to select full draft control (inner lever), full position control (outer lever) or a combination of both for maximum implement depth control, in addition to draft response.

DRAFT CONTROL

When an implement is pulled through the ground, the draft caused by soil resistance has the effect of trying to rotate the implement around the lower link hitch points. This creates a pushing or compressive force in the top link.

When changes in working depth or soil resistance cause the draft to increase or decrease; the compressive force in the top link also increases or decreases.

The system of Draft Control uses the top link signal to raise or lower the implement working depth to maintain a constant draft when the position control lever is in the lowest position.

POSITION CONTROL

Position control is selected by pushing the draft control lever to the bottom of the quadrant (there by making the draft control linkage inoperative) and moving the position control lever.

DRAFT CONTROL WITH POSITION CONTROL (BLENDING)

When the system is in draft control, the position control lever can be utilized to set a desired maximum implement working depth.

Draft control is maintained but the implement depth is regulated by the position control setting which overrides the draft control linkage.



*Figure 1
Hydraulic Control Levers*

AUXILIARY SPOOL VALVE

To facilitate the operation of remote cylinder, Double Action Auxiliary Spool Valve is provided on the tractor. It can be used with both single acting as well double acting cylinders with the help of a Selector knob. It is operated by a lever located on the right hand side of the operator's seat above the auxiliary distributor, which is connected by pipe to quick release couplers at the rear of tractor.

It works in both forward and backward positions and connects oil supply to remote couplers. Attach Blue color port in case of single acting cylinder and both for a double acting cylinder attachment.



Figure 3
QRC Couplers

2. VALVES IN THE LIFT CYLINDER ASSY.

CONTROL VALVE

The control valve is connected through internal linkage to the lift control levers and either directs the flow of hydraulic oil from the pump to the lift cylinder, to effect of raise condition, or to the reservoir for a neutral or lowering cycle.

To cater for the increased flow of hydraulic oil, the control valve has narrow section lands.

The control valve spool is matched with a unique color coded bushing.

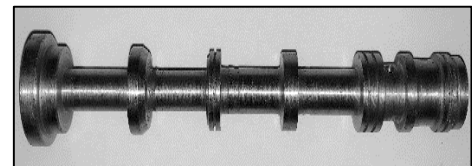


Figure 4
Hydraulic Lift Control Valve

UNLOAD VALVE

The unload valve is operated by oil pressure as directed by the control valve and has two positions. In the lower position the valve allows oil

to flow from the rear to the reservoir thereby unloading the system. In the raised position the unload valve seals off the connection to the reservoir and oil from the control valve is directed to the lift cylinder.

Spring length of Unload Valve: 52 mm

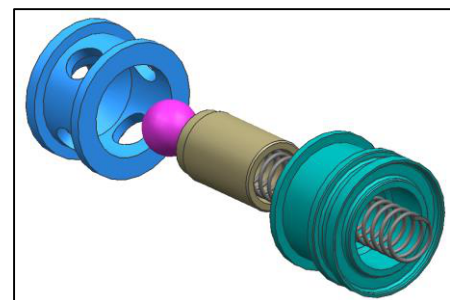
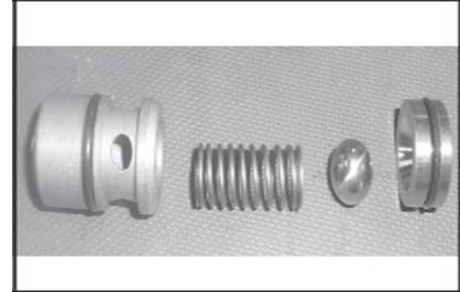


Figure 5
Hydraulic Lift Unload Valve

CHECK VALVE

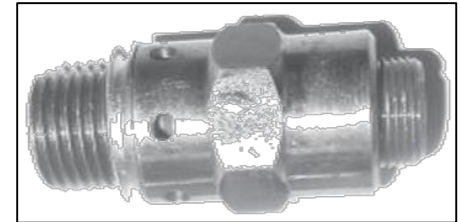
A Simple one-way ball valve which allows hydraulic oil to pass to the lift cylinder or auxiliary equipment but it prevents the return of oil.



*Figure 6
Check Valve*

LIFT CYLINDER SAFETY VALVE

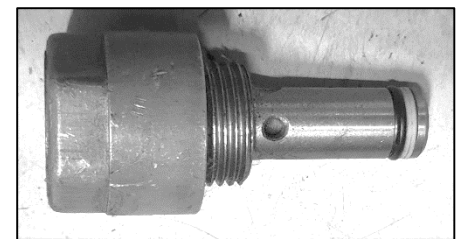
This spring operated valve is mounted directly into the lift cylinder wall. If shock loadings are encountered, for example when transporting implements over rough ground, the valve opens to relieve excess pressure and protect the system.



*Figure 7
Lift Cylinder Safety Valve*

PRESSURE RELIEF VALVE

It limits the pressure at which oil is fed to the system so that the components are not overloaded. It opens at 169 Bar and fully opened at 180-187 Bar.

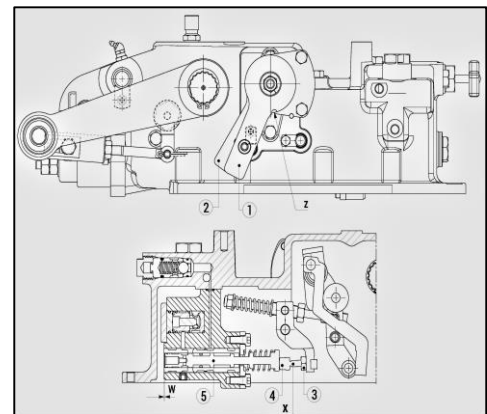


*Figure 8
Pressure Relief Valve*

3. ADJUSTMENTS

POSITION CONTROL ADJUSTMENT

1. Place draft control lever (2) at bottom of quadrant, with position control lever (1) aligned with hole 'Z' as shown.
2. Make sure that the lift arms are in the full down position.
3. Adjust the actuator hydraulic lift control valve X until the spool (5) and the cylinder face dimension W is 0.76 ± 0.13
4. Then lock this position of X with Nut M8x1.25-6 Hex (3).

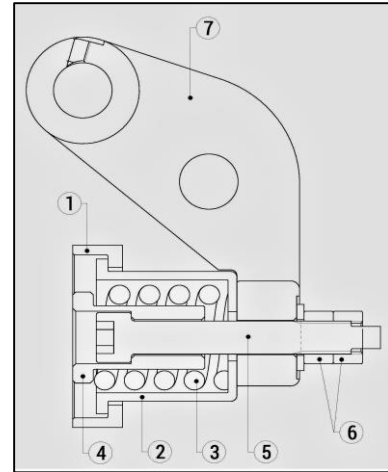


*Figure 9
Position Control Adjustment*

1	LEVER HYD. POSITION CONTROL
2	LEVER HYD. DRAFT CONTROL
3	NUT M8X1.25-6 HEX
4	ACTUATOR HYD. CONTROL VALVE
5	VALVE SPOOLHYD. CONTROL

DRAFT CONTROL MAIN SPRING ADJUSTMENT

1. Assemble the Flange Draft Spring Housing (1), Spring HPL Draft Control Main (3), Guide Lower Lift Draft Control Spring (4) and Bolt M12 Allen (5) into the Spring Housing (2).
2. Re-assemble the spring housing assembly to the lift cover assemble with the draft control flange butt with the face of the cover, guided Bolt M12 Allen (5) aligned with the Rocker (7). Secure the two attaching M10 hex-head bolts and spring washer.
3. Hand tighten the M12 Nuts (6) with Bolt M12 Allen (5) and Rocker Hydraulic Lift (7) should be in between the nuts and Spring Housing (2).
4. Tighten the M12 Nut (6) till the play between Rocker Hydraulic Lift (7) and the Spring Housing (2) becomes negligible.
5. Finally lock the assembly with the help of locking nut (6).

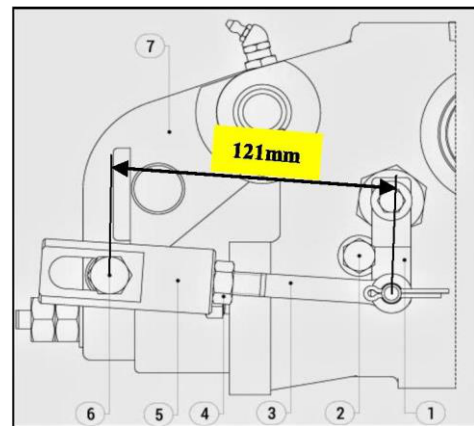


1	FLANGE DRAFT SPRING HOUSING
2	HOUSING HYDRAULIC LIFT DRAFT CONTROL SPRING
3	SPRING HPLDRAFT CONTROL MAIN
4	GUIDE LOWER LIFT DRAFT CONTROL SPRING
5	BOLT M12x1.75x75-10.9 ALLEN
6	NUT M12x1.75-6 HEX (2 QTY.)
7	ROCKER TOP LINK SENSING
8	WASHER M12 FLAT

Figure 10
Draft Control Main Spring Adjustment

DRAFT CONTROL ACTUATING LINK ADJUSTMENT

1. Assemble Connector Hyd. Draft Hyd. Lift (5) and Rod Feedback Draft control (3), with locking nut in between, such that the CD between the two is 121mm. Lock the position with help of Nut (4).
2. Make sure that, the Link Actuating (1) and Lever Draft Feedback which is inside the cover, are properly tightened and there is no play in between



1	LINK HYD. LIFT DRAFT ACTUATING
2	BOLT M8x1.25x40-8.8 HEX HEAD
3	ROD FEEDBACKDRAFT CONTROL
4	NUT M10x1.50-8 HEX
5	CONNECTER DRAFT HYDLIFT
6	BOLT M10X1.50X35 - 10.9 HEX HEAD
7	ROCKER TOP LINK SENSING

Figure 11
Draft Control Actuating Link Adjustment

LIFT ASSEMBLY INSTALLATION REMOVAL

Tools Required- Pneumatic Gun, Socket No.-24,16,17,13

- 1) Remove the tyre by loosening 4 bolts.
- 2) Remove seat by loosening 2 bolts using socket no.16
- 3) Remove RH fender using pneumatic gun and loosen
3 nuts using 13mm socket and 4 bolts using 17mm socket on
both LHS and RHS and remove the fender support bracket
Remove control levers by loosening 2 nuts.
- 5) Remove ROPS mounting bolts-6 using 21 mm socket and remove breather.
- 6) Remove 3 point linkage and QRC connections.
Remove console using 4 no. allen key.
- 4) Remove hydraulic lift mounting bolts

CYLINDER ASSEMBLY ADJUSTMENT

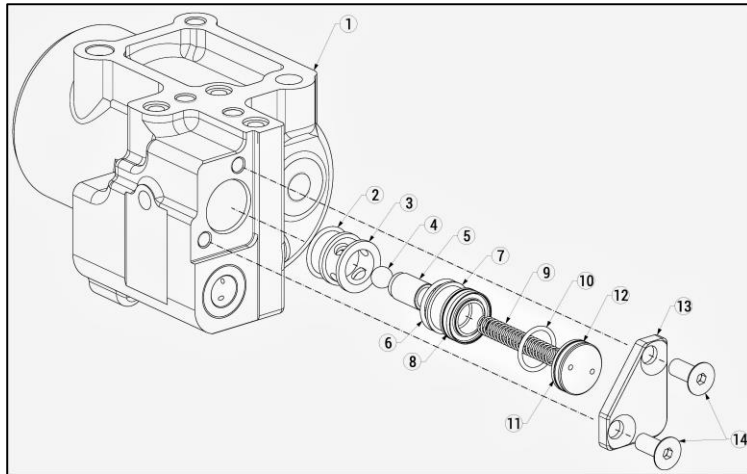


Figure 13
Cylinder Assembly

- | | | | |
|---|----------------------------------|----|--|
| 1 | CYLINDER HYDRAULIC LIFT ASSEMBLY | 8 | RING SEALING |
| 2 | RING SEALING | 9 | SPRING VALVE LOCK |
| 3 | SEAT VALVE LOCKING BALL | 10 | RING SEALING |
| 4 | BALL 10MM CHROMIUM STEEL | 11 | PLUG HYDRAULIC LIFT UNLOAD VALVE |
| 5 | SEAT UNLOAD VALVE | 12 | RING SEALING |
| 6 | RING SEALING | 13 | COVER HYDRAULIC DISTRIBUTOR BODY REAR |
| 7 | INSERT HYDRAULIC DISTRIBUTOR | 14 | SCREW M8x1.25x20 COUNTERSUNK SOCKET HEAD |

COVER ASSEMBLY ADJUSTMENT

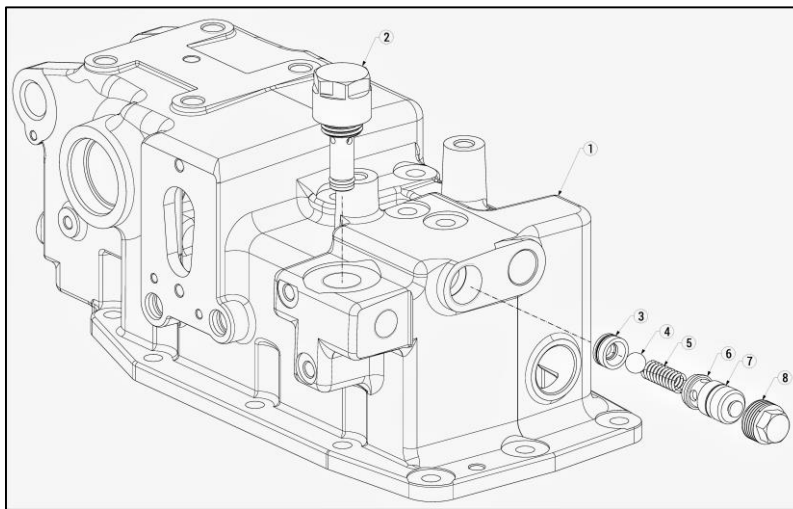


Figure 14
Cover Assembly

- | | | | |
|---|---|---|-------------------------------------|
| 1 | COVER HYDRAULIC LIFT TOP | 5 | SPRING HYDRAULIC LIFT CHECK VALVE |
| 2 | VALVE ASSEMBLY HYD. LIFT PUMP RELIEF | 6 | RETAINER HYDRAULIC LIFT CHECK VALVE |
| 3 | SEAT HYD. LIFT CHECK VALVE AND SEAL ASSY. | 7 | SEAL O RING 0.103x0.625 |
| 4 | BALL 15/32" DIAMETER | 8 | PLUG HYDRAULIC LIFT CHECK VALVE |

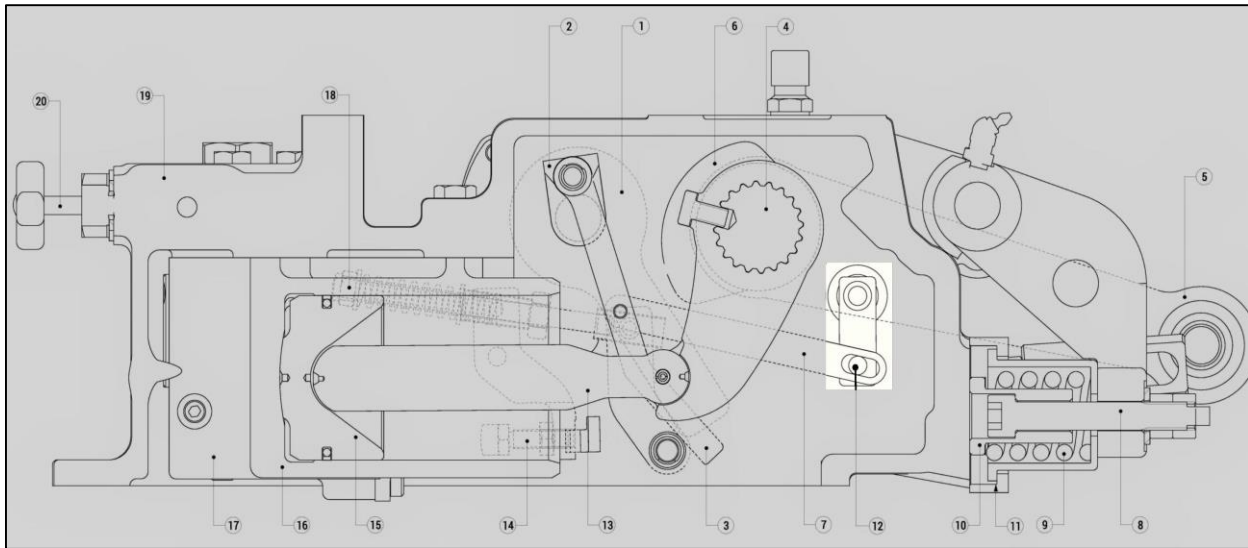


Figure 15
Draft Control Linkage Lowering into work

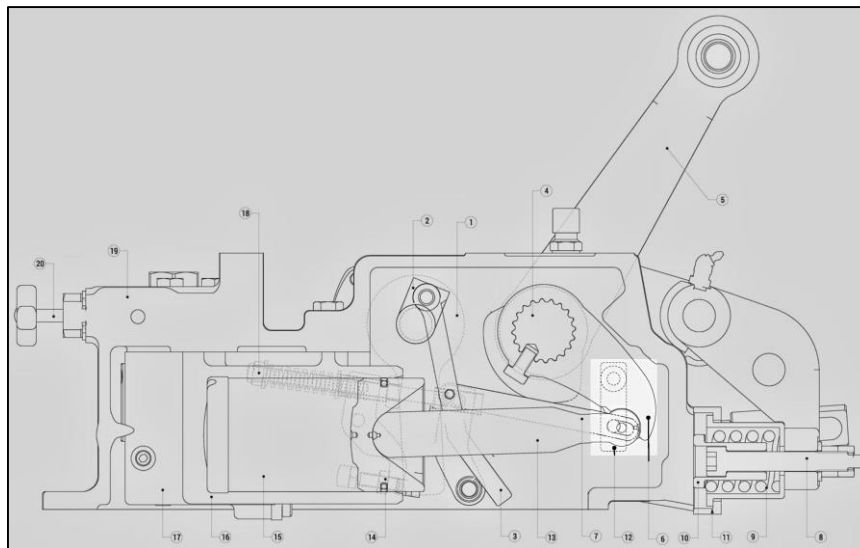


Figure 16
Draft Control Linkage Raising in Work

- | | |
|--|--|
| 1 LEVER HYDRAULIC LIFT DRAFT CONTROL | 11 FLANGE DRAFT SPRING HOUSING |
| 2 SHAFT ASSEMBLY HYDRAULIC LIFT DRAFT | 12 LEVER ASSEMBLY HYDRAULIC LIFT DRAFT
FEEDBACK |
| 3 LINK HYDRAULIC LIFT DRAFT CONTROL | 13 ROD HYDRAULIC LIFT CONNECTING |
| 4 SHAFT SERRATED HYDRAULIC LIFT | 14 LINK HYDRAULIC LIFT SPOOL VALVE |
| 5 ARM HYDRAULIC LIFT | 15 PISTON HYDRAULIC LIFT CYLINDER |
| 6 ARM HYDRAULIC LIFT RAM | 16 CYLINDER HYDRAULIC LIFT |
| 7 LINK HYDRAULIC LIFT DRAFT CONTROL | 17 CYLINDER HYDRAULIC LIFT ASSEMBLY |
| 8 BOLT M12x1.75x75 -10.9 ALLEN | 18 LINK SWIVEL ASSEMBLY HYDRAULIC LINKAGE |
| 9 SPRING HPL DRAFT CONTROL MAIN | 19 COVER HYDRAULIC LIFT TOP |
| 10 GUIDE LOWER LIFT DRAFT CONTROL SPRING | 20 TRANSPORT LOCK ASSEMBLY |

DRAFT CONTROL

When working in Draft Control an increase in draft at the implement will compress the draft control main spring in a forward direction and push the draft control link and hence the control valve lever forward. This action moves the control valve forward into a raise position and as the implement is lifted, the draft force on the draft control main spring, decreases to the original amount. The control valve spring now moves the control valve rearward into the neutral position.

A decrease in draft at the implement will reduce the compression of the draft control main spring and allow the draft control link and hence the control valve lever to move rearward.

This allows the control valve spring to extend and move the control valve rearward into a lowering position.

As the implement runs deeper the draft increases to the original amount and the control valve again returns to the neutral position.

action allows the control valve spring to move the control valve into a lowering position. As the implement runs deeper the draft increases until the original draft obtained and the draft, control main spring expands in a forward direction there by moving the control valve into the neutral position.

RAISING IMPLEMENT TO TRANSPORT POSITION

When the draft control lever is pulled to the top of the quadrant to the transport position, the draft control roller pushes the draft lever rearwards and causes the lever center pivot to move to the top of the slot in the draft control link. In this position, the draft lever pivots about the slotted link and forces the actuating lever forward. The override spring transmits the movement to the control valve lever which in turn moves the control valve fully forward into the fast raise position.

To limit the maximum height to which the implement can be raised, the linkage is designed so that the piston skirt projects slightly beyond the end of the lift cylinder. On reaching the fully raised position, the piston contacts the control valve lever which moves rearwards.

NOTE: The override spring allows the control valve lever to move rearwards relative to the actuating lever.

This action moves the control valve rearwards into the neutral position and stops any further movement of the piston. The piston stop mechanism operates both in Draft Control and Position Control.

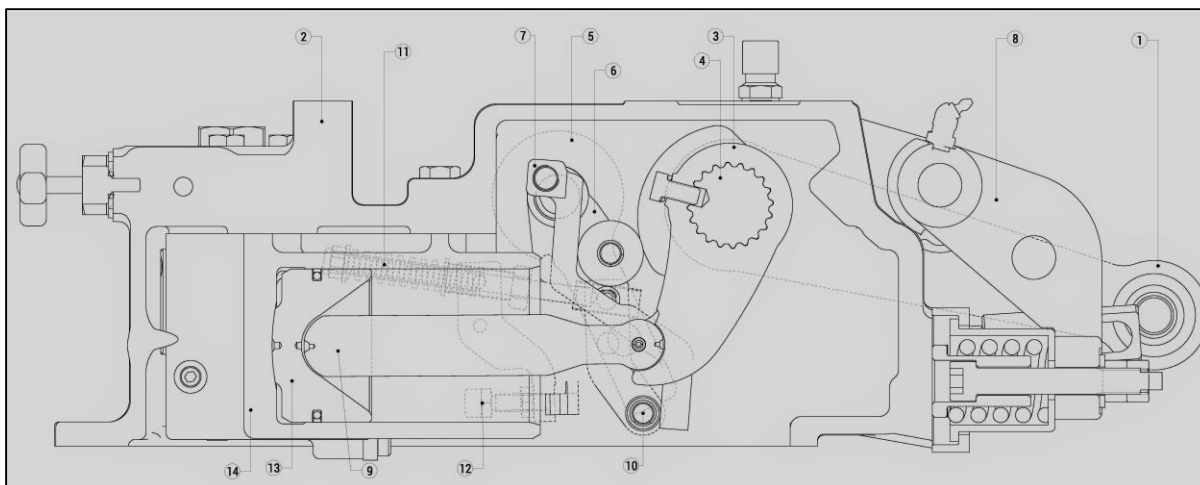


Figure 17
Position Control Lowering

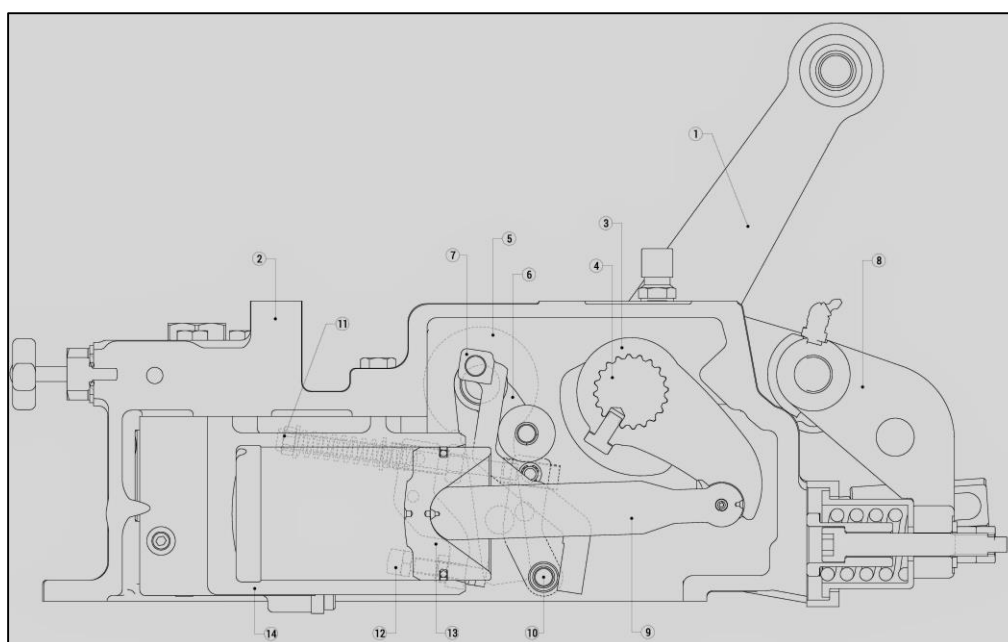


Figure 18
Position Control Raising

1	ARM HYDRAULIC LIFT	8	ROCKER TOP LINK SENSING ASSY.
2	COVER HYDRAULIC LIFT TOP	9	ROD HYDRAULIC LIFT CONNECTING
3	ARM HYDRAULIC LIFT RAM	10	LINK HYDRAULIC LIFT OVERRIDE
4	SHAFT SERRATED HYDRAULIC LIFT	11	SPRING HYDRAULIC LIFT OVERRIDE
5	LEVER HYDRAULIC LIFT POSITION	12	ACTUATOR HYDRAULIC CONTROL VALVE
6	LEVER ASSY. HYD. LIFT POSITION CONTROL	13	PISTON HYDRAULIC LIFT CYLINDER
7	POSITION CONTROL LINK	14	CYLINDER HYDRAULIC LIFT

POSITION CONTROL

The system of Position Control enables the working depth or height of an implement to be preset and maintained. When the draft control lever is in the lowest position, the position control system function as follows:

RAISING

Upward movement of the position control lever causes the position lever to pivot about the forward roller.

When the position lever pivots it pushes against a roller attached to the actuating lever which moves forward. The override spring transmits the movement to the control valve lever which in turn moves the control valve forward in to the raise position. As the lift cross shaft rotates, a cam allows the roller to move rearwards. Due to the force of the control valve spring all the linkage follow the roller allowing the control valve to move rearward to the neutral position. As soon as the valve is in this position the lifting action stops. If a further lift is required, the position control lever is moved further up the quadrant and the above procedure is repeated.

LOWERING

Downward movement of the position control lever tends to allow the position lever to swing free of the roller but the rearward force of the control valve spring pushes the control valve lever and actuating lever roller against the foot of the position lever which maintain contact with the roller. The rearward movement of the control valve spring pulls the control valve into the lowering position.

As the lift cross-shaft rotates in a clockwise direction, the increasing radius of cam pushes the roller forward. This action forces the position lever and hence the control valve lever, forward until the control valve moves to the neutral position. Further downward movement of the position control lever will cause the lift arms to drop until such times as the valve is neutralized or the implement reaches the lowest position.

ASSEMBLY

A. COVERASSEMBLY

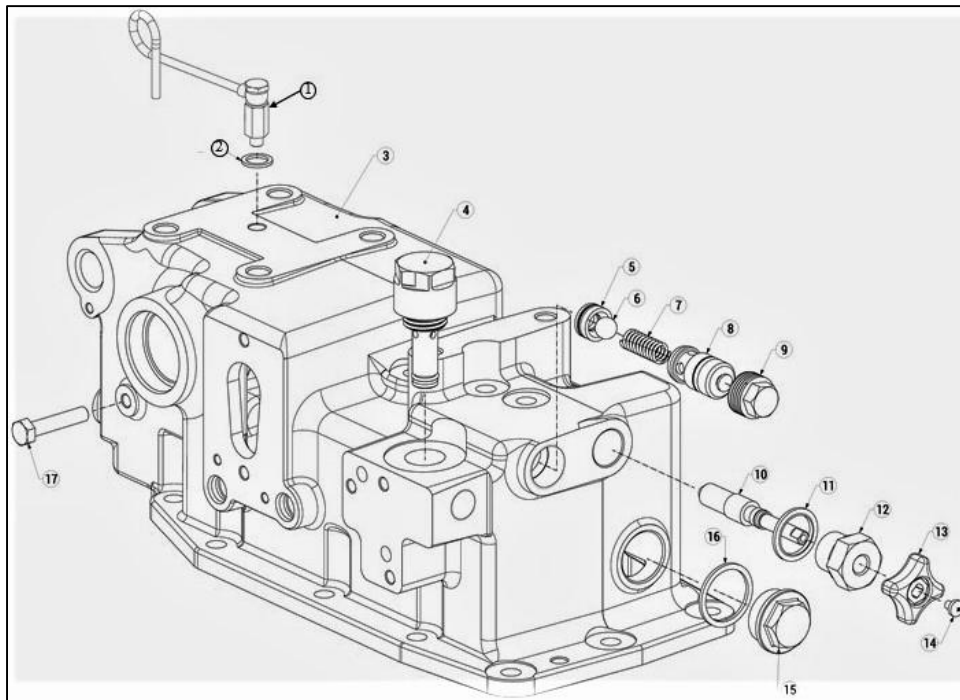


Figure 19
Cover Assembly

1	BREATHER HYD. LIFT OIL	10	HYD. ACCESSORY SPOOL COVER
2	COPPER WASHER HYD. BREATHER	11	BONDED SEAL M22 (DOWTY)
3	COVER HYD. LIFT TOP	12	ADAPTER M22X1.5
4	HYD. PUMP RELIEF VALVE ASSY.	13	KNOB COVER
5	CHECK VALVE SEAT WITH O-RING	14	SCREW
6	BALL 15/32" DIAMETER	15	PLUG M30x1.5x12
7	CHECK VALVE SPRING HYD. LIFT	16	WASHER COPPER HYDRAULIC LIFT
8	HYD. CHECK VALVE RETAINER WITH O-RING	17	BOLT M8x1.25x40 - 8.8 HEX HEAD
9	HYD. CHECK VALVE PLUG		

1. Wash the Cover Hydraulic Lift (3) with suitable solvent and dry with clean lint free cloth or compressed air.
2. Tighten the M8 bolt (17) in the threaded hole specified below the serration shaft slot.
3. Insert the Check Valve Seat with O-ring (5) in the hole specified in the figure. Then insert the Ball (6) in behind the seat. After that insert the Spring (7) to keep the cap in place. Then, insert the Check Valve Retainer (8) with O-Ring and finally close the hole with Check Valve Plug (9) with the help of a pneumatic gun.
4. Insert the Accessory Spool (10) in the hole specified. Then, with spool shaft in between the Bonded Seal-Dowty (11) close the hole with help of M22 Adapter (12), make sure that the spool's shaft sticks out from the hole in the Adapter. Match the groove cut out in the spool shaft with Knob Cover (13) and fix it with the help of Screw (14).
5. Close the cylinder safety valve hole with help of Copper Washer (16) and M30 Plug (15).
6. Finally tighten the Relief Valve (4) with M30 socket and pneumatic gun in the hole as per the figure shown.

B. POWER TRANSFER ASSEMBLY

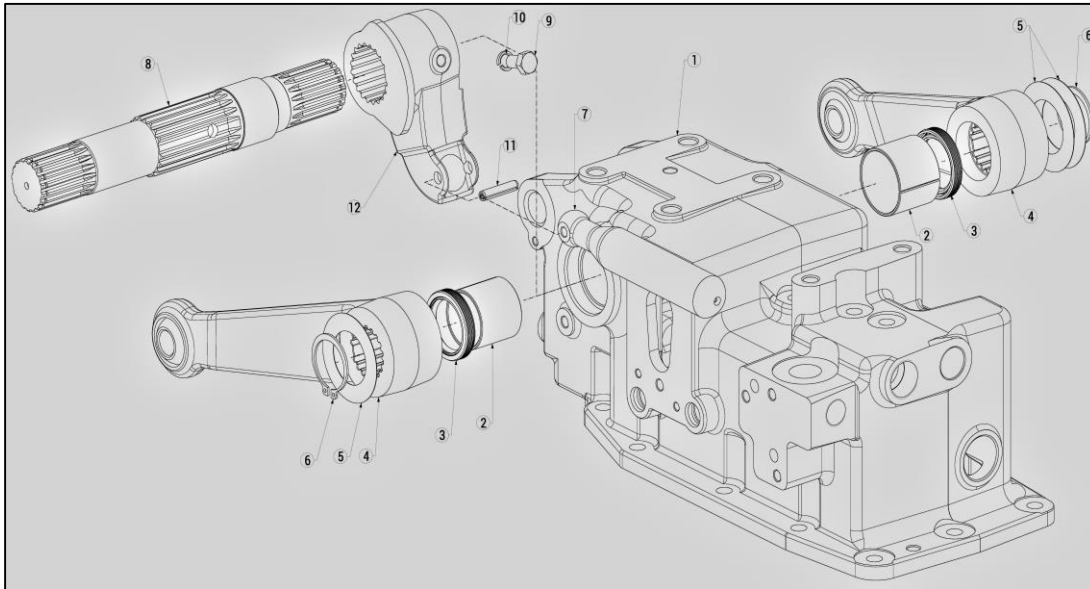


Figure 20
Cover Assembly

1	COVER HYDRAULIC LIFT TOP	7	ROD HYDRAULIC LIFT CONNECTING
2	BUSHING HYD. LIFT SHAFT RH & LH	8	SHAFT SERRATED HYDRAULIC LIFT
3	SEAL OIL 35x45x9.0	9	BOLT M8X1.25X16 - 8.8 HEX HEAD
4	ARM HYDRAULIC LIFT RH & LH	10	WASHER M8 SPRING LOCK
5	SHIM (2 QTY. FOR LH & 1 QTY. FOR RH)	11	PIN 6x30 SPRING DOWEL COMBINATION TYPE
6	CIRCLIP	12	ARM HYDRAULIC LIFT RAM

1. Fix the Cover in bench with help of cover mounting bolts and invert the fixture.
2. Take Ram Arm and Assemble it with connecting rod with help of Spring Dowel Pin. Insert the Dowel into the hole of Ram Arm keeping the Connecting Rod in between the socket.
3. Insert the Serration Shaft into the Cover Hydraulic Lift Top, shaft side with smaller diameter should inserted into the cover hole with bigger diameter. Put the Ram Arm assembly inside the cover and pass Serration Shaft through the Ram Arm spline and match the master spline.
4. With the help of tool insert the Bushing LH & RH. Make sure that the bushings are fitted according to the bore size, and while insertion the bushings doesn't get damaged.
5. After the bushing, with help of tool, insert the oil seal, Lip Side facing towards inside of cover, at both ends. Make sure that the seal position is butt with the inside face of the hydraulic cover. The seal is to be inserted with help of tool provided and shouldn't be damaged while insertion.
6. Fix the Ram Arm and Serration shaft with help of M6 Screw and Spring Washer, in between.
7. Insert the Lift Arm LH & RH by matching the master splines with serration shaft.
8. Fix the Lift Arm by inserting a couple of Shim on the LH side of the lift and a single Shim on the RH side of the lift. Finally fix the Lift Arms by inserting Circlip into the groove on both the sides of serration shaft.

C. QUADRANT HOUSING DIS-ASSEMBLY

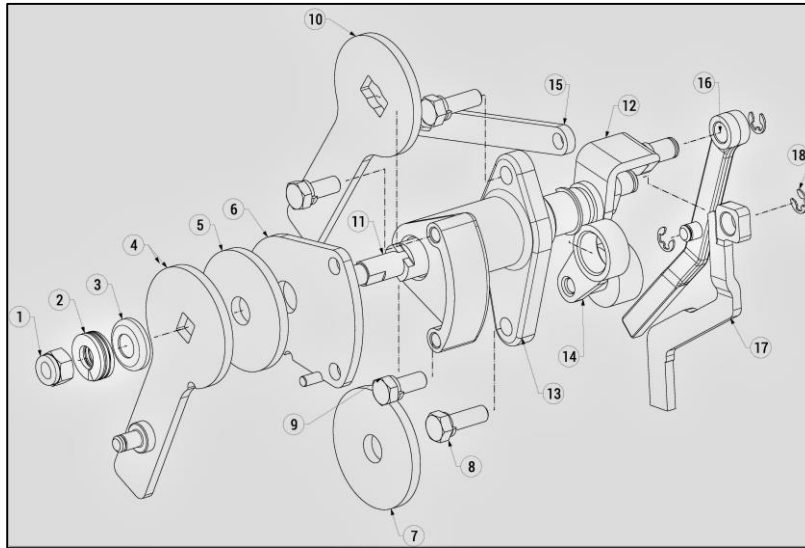


Figure 21
Quadrant Housing Dis-Assembly

1	NUT M10x1.50 NYLOCK HEX	10	LEVER HYDRAULIC LIFT DRAFT CONTROL
2	WASHER HYDRAULIC LIFT CONTROL SPRING	11	SHAFT HYDRAULIC LIFT CONTROL LEVER
3	WASHER LIFT CONTROL SHAFT CUP	12	SHAFT ASSY. HYD. DRAFT CONTROL
4	LEVER HYDRAULIC LIFT POSITION CONTROL	13	HOUSING HYD. LIFT CONTROL QUADRANT
5	DISC HYDRAULIC LIFT CONTROL FRICTION	14	LEVER ASSY. POSITION CONTROL WITH ROLLER
6	DISC HYDRAULIC LIFT CONTROL	15	LINK HYD. DRAFT CONTROL CONNECTER
7	DISC HYDRAULIC LIFT CONTROL FRICTION	16	LINK HYDRAULIC LIFT DRAFT CONTROL
8	BOLT M8x1.25x25 & M8 SPRING WASHER	17	LINK HYDRAULIC LIFT POSITION CONTROL
9	BOLT M8x1.25x20 & M8 SPRING WASHER	18	CIRCLIP (4 QTY.)

1. Loosen the Nylock nut (1) using M10 ring spanner. Then, take out the spring washer (2) along with Cup Washer (3), Position Control Lever (4) and Friction Disc (5).
2. Loosen the M8 Bolt (9) using pneumatic gun. Remove the Control Disc (6) along with Friction Disc (7) and Draft Control Lever (10).
3. Loosen the Cover mounting M8 bolts (8) in order to remove Quadrant Housing (13). Make sure to scrap the applied sealant from the face of Quadrant housing and Cover.
4. Take out the rest of the assembly from inside the cover. Remove the O-Ring from Draft Control Shaft (12), replace the O-ring with new one.
5. Take the Circlip from Draft Control Shaft and remove the Lever Assy. Position Control (14). Check wear marks on roller. If there replace the roller with a new one.
6. Carefully inspect Draft Control Connector Link (15), Draft Control Link (16), Position control Link (17) after removing Circlip (18) with help of pliers, and check for cracks or wear marks on the actuating face where it hits the roller.
7. The installation procedure is inversely identical as the dis-assembly procedure.

D. CYLINDER DIS-ASSEMBLY

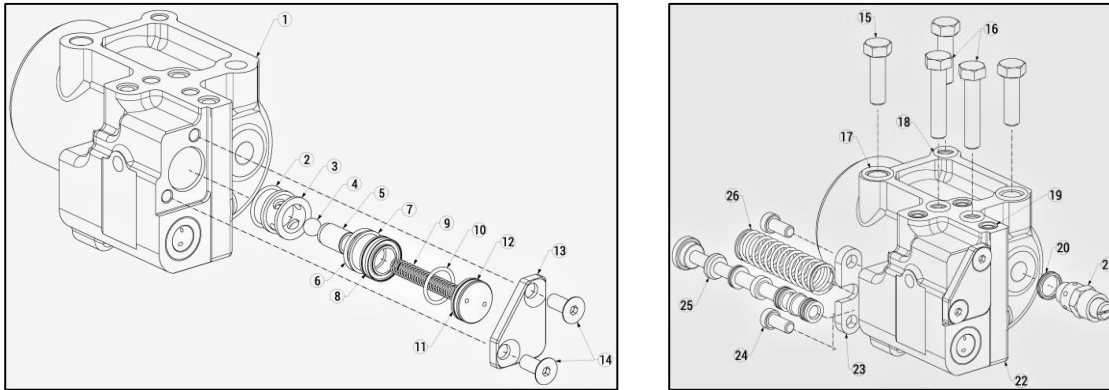


Figure 22
Cylinder DisAssembly

1	CYLINDER HYDRAULIC LIFT ASSEMBLY	14	SCREW M8x1.25x20 COUNTERSUNK
2	RING SEALING	15	BOLT M10X1.50X35-10.9 HEX (3 QTY.)
3	SEAT VALVE LOCKING BALL	16	BOLT M10x1.50x5010.9 HEX HEAD(2 QTY.)
4	BALL 10MM CHROMIUM STEEL	17	SEAL O RING 2.40x16.30 (2 QTY)
5	SEAT HYDRAULIC DISTRIBUTOR	18	SEAL O RING 2.50x11.00 (3 QTY.)
6	RING SEALING	19	SEAL O RING 0.364"x0.066" (3 QTY.)
7	INSERT HYDRAULIC DISTRIBUTOR	20	GASKET HYDRAULIC LIFT SAFETY VALVE
8	RING SEALING	21	VALVE ASSEMBLY HYDRAULIC LIFT SAFETY
9	SPRING VALVE LOCK	22	CYLINDER HYDRAULIC LIFT
10	RING SEALING	23	COVER HYD. DISTRIBUTOR BODY FRONT
11	PLUG HYDRAULIC LIFT UNLOAD VALVE	24	SCREW M8x125x18 ALLEN(2 QTY.)
12	RING SEALING	25	VALVE HYDRAULIC LIFT CONTROL
13	COVER HYD. DISTRIBUTOR BODY REAR	26	SPRING HYDRAULIC LIFT CONTROL VALVE

1. Fix the lift on a fixture and turn the lift upside down.
2. Rotate the position control lever to down position so that the spool is free. Locate the cylinder mounting bolts (5 qty.). Loosen the cylinder mounting bolts (15 & 16) using pneumatic gun.
3. Carefully remove the cylinder assembly (1) from Cover hydraulic lift.
4. Inspect the Seal O-Rings (17 & 18) on the groove of cover. If the seal appears squeezed replace with new ones. The seal at diagonal opposite to marked seal 17 is similar. Seal placed diagonally opposite to seal marked 18 are similar.
5. Inspect the Seal O-Ring (19) -3 Qty. inside the groove of Cylinder Assy. and replace with new ones.
6. Loosen the Cylinder Safety Valve (21) check for leakage.
7. Loosen Allen Screw (24) – 2 Qty. and take out the spool along with spring. Check for the easy sliding of spool on bushing inside cylinder. Check for burrs/cracks on face of bush and lands of spool.
8. At the rear of the cylinder unscrew the Screw (14) using Allan key. Take out the Rear Cover Plate (13).
9. Using needle nose plier pull the Unload Valve Plug (11), remove Sealing Ring (12) and replace it with new one. Pull out the Insert Hydraulic (7) and change O-Ring (2, 6, 8 & 10) with new one. Check for dust and sludge in the holes. The assembly procedure is inversely identical as the dis-assembly procedure.

OIL FLOW WHEN NEUTRAL

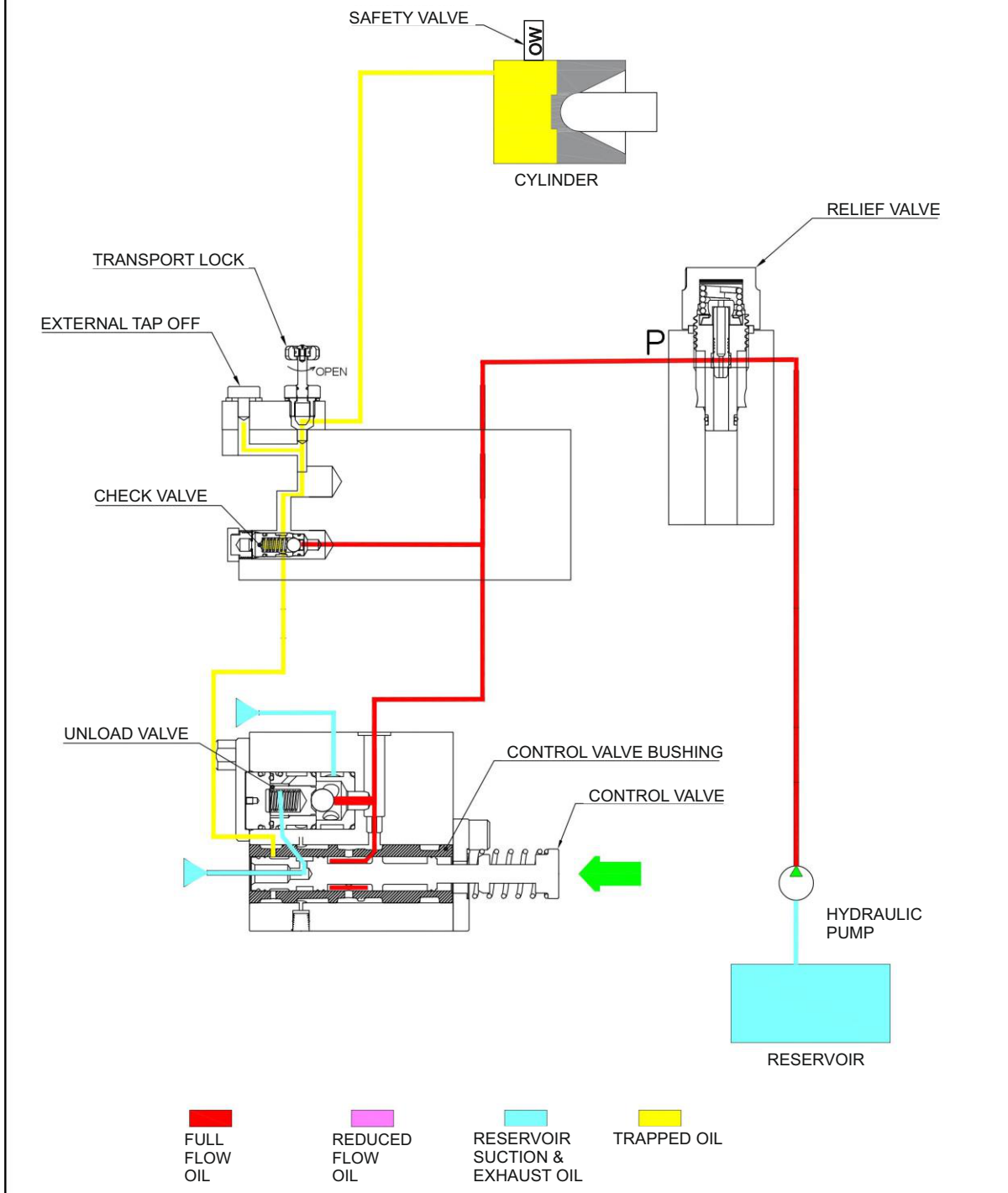


Figure 23
Oil Flow when Neutral

OIL FLOW WHEN NEUTRAL

In this pahse the control valve keeps pressure on the oil contained in the cylinder thus allowing the oil coming from the pump to flow freely to the tank.

In this phase the control valve is in such a position to connect chamber of unload valve directly to discharge.

The oil coming from the pump enter the relief valve, through the galleries in control valve bushing and control valve oil enters unload valve and pushes the ball and spring arrangement and gets discharged to the tank.

The oil contained in the cylinder is kept under pressure by the check valve and by safety valve connected to cylinder thus holding the load applied to the lifting arms.

The safety valve secures protection from any possible over-pressure during the implement movement.

OIL FLOW WHEN RAISING

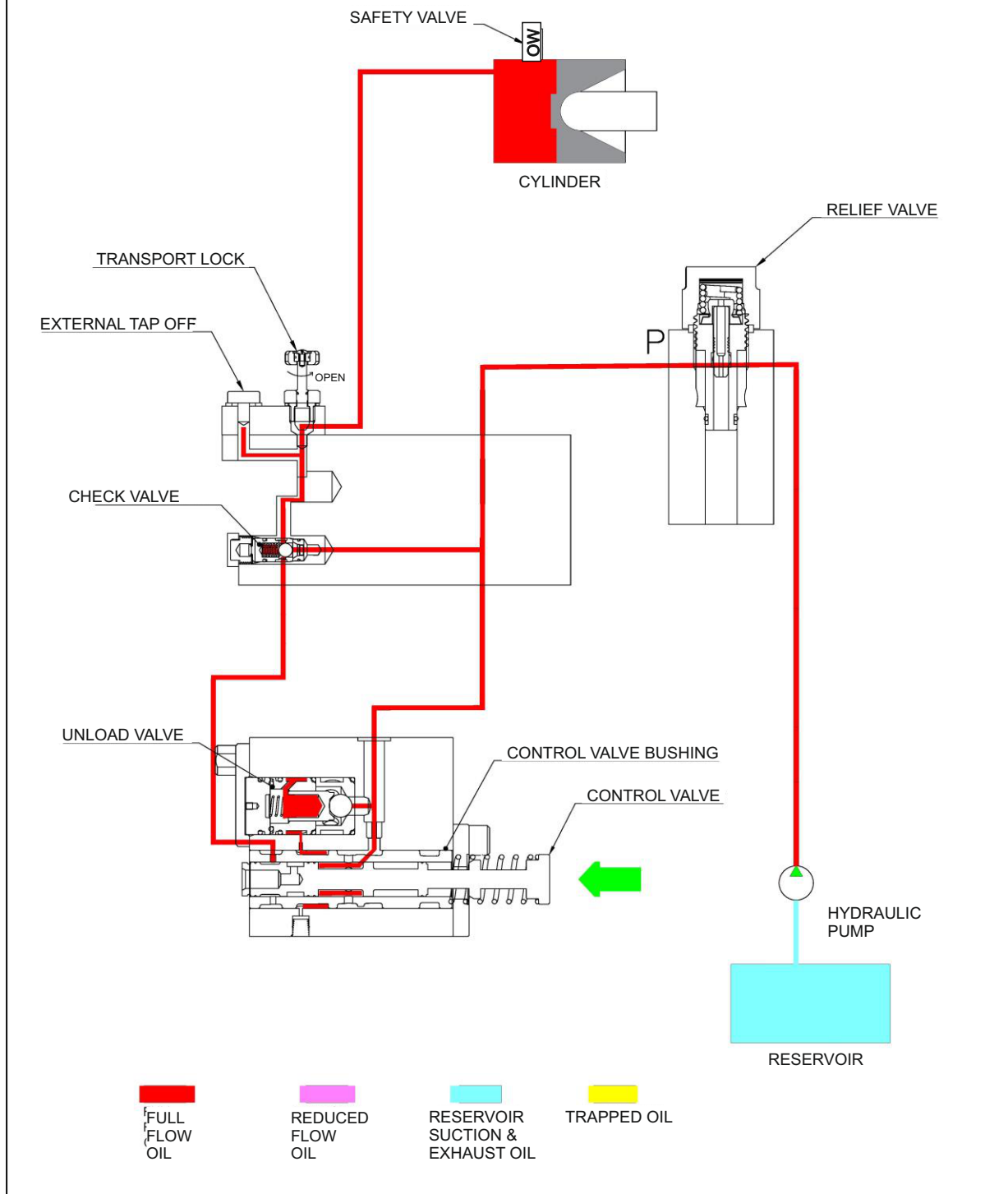


Figure 24
Oil Flow when Raising

OIL FLOW WHEN RAISING

During this phase the Control Valve supplies the oil under pressure to cylinder and it consequently lifts the arms.

The Control Valve is in such a position to connect chamber of Control Valve Bushing with unload valve. With the oil coming from pump through Control Valve Bushing making it's way to the unload valve itself to close.

The oil from pump finding the closed unload valve then goes to open check valve enters the cylinder.

The lifting depends on pump RPM.

In this phase the maximum lifting pressure is controlled by the relief valve that is connected in between oil inlet and Control Valves.

OIL FLOW WHEN LOWERING

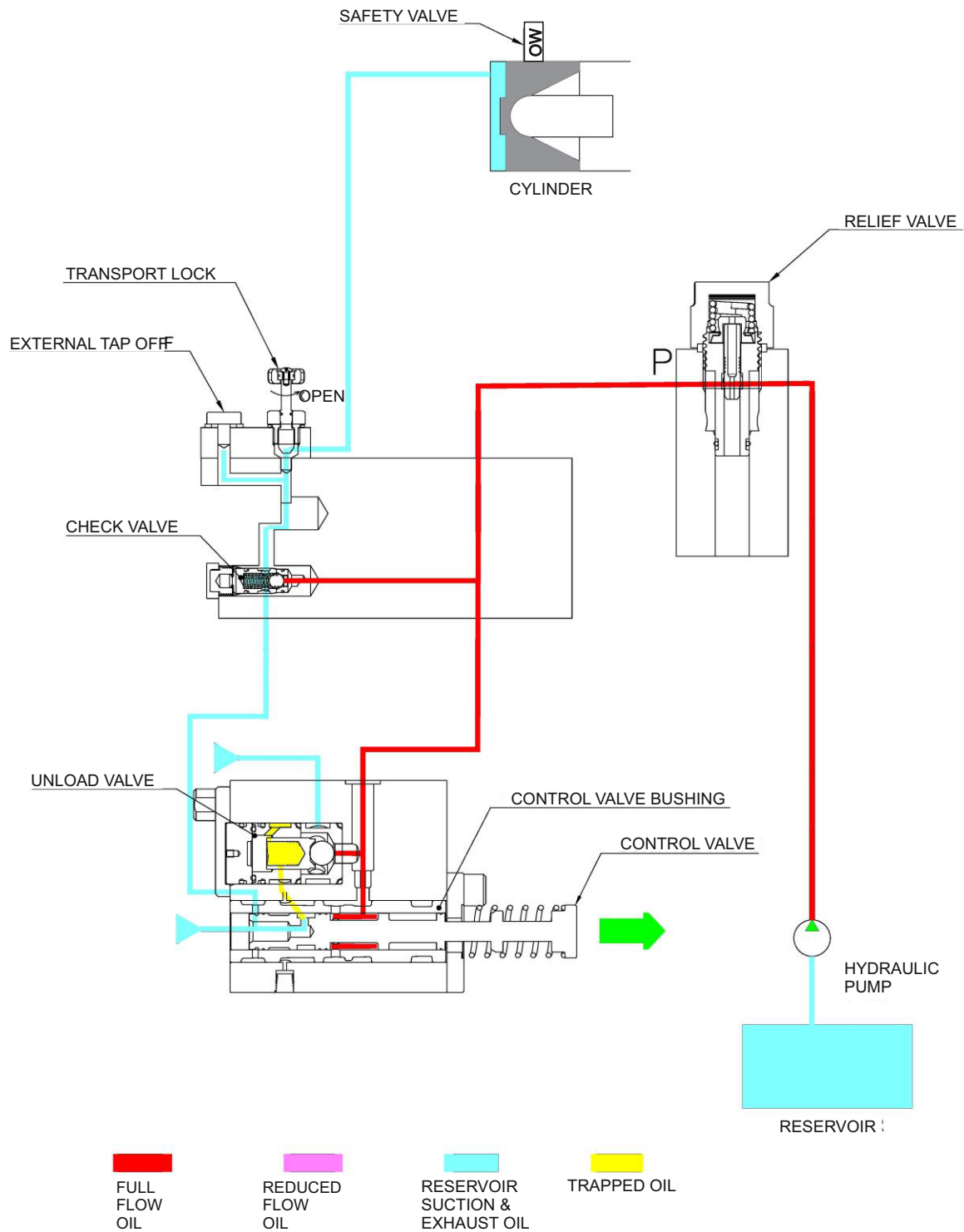


Figure 25
Oil Flow when Lowering

OIL FLOW WHEN LOWERING

During this phase the control valve supplies at the same time the oil coming from the pump and the oil contained in the cylinder to the discharge causing the lowering of the arms.

The Control Valve is in such a position to connect chamber of Cylinder directly to discharge.

The oil coming from the pump enters in the Control Valve Bushing is able to go to unload valve and gets trapped in Unload Valve.

At the same time the pressure oil contained in the cylinder flows to the tank therefore causing the lowering of arms.

PROBLEM	POSSIBLE CAUSES		REMEDY	
Failure to Lift Under All conditions	1.	Low oil level.	1.	Fill system with correct grade and quantity of oil.
	2.	Hydraulic piston pump not primed.	2.	Prime pump.
	3.	Hydraulic pump pressure low.	3.	Adjust pump pressure.
	4.	Check valve damaged or worn.	4.	Install new check valve ball and seat.
	5.	Draft or position control linkage damaged.	5.	Install new parts and adjust linkage.
	6.	Unload valve or back pressure valve faulty.	6.	Inspect and renew if necessary.
	7.	Lift piston seals damaged.	7.	Install new seals.
	8.	Unload valve plug worn.	8.	Install large size plug.
	9.	Lift cylinder, lift cover castings cracked or porous.	9.	Renew defective parts.
Failure to Lift Under Load	1.	Hydraulic pump pressure low.	1.	Adjust pump pressure.
	2.	Damaged "O" rings between lift cylinder and lift cover or between accessory cover and lift cover	2.	Install new "O" rings.
	3.	Damaged "O" rings on hydraulic pump pipes.	3.	Install new "O" rings.
	4.	Damaged lift cylinder safety valve.	4.	Install new valve.
	5.	Faulty lift piston seals.	5.	Install new seals.
	6.	Cracked, porous lift cylinder or lift cover casting.	6.	Renew defective parts.
Excessive Corrections in the raised or Transport Position	1.	Selector valve worn or damaged.	1.	Install larger size spool.
	2.	Unload valve workball or seat plug.	2.	Install larger size plug.
	3.	Lift cylinder safety valve damaged.	3.	Install new valve.
	4.	Faulty lift piston seals.	4.	Install new seals.
	5.	Control valve worn.	5.	Install new (or larger) valve.
	6.	Worn or damaged check valve.	6.	Install new ball and seat.



Escorts Kubota Limited

(Formerly Escorts Limited)

International Business Department

Plot No. 2 Sector-13, Faridabad - 121007, India

Phone : +91-0129-2575292/5507

E-mail: ekl_ex.internationalbusiness@escortskubota.com

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