Telma™

Friction Free Efficiency

Maintenance Manual

TL101009-FEB12

CONGRATULATIONS. Your vehicle is equipped with a TELMA Frictionless Braking System. Permanently connected to the driveline of your vehicle, it provides you with essential safety, cost effectiveness, accurate and reliable braking, and is ready to function under all circumstances. TELMA supplies your vehicle with an additional braking system that works along with your service brakes. You will benefit from improved braking resulting in increased safety and substantial savings on brakes, tires and route times.

Using your TELMA will reduce the use of the service brakes, which as a result, remain cool and fully effective for the occasions on which they are really needed – such as emergency stops. Read this guide before getting behind the wheel. It will tell you how to make the most of your TELMA.

CONTENTS

Foundation Brakes & TELMA

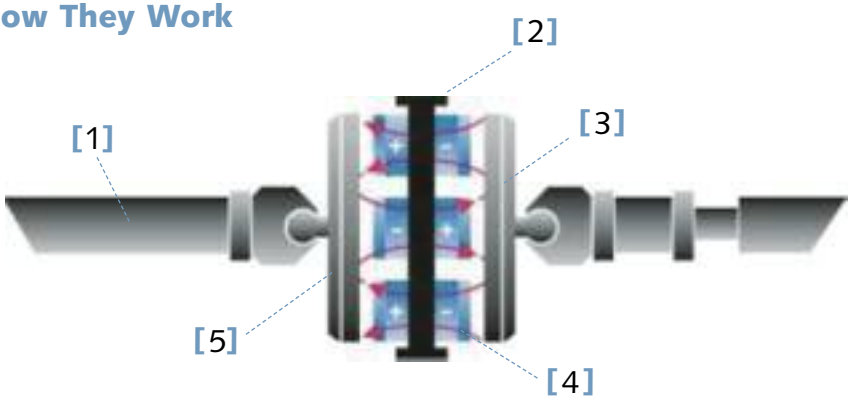
What are foundation brakes designed to do?

Stop the vehicle within a certain distance
Hold the vehicle in place when stopped

What is the TELMA designed to do?

Provide additional braking
Provide braking without wear
Provide braking without fade
Provide extended foundation brake life

How They Work



- The TELMA is permanently connected to the drive shaft [1].
- The TELMA contains two rotating discs called rotors [3] and a stationary component called the stator [2]. The rotors rotate at the same speed as the drive shaft. The stator is mounted between the two rotors and has eight coils [4].
- When the TELMA is activated, current flows through the coils which induces a magnetic field that passes through the rotors. This magnetic field produces "eddy currents" within the rotors which slows the motion of the drive shaft, thus decelerating the vehicle. There is no physical contact (friction) within the TELMA and, therefore, no wear.
- The system is configured so that it will be applied gradually in four stages. The four stages reflect 25%, 50%, 75% and 100% of TELMA power that is applied.
- The system is air-cooled. The heat generated by the rotors is dissipated directly to the air through the rotor vanes [5], therefore the system is said to be self-regulating (the heat absorbed equals the heat dissipated).

Types of TELMA Mounts

There are two types of TELMAs: a driveline mount and a focal mount. There is no difference in their operation; the difference is where the TELMA is mounted. The driveline unit is mounted within the driveline, between the transmission and the rear axle. The focal is mounted directly to the rear axle.

Driveline Mount Focal Mount

Air Brake Foot Control

Pressure Switches

The pressure switches are activated when the brake pedal is applied. Each pressure switch assembly contains four switches, two in each side of the manifold. These switches are factory calibrated to trigger at 3, 5, 7 and 10 psi of brake pedal pressure. The air supplied to the pressure switch is connected directly to the braking system primary delivery line. The electrical connection is made to the main TELMA wiring harness.

Pressure Transducer

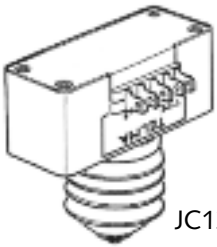
The air pressure transducer is connected to the primary delivery line of the braking system to activate the retarder. The pressure transducer outputs an analog (variable voltage) signal that can only be used with the Telma Control Module (TRCM). Each stage of the Telma can be activated at different pressures through the TRCM configuration software.

Air Switch Manifold (TID11012)

Air Pressure Transducer (TIG31065)

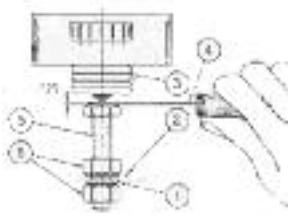
NOTE: TRCM is required to use the TIG31065.

Mechanical switch for hydraulic brake foot control



JC120102

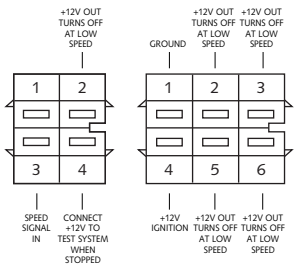
Plunger Type Foot Switch



Foot Switch Adjustment

The TELMA hydraulic brake foot switch has four levels of activation based on brake pedal position. The foot switch should be carefully adjusted to avoid switch damage and optimize retarder activation in the free play of the brake pedal. The foot switch adjustment diagram shows the foot switch plunger [3] fully engaged and the brake pedal disengaged. Position a feeler gauge [4] between the switch stop [5] and the plunger and adjust the switch stop until there is 1/8" (0.125") gap. Be sure that there is a lock washer [1] positioned between the jam nuts [6] and the pedal bracket [2] to ensure proper securing of the assembly.

Speed Switch



Speed Switch Wiring Diagram

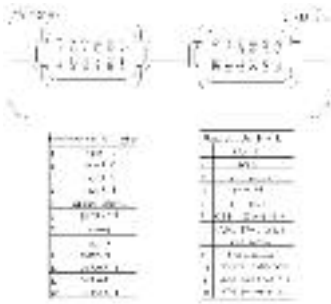
Speed Switch

The TELMA speed switch can be used with hand control in some light truck applications to automatically turn off the TELMA when the vehicle comes to a stop or the vehicle speed drops below approximately 2 mph. There are two versions of the speed switch available and can be distinguished by the part number printed on the exterior of the box. Part number JC251100 is designed for speed signals with output higher than 3.5 volts such as Allison World transmissions. Part number JC251101 is for use when speed signals are less than 3.5 volt output such magnetic pickup sensors in manual transmissions and Allison AT, MT, HT automatic transmissions.

Outputs from the speed switch are connected to:

- Air brake pressure switch C terminal
- Hydraulic foot switch pin C
- Hand control pin 5

Telma Control Module (TRCM)

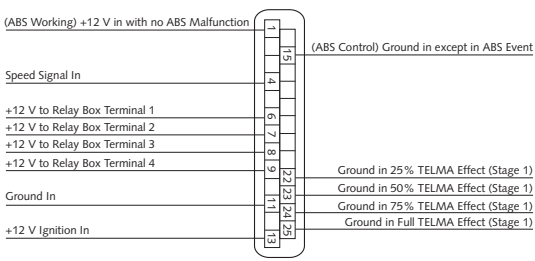


TRCM Pin Layout

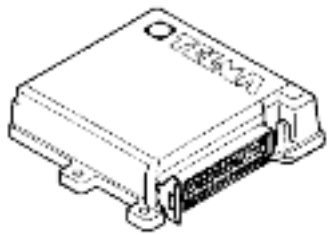
TIG31062

The TRCM is a new control module with modernized architecture and features such as PC interface for diagnostics and configuration as well as the ability to obtain speed, ABS, and other information by listening to the vehicle CAN bus.

ABS Interface



ABS Wiring Harness Connections



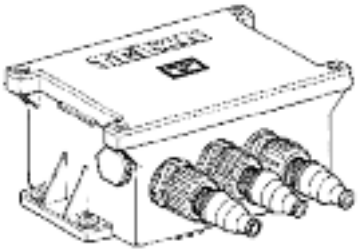
ABS Interface

NOTE: ABS Interface is no longer available, refer to TL105089 for more information.

The TELMA system is equipped with an electronic interface designed to work with your vehicle's Anti-Lock Braking System (ABS). During an ABS event (an ABS event is defined as any wheel lock-up) the TELMA will automatically turn off, allowing the ABS to control the brakes without interference from TELMA. After the ABS event, the TELMA will reactivate progressively to assure proper braking. There are two versions of the ABS Interface available and can be distinguished by the part number printed on the exterior of the box. Part number JC241105 is designed for speed signals with output higher than 3.5 volts such as Allison World transmissions. Part number JC251103 is for use when speed signals are less than 3.5 volt output such as magnetic pickup sensors in manual transmissions and Allison AT, MT, HT automatic transmissions.

NOTE:
If the vehicle's ABS warning light remains on, the TELMA may not operate. When the ABS warning light is on, there is a problem with the ABS. The ABS must be serviced before the TELMA will operate. Refer to TL105089 for more information about the ABS Interface.

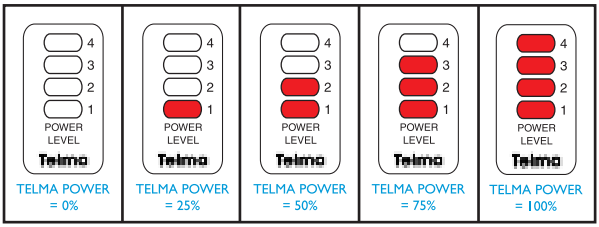
Relay Box



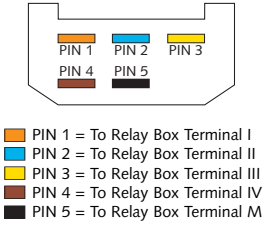
The relay box is a high strength thermoplastic enclosure that contains four relays mounted on a black plastic chassis. The box measures approximately 7-1/2" x 4-3/4" x 4". Please refer to the wiring diagram section of this manual for complete terminal connections. The relay box distributes battery power to the TELMA in four stages, and is usually mounted on the frame rail between the batteries and the TELMA. Battery power is connected to the relay assembly at the "+" terminal. When voltage is applied to terminals 1, 2, 3 and 4, their respective relays close. This switches battery power to terminals I, II, III and IV respectively. The "M" terminal is to ground the relay assembly and dissipate the reverse voltage spike that occurs when each stage is deactivated. The "S" terminal receives battery power whenever any relay is closed. The relay box should always mount in a vertical position with the wiring coming out of the bottom.

Dashboard Indicator

A dashboard indicator is the driver's main indication of the TELMA's function. This indicator contains four separate lights within the display that are connected directly to the relay outputs which illuminate as the unit is activated. Each light corresponds to one of the four stages of the unit. The lights will illuminate in succession as the TELMA is being activated.



Dashboard Indicator



Wiring Connections

IMPORTANT! The lights indicate that the TELMA is operating. They should never illuminate when the vehicle is stopped or when the brakes are not applied. If this occurs discontinue operation and drive the vehicle to the maintenance facility for immediate repair.

CONTROLS

The TELMA Frictionless Braking System contains several components that the driver needs to understand in order to operate the vehicle safely and effectively. Listed below are the major components and their function within the TELMA system. The TELMA system may be activated by several different methods. It may be necessary to determine which type of controls your vehicle is equipped with.

Brake Pedal

Brake Pedal Application (Foot Control)

This type of control should be used in urban stop-and-go type applications and where automatic TELMA activation is desired. The TELMA activates automatically when the brake pedal is applied. It is integrated into the vehicle braking system (air or hydraulic), and will function as the brake pedal is depressed. Slight pressure on the brake pedal gradually applies the TELMA. The TELMA activates before the service brakes are applied.

Hand Control

This type of control is used for mountainous applications where TELMA activation on long downgrades independent of the brake pedal is desired. The hand control may be mounted either on the steering column or built into the dashboard. To activate the TELMA, simply move the hand lever to one of the four powered positions:

Position 0: TELMA Power OFF
Position 1: 25% TELMA Power
Position 2: 50% TELMA Power
Position 3: 75% TELMA Power
Position 4: 100% TELMA Power

Hand Control

IMPORTANT! The hand control does not automatically turn off at low speeds. Do not forget to reset the lever to Position 0 when the vehicle is stationary or when the TELMA is no longer required.

Off-Throttle Control

Off-throttle control allows the TELMA to be automatically engaged when the driver lets off the accelerator pedal. Either one or two stages can be activated in this manner and the remaining stages activated by the brake pedal. This type of control is usually combined with brake pedal application. A hand control switch can also be used to select the number of TELMA stages that will activate when the accelerator pedal is released.

The TELMA is a very low maintenance device. However, there are several general maintenance procedures that can improve the life and performance of your TELMA.

Routine Maintenance Checklist

It is recommended that the TELMA maintenance checklist be incorporated into the regular vehicle maintenance schedule. The maintenance intervals may vary depending upon the severity of operation and the annual mileage of the vehicle. The following maintenance schedule is recommended:

	At	Every	Every
MILES	3,000	12,500	40,000
HOURS	300	1,200	3,600
Grease TELMA (Driveline Mount) *NOTE: TELMA's sealed grease fittings do not require greasing.*			✓
Check End Play in Rotor and Stator	✓	✓	✓
Check Air Gap Measurement	✓	✓	✓
Check Grease Seal (Driveline Mount)		✓	✓
Check Axle Pinion Seal (Focal Mount)		✓	✓
Check Fastener Tightness – Driveline and Brackets	✓	✓	✓
Check Condition on Rubber (Shock) Mounts			✓
Verify Grounds and Wiring Condition	✓	✓	✓
Check Relay Box Function	✓	✓	✓
Check Relay Box Contacts and Terminal Condition		✓	✓
Verify Retarder Amperage			✓
Check Hydraulic Brake Foot Pedal Adjustment	✓	✓	✓
Verify Dashboard Indicator Light Function	✓	✓	✓
Verify that the TELMA Disengages When Vehicle Stops	✓	✓	✓

IMPORTANT! In the case of any abnormalities, consult your TELMA distributor or the factory as soon as possible for assistance in the maintenance of your vehicle.

Washing

Driveline Units

Focal Units

The TELMA should be pressure washed periodically. Visually inspect the unit to verify that it is clean and free of debris. If washing is necessary, please follow these guidelines:

- Maximum pressure = 360 psi.
- Maximum temperature = 180° F.
- Keep washer tip at least 10" from the TELMA at all times.
- Coils should not be subjected to continuous direct pressure.
- Concentrate the stream on the rotors and air gap locations (as shown above).
- Do not wash the unit immediately after use.
- Do not use detergents or degreasing agents.
- Do not wash the unit if it is not necessary.

Air Gap Verification

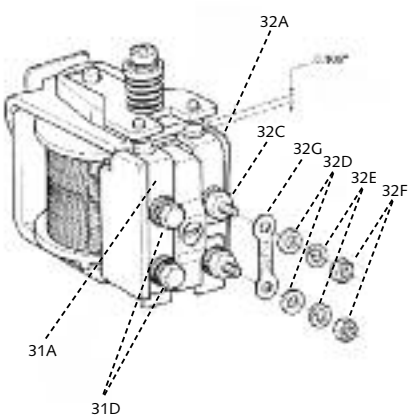
The air gap distance between the rotors and the pole shoes is very important in the proper functioning of the TELMA. If the air gaps are too large, the unit will not provide the driver with the full braking power and efficiency that the TELMA is capable of. If the air gaps are too small, the rotors may interfere with the pole shoes and lead to unnecessary wear and premature failure of the TELMA or its components. The following checks should only be performed when the TELMA is cool. To verify the air gaps, use a feeler gauge to check clearances between the rotor and pole shoes at four points on each rotor. Refer to the individual TELMA data sheet for correct air gap spacing.

Driveline Units

Focal Units

Important Notes About Grounding the System

- A defective TELMA ground can cause poor performance.
- A defective relay box ground can cause relay and dashboard light failure.
- All ground circuits must return to battery negative with the correct wire size.
- Relay box ground wire size must be:
  - _____minimum 10 gauge for TELMAs up to 20 amps per stage.
  - _____minimum 8 gauge for TELMAs up to 45 amps per stage.
  - _____minimum 6 gauge for TELMAs above 45 amps per stage.
- TELMA ground wire size must be:
  - _____minimum 4 gauge for TELMAs up to 20 amps per stage.
  - _____minimum 2 gauge for TELMAs up to 45 amps per stage.
  - _____minimum 00 gauge for TELMAs above 45 amps per stage.
- All ground points must be attached to a bare metal surface.



Relay Box Contacts

Contact Replacement & Adjustment

Long fixed contact without fuse (31A)

- Remove the two screws (31D) to replace the long fixed contact (31A) without fuse on the left.
- Replace the contact and reinstall the screws.
- Adjust the contact until there is a gap of 0.106". Tighten the screws (31D).

Short fixed contact with fuse (32A)

- Remove the nut (32F), washers (32D and 32E) and the fuse (32G).
- Replace the contact and reinstall fasteners.
- Adjust the contact until there is a gap of 0.106". Tighten the nut (32F).

Note: Replace contacts whenever they become pitted or burned. Always replace moving and fixed contacts as a complete set.

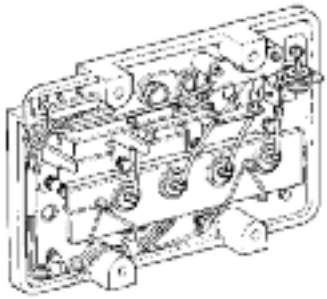
Fuse Replacement

A spare fuse is located on the lower screw on the left side (not shown).

- Loosen the nuts (32F)
- Remove all hardware (32D and 32E) and replace the fuse
- Reinstall hardware and adjust the contact until there is a gap of 0.106"
- Tighten the nuts.

Note: The fuse should only fail if there is a short circuit. Check the wiring or retarder for a short before installing a new fuse.

Relay Box Diodes



Rear view of relay card assembly in JD331121

A set of four protective diodes is installed on the underside of the relay assembly. These diodes protect the relays from reverse voltage spikes and arcing that occurs when the TELMA is deactivated. Severe contact burning and repeated dashboard indicator light failure suggests that one of these diodes may have failed or the relay box is not grounded correctly.

Amperage Check

If a noticeable reduction in the TELMA braking force is reported, it may be necessary to check the amperage draw and resistance to verify that the TELMA is operating correctly. Record the results in the chart provided on the next page. A procedure to check this amperage draw follows:

Tools Needed:

Inductive clamp-on ammeter 0-400 amps

- Clamp the ammeter around the main power cable connected to the "+" terminal of the relay box.
- Start engine and run at fast idle if equipped.
- Close each relay individually and record the amps and voltage.
- Amp value for each stage should be similar to each other and close to the published specifications for your retarder.
- If there is a wide variance between stages, check the condition of the relay contacts and the wiring connections.
- If amps for all stages are similar but too low, check the main retarder ground connection as well as all other wiring connections.
- If the amps are zero for one or more stages, check for a blown relay fuse. A blown fuse indicates a short circuit in the wiring or retarder. Diagnose and repair before replacing the fuse.
- Refer to retarder technical data sheet for amperage specifications.

Note: Refer to your retarder technical data sheet for proper amperage value and note any variance from the nominal temperature (68° F).

Resistance Check

Tools Needed:

Digital ohmmeter with a 0.01 ohm accuracy on a scale of 0-3 ohms

- Disconnect the TELMA from the relay box terminals (I, II, III, IV).
- Connect the ohmmeter with one lead on one terminal of the connecting block and the other lead on the TELMA ground stud. Read each resistance and note each abnormal stage compared with the values indicated on the specification sheet for driveline or focal units.
- Connect the ohmmeter to position 1 and 2; 1 and 3; 1 and 4; 2 and 3; 2 and 4; and 3 and 4 of the TELMA. In each case, you should read a resistance value corresponding to the sum of the stages measured in the previous step. This procedure determines if the stages of the TELMA are shorted. If they are shorted, trace the short and replace the damaged wires.
- Now that the defective stages of the TELMA have been identified, disconnect all the coils associated with these stages and check individually the resistance of each coil.

Note: Refer to technical characteristics sheet OC441210 (consult www.telmausa.com) for proper resistance value and note any variance from the nominal temperature (68° F).

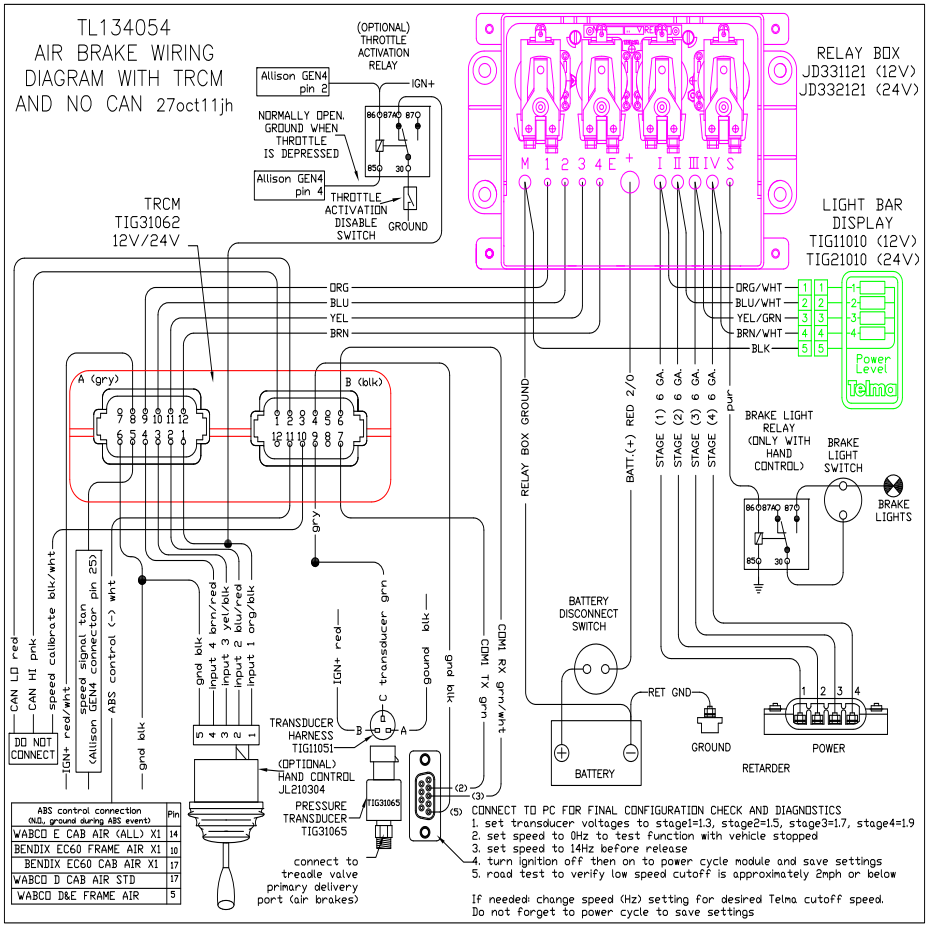
- Change all defective coils (see coil replacement section of this manual).
- Check the resistance per stage (as mentioned above).
- Repair the TELMA and relay box in case of any damage.
- Finally, check all amperage draws according to the technical characteristics sheet 0C441210.

Chart of Check Results

	Resistance (Ω)	Current Draw (A)	Voltage (V)	Observation (current drop, voltage drop or anomaly)
Resistance of the ohmmeter wires				
Theoretical values per circuit				
Stage 1				
Stage 2				
Stage 3				
Stage 4				

Universal Wiring Diagram

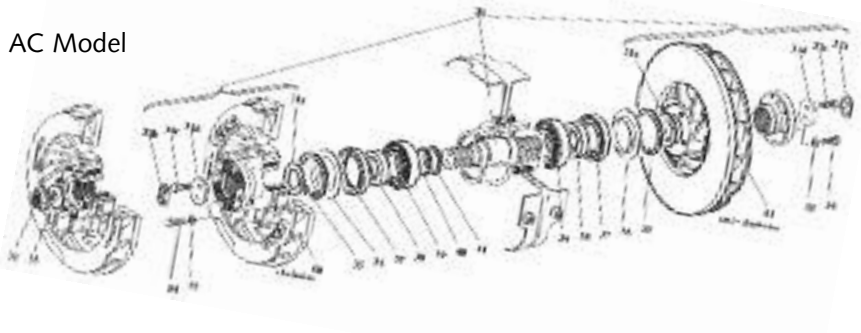
The following wiring diagram is Telma's universal air brake diagram. This diagram may not be fully applicable to your vehicle; it is for reference use only. Please contact your TELMA distributor or the factory to obtain a wiring diagram that fully describes your system. Go to www.telmausa.com for additional diagrams.



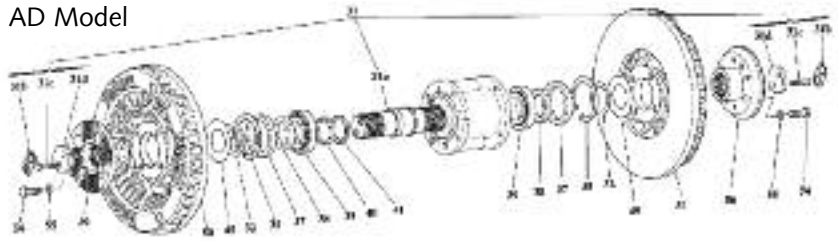
Note: Above diagram for reference only,
please download latest wiring diagrams from www.telmausa.com

Driveline Component Parts

AC Model



AD Model



Item	Description	Qty.
▲ 31	Shaft assembly, including:	1
▲ 31a	Shaft with countersunk holes	1
●▲ 31b	Tab washer	2
●▲ 31c	Shaft end screw	4
▲ 31d	Plate	2
●▲ 32	Set of air-gap adjusting shims	1
●▲ 35	Snap ring for bore	2
●▲ 37	Double lip seal kit	1
●▲ 38	Spacer ring	2
▲ 39	Tapered roller bearing	2
▲ 40	Set of bearing adjustment shims	1
41	Spacer ring	1
▲ 45	Dust cover	2
50	Clockwise rotor	1
51	Anti-clockwise rotor	
54	Coupling flange securing screw to rotor	8
55	Spring washer for flange securing screw	8
56	Coupling flange	2
▲ 57	Hub Assembly	1

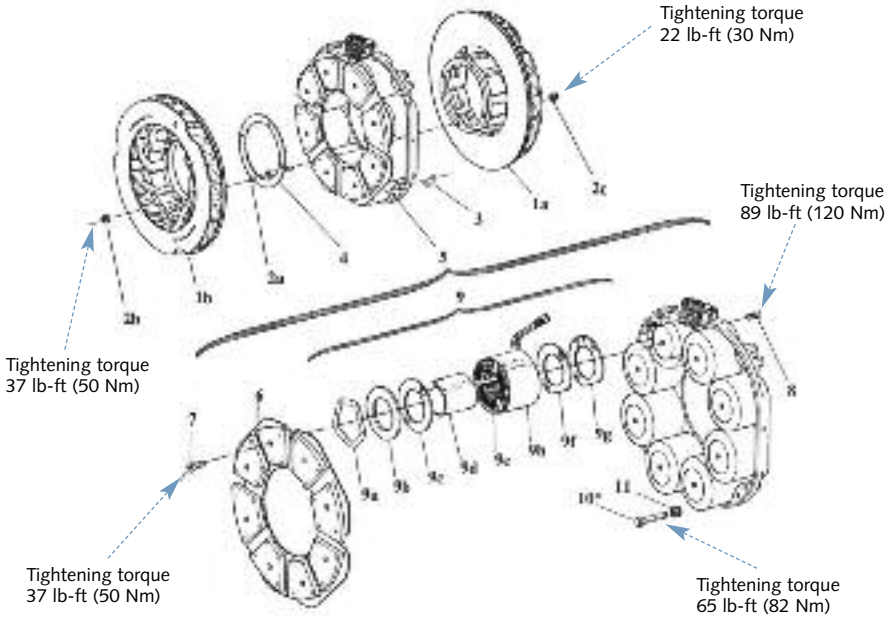
▲ = Included or pre-installed in Item 57 Hub Assembly

● = Included in Item 37 Double lip seal kit

(Item 37 and 57 supplied 1 per retarder)

For further reference see: OC443014 AD, OC443013 AC and OC443001 Focal Spare Parts Catalogs

Focal Component Parts



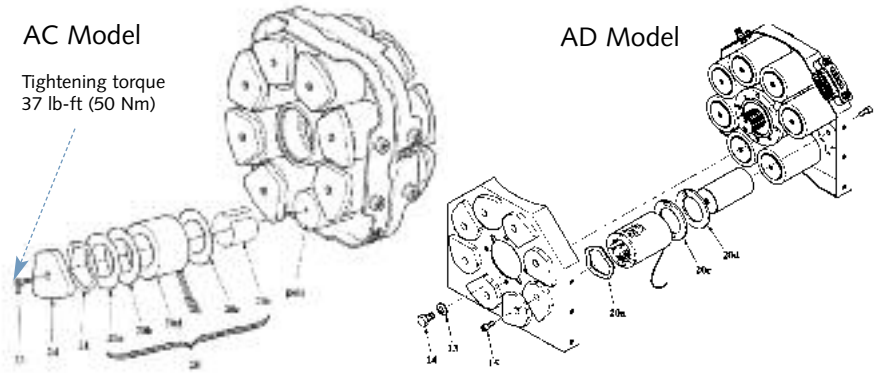
Item	Description	Qty.
1	Balanced rotor assembly, including:	1
1a	Clockwise rotor	1
1b	Counterclockwise rotor	1
2	Set of rotor fasteners, including:	1
2a	Shoulder studs	4 or 8*
2b/2c	All metal lock nuts	8 or 16*
3	Set of stator air-gap adjusting shims	1
4	Set of rotor air-gap adjusting shims	1
5	Stator assembly	1
6	Pole shoe plate	1
7	Socket cap screw M10 x 1.5	8
8	90° countersunk screw M14 x 2	8
9	Coil assembly, including:	8
9a	Pressure washer	1
9b	Coil end protective cover	1
9c	Upper coil end insulator	1
9d	Pole insulator	1
9e	Impregnated coil	1
9f	Lower coil insulator	1
9g	Protective washer	1
9h	External protective sleeve	1
10	Stator securing screw	8
11	Trep washer	8

*Consult www.telmausa.com for quantity needed for specific model number.

For further reference see: OC443014 AD, OC443013 AC and OC443001 Focal Spare Parts Catalogs

Driveline Coil Replacement

The following procedure will instruct the technician on how to replace a faulty coil. The identification of the faulty circuit may be carried out on the vehicle by means of the electrical check procedure. The TELMA should be removed from the vehicle to replace a coil.



1. Removing a damaged coil:

- Remove the cover of the junction block which corresponds to the faulty coil.
- Disconnect the faulty coil after having carefully marked the position of each wire (red and blue sleeves).
- Remove the pole shoe securing screw (23).
- Remove the pole shoe (24), the pressure washer (21) and the faulty coil or coil assembly (20).

2. Cleaning the stator:

- Remove all traces of varnish, insulating material, Araldite and corrosion from the pole, the pole shoe and the stator.

3. Fitting the new coil:

- Take the pole insulator (20c) and position it around the pole.
- Fit the new coil over the pole and pole insulator.
- Position the upper coil end insulator (20b), the stainless protective washer (20a) and the pressure washer (21) over the pole and coil.
- Secure the pole shoe (24) with the screw (23).
- Check to see that the coil does not rotate. If the coil does rotate, disassemble to the pressure washer and add an additional pressure washer and reassemble to lock the coil into place.
- Reconnect the coil wires to the terminals during disassembly (red and blue sleeves).
- Install the contact washers (6 mm diameter) and tighten the M6 nuts to 3.7 lb-ft (5 Nm).
- To protect the connecting and junction block terminal against corrosion use a dielectric grease or an automotive electrical connection sealant.
- Refit the cover of the junction block, the locking tab and the nut to 3 lb-ft (4 Nm).
- Deform the locking tab to avoid rotation of the nut.

Focal Coil Replacement

Please refer to the diagram on the previous page.

1. Removing a damaged coil:

- Mark the position of the pole shoe plate (6) with regard to the connecting block of the stator.
- Unlock the eight socket cap screws (7) and remove the pole shoe plate.
- Cut the internal wiring as close as possible to the coil terminal.
- Unlock and remove the countersunk screw (8) which secures the pole and coil assembly to the stator housing.
- Mark the position of the pole with regard to the housing in order to refit it in its original position, and remove the pole and coil assembly.
- Separate the coil from the pole by using a press.

2. Cleaning the stator:

- Remove all traces of varnish, insulating material, Araldite and corrosion from the pole, the pole shoe and the stator.
- Reassemble the pole on the stator in its genuine position using the new screw (8), tightening torque = 89 lb-ft (120 Nm).
- Paint protective varnish, part no. VH 510 440, red color, on the inner side of the stator housing.

3. Fitting the new coil:

- The repair coil assemblies of the present generation are fitted with crimp connectors and can be connected directly.
- Prior to the crimping of the crimp connector, remove the insulating varnish from approximately 0.20" (5 mm) of the coil wire.
- Fit the coil end insulation washer (9f) and the pole insulator (9d) around the pole.
- Install the coil over the pole.
- Position the upper coil end insulator (9c), if necessary.
- Next, fit the stainless protective cover (9b) and the pressure washer (9a) over the coil and pole.
- Relocate the pole shoe plate (6) in its original position and secure it with new screws (7), tightening torque = 37 lb-ft (50 Nm).
- Slide a VITON sleeve on both wires of the new coil.
- Remove approximately 0.20" (5 mm) from the ends of the connecting wires.
- Follow the marks made during the disassembly process and install the ends of the connecting wires inside the crimp connectors of the coil and crimp the connector.
- Slide the VITON sleeve over the connector and heat shrink it.
- Using a brush, liberally coat these connections with varnish, part no. VH 510 440, red color.
- Depending on the type of wiring protection (sealed or impregnated), bond the terminal connections with silicone compound, part no. VH 510 130 or clamp them with the small cable securing plates.

WARRANTY

Telma warrants to customers that the product shall be free from defects in materials and workmanship and will confirm to applicable specifications. TRI shall, at its option, repair correct or replace any product or part thereof which is defective in workmanship of material: provided, however, that TRI is given prompt written notice of any failure (setting forth the alleged defect and pertinent delivery dates showing that the product is covered under the warranty) occurring within the lesser of a) two (2) years after the date of delivery to the first user of OEM product into which the product is installed of b) thirty (30) months from original delivery of the product. This Warranty does not cover a product or component thereof which fails, malfunctions or is damaged as a result of (i) improper installation, modification or repair, (ii) accident, abuse or improper or insufficient maintenance including deviation from approved lubricants or change intervals. In addition, this warranty does not cover normal wear and tear. This Warranty does not apply to products of components thereof not manufactured or supplied by TRI or to products of components thereof on vehicles operated outside the United States, Canada and Mexico. The warranty period for repairs or replacements is limited to the greater of 1) three (3) months or twenty-four thousand (24,000) miles, whichever shall occur first or 2) the expiration of date of the original warranty. THE EXPRESSED WARRANTIES HEREIN ARE IN LIEU OF ALL OTHER WARRANTIES, GUARANTEES, PROMISES, AFFIRMATIONS OR REPRESENTATIONS, EXPRESSED OR IMPLIED, INCLUDING, WITHOUT LIMITATION, WARRANTIES OF MERCHANTABILITY AND FITNESS FOR ANY PARTICULAR PURPOSE OR USE. TELMA SHALL NOT BE LIABLE FOR ANY INCIDENTAL, COLLATERAL, SPECIAL OR CONSEQUENTIAL LOSS, DAMAGE OR INJURY OF ANY NATURE INCLUDING, WITHOUT LIMITATION, SALES OR USE OF THE PRODUCTS WHETHER OR NOT OCCASIONED BY TELMA'S NEGLIGENCE OR OTHERWISE.

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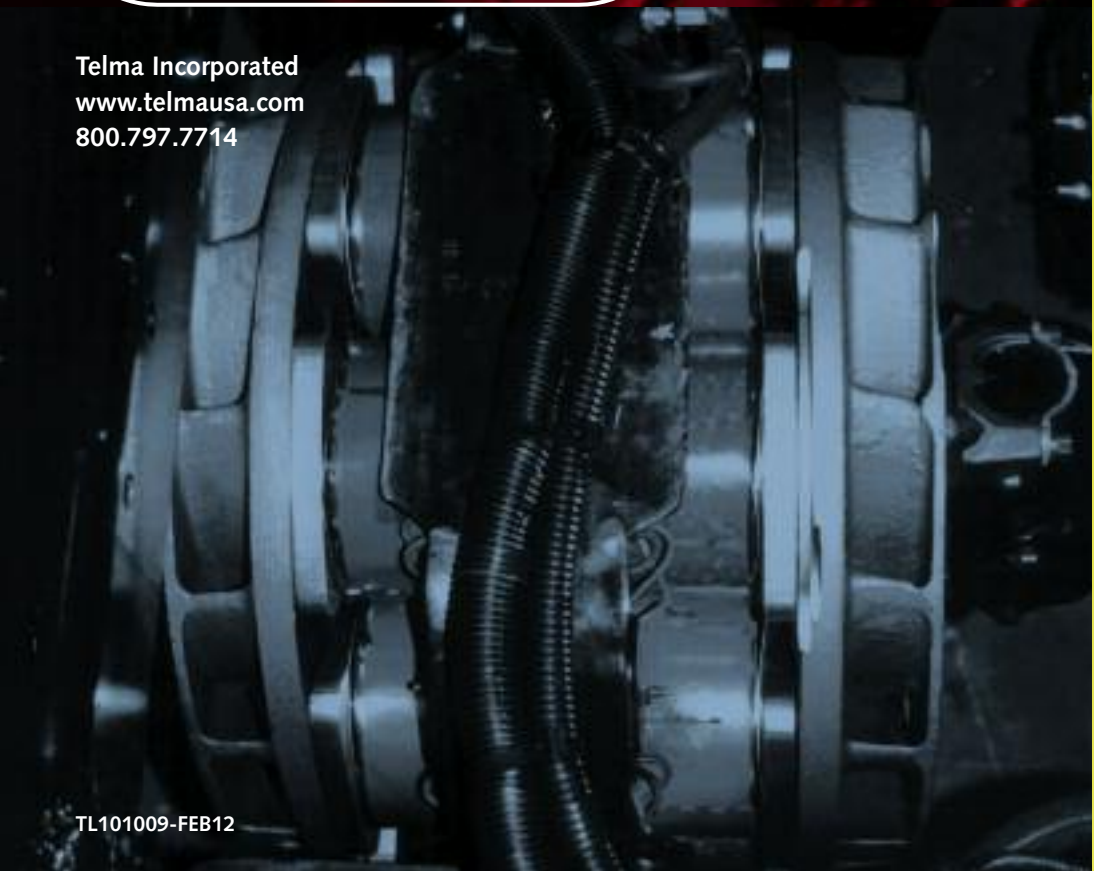

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