
Table of Contents

E83 Chassis Dynamics

Subject	Page
Purpose of the System	3
E83 Chassis Dynamics	3
System Components	3
Front Axle	3
Mechanical Components	4
Technical Data	4
Workshop Hints	5
Alignment and Camber Adjustment	5
Strut Replacement	5
Spring Replacement	5
Reinforcement Plate	5
Rear Axle	5
Technical Data	6
Workshop Hints	6
Adjustment of Rear Wheel Alignment	6
Lowering (removing) the Rear Axle	6
Brakes	7
Mechanical Components	7
Hydraulic Unit with Vacuum Brake Booster and DSC Hydraulic Module	8
Foot Controls with Brake and Clutch Pedals	8
Parking Handbrake Lever, ASZE, Cables and Duo-Servo Brakes. .	8
Workshop Hints	8
Changing Cables	8
Steering	9
Wheels and Tires	10
Tire Deflation Warning (RDW)	11

Chassis Dynamics

Model: E83

Production: Start of Production MY 2004

OBJECTIVES

After completion of this module you will be able to:

- Visually identify the suspension components that are unique to the E83
- Describe the steering system mechanical/hydraulic components
- Demonstrate how to access, remove and install the spare wheel
- Explain how to initialize RDW

Purpose of the System

E83 Chassis Dynamics

As with all BMW vehicles, the X3 chassis and suspension was designed with particular emphasis on driving pleasure, dynamics and favorable handling.

The main aim in the full development of the X3 was to achieve:

- Agility on the road
- Driving dynamics
- Stability
- Traction

The front axle is a double joint spring strut axle with tension arms and a rack and pinion steering system with hydraulic power assist. Conventional rack and pinion power steering is installed to the E83 as standard. Servotronic is available as an option. Spring struts with coil springs and twin tube gas-pressure dampers are used on the front axle. It is similar the front axle of the E53.

The rear axle design is based on the E46/16 with barrel springs and separate twin tube gas-pressure dampers.

The brake system is a hydraulic dual-circuit brake system with "front/rear split" vacuum boost power assist and EBV. The parking brake actuating unit is located in the center console and is equipped with an automatic cable adjuster (ASZE) and a compensating element.

Several different wheel and tire combinations are available for the E83. The spare wheel (steel) is located in a special bracket under the luggage compartment floor in the rear. The tire deflation warning (RDW) is a standard feature on the E83.

System Components

Front Axle

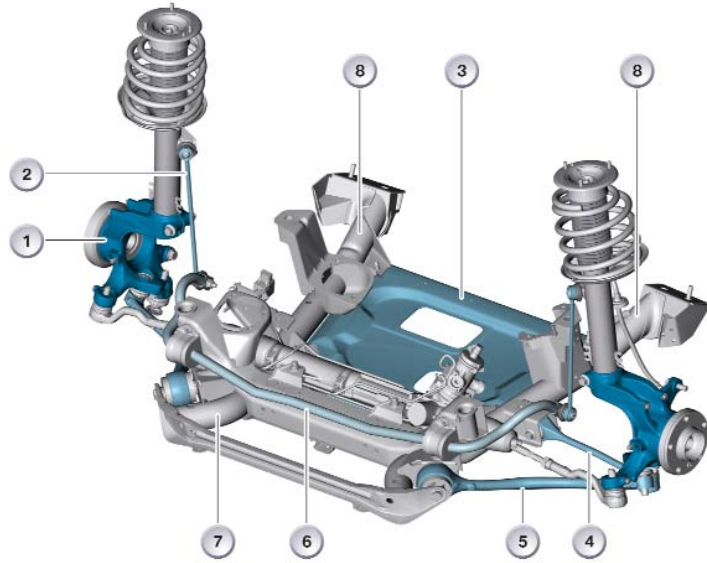
Specific components in the E83 (subject to additional load) are designed as forged steel parts.

- Control arms: forged steel with rubber mount
- Tension arms: forged steel with hydraulic bushing
- Swivel bearing: forged steel, track arm forged on

A reinforcement plate (thrust panel) is bolted to the front axle carrier. This makes a contribution to the rigidity of the front structure and suspension. There are two recesses in this thrust zone for accessibility to the engine oil drain plug (rectangular recess on 6 cylinder engines).

Mechanical Components

1. Swivel bearing
2. Anti-roll bar link (attached to strut tube)
3. Thrust panel
4. Control arm
5. Tension arm
6. Anti-roll bar
7. Front axle carrier
8. Axle carrier rear mounts



Technical Data

Wheels	7Jx17	8Jx17	8Jx18
Tires	215/60	235/55	235/50
Rim offset (mm)	39	46	46
Track width (mm)	1,537.7	1,523.7	1,523.7
Total toe-in	6° ± 10'	6° ± 10'	6° ± 10'
Min. camber	-20' ± 20'	-20' ± 20'	-20' ± 20'
Camber differential angle	max. 30' left to right	max. 30' left to right	max. 30' left to right
Caster offset (mm)	25.79	25.79	25.79
Kingpin offset (mm)	-0.88	-7.88	-8.53
Toe difference angle	2° 16' ± 30'	2° 16' ± 30'	2° 16' ± 30'
Steering axis inclination angle	12° 41' ± 30'	12° 41' ± 30'	12° 41' ± 30'
Caster angle	5° 47' ± 30'	5° 47' ± 30'	5° 47' ± 30'
Caster angle differential	max. 30' left to right	max. 30' left to right	max. 30' left to right
Maximum steering angle	internal 38° external 31°	internal 38° external 31°	internal 38° external 31°

Workshop Hints

Alignment and Camber Adjustment

Toe-in adjustment is performed at the tie rods. If necessary, the camber is corrected by driving out the pin on the strut tower (spring cup).

Strut Replacement

When replacing the strut, the mounting on the swivel bearing must be expanded with a special tool.

Spring Replacement

There are new spring tensioners to be used during spring replacement. Refer to Repair Instructions for detailed information about special tools.

Reinforcement Plate

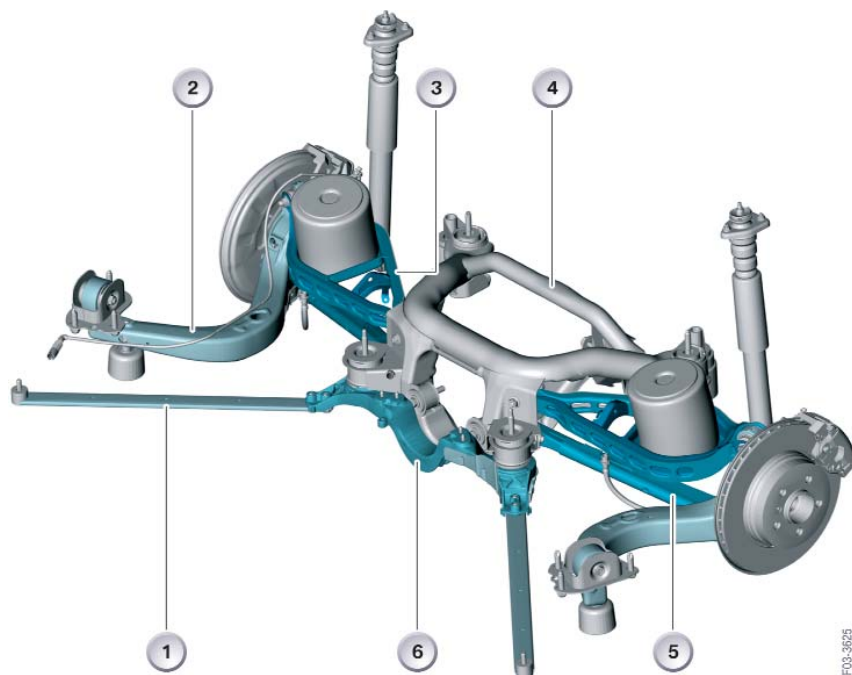
The vehicle must not be driven without the reinforcement plate in place. The reinforcement plate ensures the transversal rigidity and contributes to the strength of the front axle.

Rear Axle

The E83 is fitted with a central rear axle and subframe. The design of the rear axle is similar to the E46/16. Two tension arms have been added to the rear axle of the E83 and are secured to the bodyshell.

Mechanical Components

1. Tension arm
2. Trailing arm
3. Upper control arm
4. Rear axle bracket
5. Lower control arm with plastic cover
6. Thrust brace



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Modifications to the E46/16 rear axle to adapt it to the E83:

- Anti-roll bar secured to the rear axle carrier by clamps.
- Front of rear axle carrier suspension converted to special bolts with additional thrust washer.
- Thrust brace and tension arms.
- Surface of control arms are galvanized steel plates.
- Anti-roll bar link with ball joint attached directly to the control arm.
- Dampers with three point flange (bolt) plate.

Technical Data

Wheels	7Jx17	8Jx17	9Jx18
Tires	215/60 R17	235/55 R17	255/45 R18
Rim offset (mm)	39	46	51
Total track width (mm)	1,611	1,611	1,611
Total toe-in	6° ± 8'	6° ± 8'	6° ± 8'
Camber	-2° ± 15'	-2° ± 15'	-2° ± 15'
Thrust angle	0° ± 4'	0° ± 4'	0° ± 4'

Workshop Hints

Adjustment of Rear Wheel Alignment

Rear wheel alignment is adjusted by a special tool on the lower trailing arm (refer to Repair Information for additional details). The camber is adjusted by an eccentric element on the lower control arm at the axle carrier connection.

Lowering (removing) the Rear Axle

The handbrake cables (routed through the rear axle carrier and the body console) must be disengaged before the rear axle is lowered. This is to prevent shearing of the handbrake cables.

Brakes

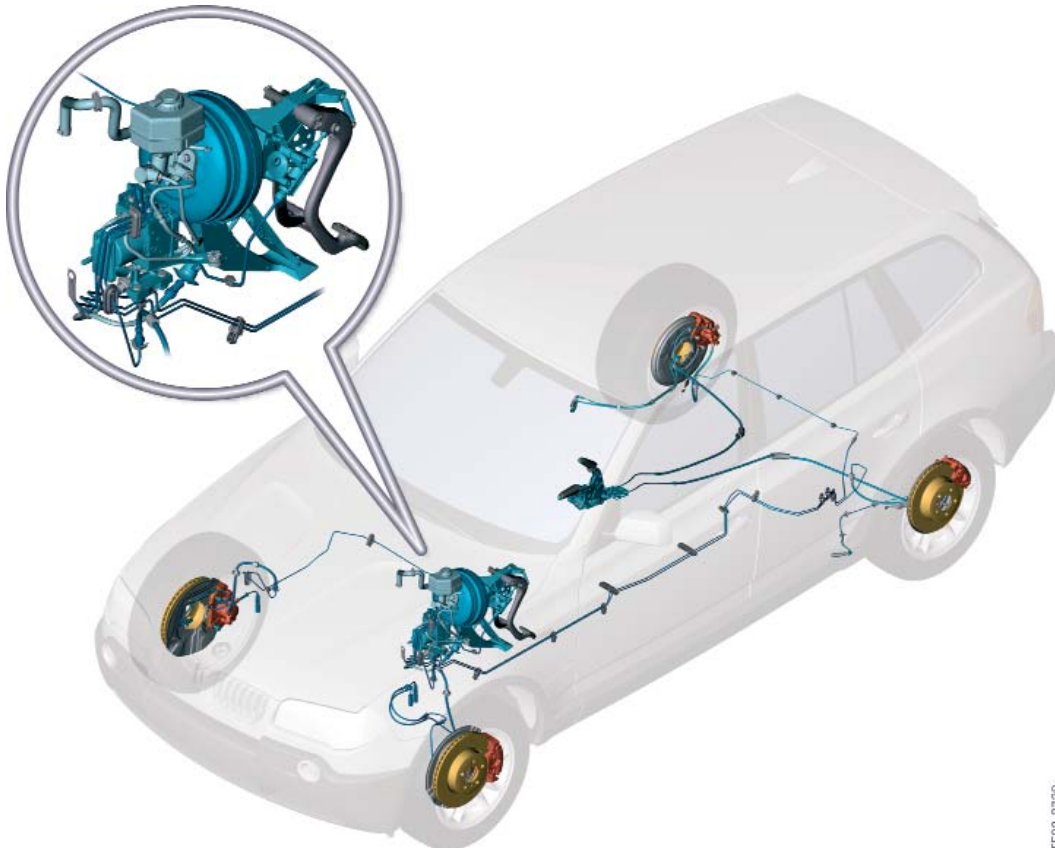
The brake system is a hydraulic dual-circuit brake system with "front/rear split", vacuum boost power assist and EBV. One brake circuit each for the front and rear axles. The parking brake actuating unit is located in the center console and is equipped with an automatic cable adjuster (ASZE) and a compensating element.

The advantages of the parking brake with automatic cable adjuster are:

- The 2 cables no longer have to be adjusted during installation.
- Cable extensions (cable conduit) contractions over the operating time are automatically compensated so that the parking brake lever travel is consistent.
- Prestretching of the cables is no longer necessary.
- The parking brake does not have to be adjusted at the end of the assembly line and in the service department.
- Note: color coded handbrake cables (left/right different part numbers).

Mechanical Components

The brake system consists of the following components:



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Four Wheel Hydraulic Disc Brakes

The front brakes are constructed of ventilated brake discs 325mm diameter x 25mm thick (Geomet coating) with FN57/25 single piston floating calipers.

The rear brake brakes are constructed of ventilated brake discs 320mm diameter x 22mm thick (Geomet coating) with FN42/22 single piston floating calipers.

Hydraulic Unit with Vacuum Brake Booster and DSC Hydraulic Module

The hydraulic unit is located at the front on the left hand side under the main brake cylinder. The electric precharging pump is no longer required. All vehicles are equipped with an 8"/9" tandem brake booster and have a tandem brake master cylinder. The DSC hydraulic module is a DSC8 system.

Foot Controls with Brake and Clutch Pedals

The essential components of the foot controls are:

- Pedal mounting block
- Brake pedal
- Clutch pedal
- Clutch master cylinder

The pedal mounting block is made of aluminum and is bolted to the bulkhead. The vehicle has a wide steel brake pedal. The clutch pedal is made of plastic.

Parking Handbrake Lever, ASZE, Cables and Duo-Servo Brakes.

The duo-servo brakes are similar to the duo-servo brakes on the E65 and E53 (185mm diameter x 30mm wide).

The handbrake lever is bolted to the floor pan and is equipped with an automatic cable adjuster (ASZE) and a compensating element. Refer to ST045 E85 or ST047 E60 Technical Training handouts for additional details on deactivating and activating this unit.

Workshop Hints

Changing Cables

If there is a broken cable, the automatic cable adjuster is in the untensioned position. To replace the cables, it is necessary to remove the center console and the rear compartment ventilation ducts. For the cables to be removed or parking break shoe replacement, the parking-brake lever **must** be in the released position and the ASZE unit must be deactivated. Refer to the Repair Instructions or ST045 E85, ST047 E60 Technical Training handouts for additional details.

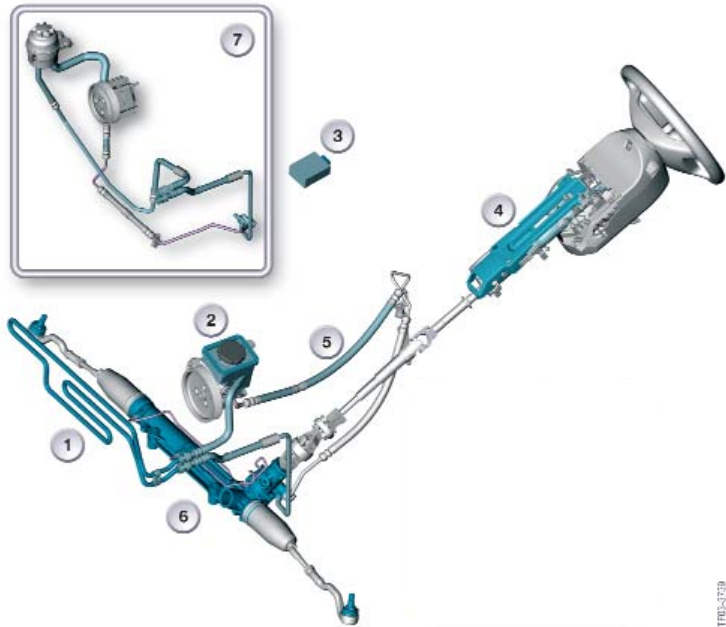
Steering

Conventional rack and pinion power steering is used in the E83 and Servotronic is available as an option. The design and functioning principle of the Servotronic option are nothing new but have been modified as described in this chapter.

The servotronic steering system controls the amount of power assistance based on the current road speed. The hydraulic pressure is electronically adapted to the current road speed, with greater power assistance available at lower road speeds and less power assistance available at greater road speeds.

Mechanical/Hydraulic Components

1. Power-steering cooler
2. Hydraulic pump with supply reservoir (M57TU, diesel)
3. Servotronic control unit
4. Upper steering column assembly
5. Flexible hoses
6. Steering gear
7. Hydraulic pump with separate supply reservoir (M54B25 and M54B30)



The E83 is equipped with hydraulic assisted rack and pinion steering. The total ratio of the steering is: 18.9 : 1. The total rack stroke is 81.0 mm (1.7 turns of the steering wheel). The hydraulic ports on the steering gear have quick release couplings. The hydraulic pump maximum pressure is limited to 127 bar.

E83 vehicles are equipped with “W” shaped cooling loops (hoses) to assist in cooling.

CAUTION!!!

The hydraulic pump does not have a pump end shutdown feature. The hydraulic pump could be damaged after approximately 1 minute if the steering is kept on full lock (end stop) for a long period.

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Wheels and Tires

Several different wheel stylings are available. Different 17" wheel stylings are standard equipment. Other 17" and 18" wheels are available as options, depending on the type of engine.

A compact wheel (spare/emergency wheel) is standard, regardless of the vehicle version.

The tire deflation warning (RDW) is a standard feature. The RDW function is integrated in the DSC control unit.

The following wheel/tire combinations are available for US models:

2.5 Liter Engine (optional for 3.0 Liter)

- 8.0Jx17 EH2 IS46* (shown to the right)
- 235/55 R17 LI 99** tires
- A/S
- H-rated tires, M+S



TF03-3661

3.0 Liter Engine (optional for 2.5 Liter)

- 8.0Jx17 EH2 IS46* (shown to the right)
- 235/55 R17 LI 99** tires
- A/S
- H-rated tires, M+S



TF03-3662

Optional (for 2.5 and 3.0)

- 8.0Jx18 EH2 IS46* (shown to the right)
- 235/50 R18 LI 97** tires
- A/S
- H-rated tires, M+S



TF03-3663

Optional (for 2.5 and 3.0)

- 8.0Jx18 EH2 IS46* (shown to the right)
- 235/50 R18 LI 97** tires
- A/S
- H-rated tires, M+S



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* IS = insert size
** LI = load index
A = all season tires
S = summer tires

The spare/emergency wheel (compact wheel) is standard equipment. The E83 has a special bracket for the compact wheel which is located in the vehicle floor under the luggage compartment and is operated from inside the vehicle.

The release knob is located under the luggage compartment floor covering next to the tool kit.

The compact wheel is a 4Bx17 IS18 steel wheel with T135/90 R17 104 M tire.

The compact wheel bracket has a special service access cap (1) to check the tire pressure without having to lower the bracket/wheel.



Tire Deflation Warning (RDW)

The RDW function is integrated (and diagnosed) in the DSC control unit. The system uses the rotation speed of the diagonally opposite wheels to compare the dynamic circumferences of all four wheels.

The RDW system does not monitor uniform air pressure loss over all 4 tires. If the pressure loss is the same in all four tires, the wheel speeds change equally and pressure loss cannot be detected. The customer must continue to check inflation pressures on a regular basis.

The system must be reinitialized if tire inflation pressures are modified or if the tires/wheels are replaced. Initializing RDW:

1. Start the engine but do not drive away.
2. Press and hold the RDW button in the center console until the indicator light in the instrument cluster illuminates in yellow for several seconds.
3. Drive away.

After a certain distance, the system stores the new wheel speeds as reference values and is then able to display a detected deviation. RDW has an indicator light in the instrument cluster that may illuminate in yellow or red.

Indicator illuminates in red:

- Indicates a loss of more than 30% of inflation pressure in one of the tires
- Accompanied by a “gong” sound



Indicator illuminates in yellow :

- Possible faults in the system
- Initialization

