

# 30 years of BMW all-wheel drive: From the BMW 325i “Allrad” to the BMW X5 xDrive40e. Contents.



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# 1. **BMW all-wheel-drive technology.** **Facts, features, milestones.**



- 1985: BMW's first ever all-wheel-drive production model, the BMW 325i "Allrad", is unveiled at the Frankfurt Motor Show (IAA). It is followed in 1988 by the BMW 325iX touring.
- 1991: All-wheel drive – now electronically controlled – is introduced in the BMW 5 Series (BMW 525iX). The BMW 5 Series 525iX touring, with the same technology, follows in 1992.
- 1999: BMW presents the BMW X5, with standard-fitted all-wheel drive, as the world's first Sports Activity Vehicle (SAV).
- 2003: The BMW xDrive intelligent all-wheel-drive system is introduced in the new BMW X3. It is the first system of its kind in the world that proactively monitors the driving situation and, if necessary, takes corrective action.
- 2005: Model-specific versions of BMW xDrive are offered for the Sedan and Touring versions of the BMW 3 Series and 5 Series. Later, xDrive is also supplied for the BMW 3 Series Coupe.
- 2006: The second generation of the BMW X5 debuts the Integrated Chassis Management system (ICM), which integrates all the vehicle dynamics control systems, including xDrive.
- 2007: BMW presents the world's first Sports Activity Coupe (SAC), the BMW X6, at the Frankfurt Motor Show (IAA); the BMW xDrive intelligent all-wheel-drive system is standard specification. At the same time, Dynamic Performance Control (DPC) marks its debut in the premium segment.
- 2009: BMW xDrive intelligent all-wheel drive is introduced into the BMW 7 Series.
- 2010: The BMW ActiveHybrid X6 combines all-wheel drive with a hybrid powertrain for the first time.

- 2012: Launch of the first two all-wheel-drive models in the BMW 6 Series: the BMW 6 Series Coupe and BMW 6 Series Convertible.
- 2013: The new BMW 4 Series makes its debut. The BMW 4 Series Coupe is available with intelligent all-wheel drive from launch. It is followed in 2014 by the 4 Series Convertible and BMW 4 Series Gran Coupe. 2013 also sees BMW xDrive make its debut in the BMW 1 Series.
- 2014: The BMW 2 Series Active Tourer combines BMW xDrive with an all-new front-wheel-drive setup.
- 2014: The new BMW X4 imports the successful Sports Activity Coupe concept into the premium mid-sized segment. BMW xDrive intelligent all-wheel drive is standard equipment.
- 2014: The BMW i8 is equipped with a special form of all-wheel drive. The 2+2-seater sports model's plug-in hybrid drive system pairs an internal combustion engine driving the rear wheels with an electric motor driving the front wheels.
- 2015: The plug-in-hybrid BMW X5 xDrive40e combines BMW xDrive with BMW eDrive. Presentation of the BMW 225xe, which combines the plug-in hybrid drive with a modern front-wheel-drive platform while also offering electrified all-wheel drive.
- 2015: The second generation of the BMW X1 is launched. This compact premium SAC is now based on a front-wheel-drive platform.
- 2015: On the new BMW 7 Series, BMW xDrive can be combined with Integral Active Steering.
- Today, BMW offers more than 110 models – of either transmission type – with BMW xDrive intelligent all-wheel drive, in 12 model series. In addition, the plug-in hybrid BMW i8 sports car features road-linked all-wheel drive.
- Almost 5 million models with BMW xDrive were sold worldwide by the end of September 2015.
- BMW xDrive models now account for more than one in three of all new BMW registrations.

## 2. 30 years of BMW all-wheel-drive expertise. Short version.



BMW, one of the world's most successful premium carmakers, also boasts an excellent position in the all-wheel-drive market, a segment it first entered 30 years ago. Around one in three BMW cars sold around the world is now equipped with the intelligent BMW xDrive all-wheel-drive system. BMW's success in this segment has been driven not only by the ever-popular BMW X models but also by all-wheel-drive models based on the other model series, from the BMW 1 Series to the BMW 7 Series. Across these model series, a large choice of AWD models is offered in a wide range of engine versions. At the same time, BMW continues to refine this technology and take it in new directions. By offering BMW xDrive in combination with a hybrid drive and with a front-wheel-drive platform, the company has repeatedly demonstrated its proficiency in the all-wheel-drive field, proficiency that will secure BMW's position at the forefront of this sector well into the future. Today, BMW offers more than 110 models – of either transmission type – with BMW xDrive in 12 different model series, as well as the plug-in hybrid BMW i8 sports car and the compact BMW 225xe with electrified all-wheel drive.

### **The focus from day one: traction and dynamics.**

BMW's first foray into the all-wheel-drive market came with the unveiling of the BMW 325i "Allrad" at the Frankfurt Motor Show (IAA) in 1985. From the outside, the newcomer didn't immediately reveal its inner qualities, so its performance when the journalists took it out on the test track was even more of an eye-opener. This very first BMW all-wheel-drive system not only improved traction away from surfaced roads and in adverse weather conditions, but also made for more dynamic handling through corners. "The new BMW is the new champion when it comes to handling," was the verdict of the testers from German car magazine Auto Zeitung not long after the first unveiling.

Today, the intelligent BMW xDrive all-wheel-drive system takes typical BMW driving dynamics to new levels. The current generation of this system is controlled by the Integrated Chassis Management (ICM) system, which ensures that xDrive always responds appropriately at the earliest possible moment, based on reliable sensing and monitoring of the current driving situation. The interventions may be performed either entirely by BMW xDrive, or by xDrive in combination with Dynamic Stability Control (DSC) or Dynamic Performance Control (DPC). The resulting fast and precise control of drive

power distribution ensures typical BMW handling characteristics even under extremely dynamic cornering.

The all-wheel-drive system is biased towards the typical BMW rear-wheel-drive characteristics. That is to say, on the all-wheel-drive models a greater share of the drive power is sent to the rear wheels, even under normal driving conditions. This maintains the typical BMW precise steering response, with virtually no torque steer. For crisp turn-in and high tracking stability, the latest-generation BMW xDrive system starts increasing the amount of power sent to the rear wheels as soon as the vehicle enters a corner, further enhancing the driving pleasure for which BMW is a byword.

### **BMW all-wheel-drive technology: continuous evolution since 1985.**

The full-time all-wheel-drive system featured on the BMW 325i "Allrad" of 1985 split the drive power in a ratio of 37 to 63 per cent between the front and rear wheels. In response to wheel speed differences, visco locks in the transfer case and rear differential were capable of providing a virtually rigid connection between the front and rear wheels, in order to improve traction and stability. This model's name was soon changed to BMW 325iX, and from 1988 it was offered in a "touring" version as well (lower-case spelling up to and including the E46 series).

### **1991: BMW 525iX.**

Three years on, BMW introduced an all-wheel-drive model in the BMW 5 Series too. For the first time, the power split was now electronically controlled. The newly developed system featured multi-plate clutches that allowed the default 36:64 front-to-rear power split to be varied seamlessly and automatically in line with driving conditions. Initially a hydraulically controlled multi-plate clutch was used at the rear axle, but this was later replaced by electronically controlled selective braking intervention. The system monitored the driving situation using wheel speed signals from the Anti-lock Braking System, supplemented by further information about brake status, engine speed and throttle valve position.

From the outset the all-wheel-drive system of the BMW 525iX was a class apart. The electronic control system delivered a very fast and precise response, resulting in safe, neutral handling characteristics even in difficult driving conditions, such as on wet roads or snow. In the BMW 5 Series, too, the first all-wheel-drive models were offered in both Sedan and touring versions.

### **1999: The Sports Activity Vehicle (SAV) opens a new chapter.**

In the run-up to the new millennium, a highly innovative vehicle concept from BMW made its sensational debut. The BMW X5, the first Sports Activity Vehicle (SAV), impressed customers with driving dynamics that were unmatched among other all-terrain vehicles of the time. The outstanding all-wheel-drive system played a big part in this. A planetary gear system split the drive power in a ratio of 38:62 per cent between the front and rear wheels, while electronic control systems such as DSC (Dynamic Stability Control), ADB-X (Automatic Differential Brake) and HDC (Hill Descent Control) ensured the new BMW X5 was both sporty on the road and equipped to handle challenging conditions off the beaten track.

In the years following the successful launch of the SAV concept, there was no let-up in the fast pace of all-wheel-drive development at BMW. The next year, 2000, a model-specific version of the BMW X5's all-wheel drive technology became available for the fourth generation of the BMW 3 Series.

### **2003: BMW xDrive makes its debut in the BMW X3 and BMW X5.**

Four years on from the debut of the BMW X5 in 1999, BMW kept up the momentum by launching the SAV concept in a further vehicle segment. The new BMW X3 was more compact than the BMW X5 and offered even more agile handling. It set new benchmarks and remained the only premium model in its class for years to come.

The newly developed BMW xDrive all-wheel-drive system, which was introduced in the same year in both the BMW X3 and the BMW X5, soon extended BMW's lead in the AWD segment. Based on an extremely fast-acting electronic multi-plate clutch in the transfer case, xDrive worked in tandem with the Dynamic Stability Control system (DSC) to continuously adapt the drive power split to the current driving situation. In addition to wheel speed, for the first time the electronic control system also took into account Dynamic Stability Control data, for example about steering angle, accelerator position and lateral acceleration. This is what makes BMW xDrive the world's first, and still only, "intelligent" all-wheel-drive system. Unlike conventional all-wheel-drive systems, which only react when at least one wheel is already spinning, xDrive is able to detect a risk of oversteer or understeer at the very first signs, and proactively corrects this by redirecting the flow of drive power.

In the years that followed, the BMW xDrive intelligent all-wheel-drive system was fitted not only on the X models but also on the xDrive versions of the BMW 3 and 5 Series Sedan and Touring models. By the time the second generation of the BMW X3 was introduced in 2010, more than 600,000 units

of this series had already been sold worldwide. A little earlier, sales of the BMW X5 – which entered its second generation in 2006 – had topped the one million mark.

### **2008: SAC with Dynamic Performance Control and hybrid drive.**

With the two Sports Activity Vehicles now firmly established in their respective segments, in 2007 BMW went on to present the world's first Sports Activity Coupe. Unveiled at the Frankfurt Motor Show (IAA), the brand-new BMW X6 elevated the typical dynamic character of the BMW X models to a new level of intensity. For the first time, the intelligent all-wheel-drive system was combined with Dynamic Performance Control (DPC), which varies the drive power split between the rear wheels when cornering to ensure unrivalled agility and stability, even under sudden throttle changes or on overrun. In 2009, the BMW Active Hybrid X6 demonstrated a further perfect pairing – between BMW xDrive and hybrid propulsion. Meanwhile, in the same year, BMW M GmbH added two very special models to its range of high-performance sports cars. With an M-tuned BMW xDrive system, including Dynamic Performance Control, the BMW X5 M and BMW X6 M boasted performance that was previously unknown in the all-wheel-drive market.

2009 also saw the arrival of a new X model, the BMW X1. For many years to come, the BMW X1 was destined to remain the only vehicle of its kind in the premium compact segment. Its intelligent BMW xDrive all-wheel-drive system, like that of the new BMW X3 (2010), was also combinable with Performance Control. This system selectively brakes the wheel on the inside of a turn while simultaneously increasing engine power, resulting in quick and precise turn-in to corners and taking the agile handling of both models to new levels.

### **BMW xDrive also available for other model series.**

The steady advance of the BMW X models has been accompanied by an increase in the number of xDrive versions offered in the other BMW model series too. Designed to improve cornering agility and precision, BMW xDrive provides an enhanced driving experience and an optimal combination of dynamics and comfort. So it was only a matter of time before this intelligent drive technology made its debut in the BMW 7 Series as well, in 2009. In spring 2012, the first all-wheel-drive Coupe and Convertible models were then offered in the sporty BMW 6 Series. BMW xDrive can also be specified on the current BMW 3 and 5 Series and, since 2013, on the Convertible, Coupe and Gran Coupe models of the new BMW 4 Series.

### **Driving progress ever forward.**

BMW took things forward in the premium mid-sized segment with the launch of the BMW X4 in 2014. The new Sports Activity Coupe offers a unique blend of driving enjoyment, sophisticated style and contemporary practicality. It comes with BMW xDrive as standard and is available in a wide range of engine versions. In the same year, BMW also presented the third generation of the BMW X5, the second generation of the BMW X6, and M Sport versions of both models. BMW xDrive also made its debut in the new BMW 2 Series Active Tourer. This was a debut with a difference, being the first time BMW had combined its intelligent all-wheel-drive system with an all-new front-wheel-drive format.

With the BMW i8, unveiled in 2014, the BMW Group took a bold new step in new directions – which also extended to the all-wheel-drive system. This 2+2-seater sports model is powered by a highly advanced plug-in hybrid drive system that pairs an internal combustion engine driving the rear wheels with a high-performance electric motor driving the front wheels.

### **Focused on the future: BMW xDrive meets BMW eDrive.**

BMW's latest all-wheel-drive models bring technology advances that are firmly focused on the future of mobility. The BMW i8 was followed by the international launch of the first production plug-in hybrid model from the BMW core brand: the BMW X5 xDrive40e. Thanks to full-time BMW xDrive all-wheel-drive and eDrive BMW EfficientDynamics technology, this Sports Activity Vehicle mates thrilling and effortless sporty performance with outstanding efficiency. Intelligent hybrid power management synchronises the operation of the internal combustion engine and the electric motor to maximise efficiency at all times, while also responding perfectly to the driver's demands. The drive from the two power units is transferred to the road via the full-time BMW xDrive intelligent all-wheel-drive system.

### **BMW 7 Series: Integral Active Steering combinable with BMW xDrive.**

In September 2015, the sixth generation of the BMW 7 Series makes its world debut at the Frankfurt Motor Show (IAA). This high-end BMW luxury model pioneers groundbreaking innovations on all fronts, and will be available with BMW xDrive from its market launch in October. The new luxury sedan will also be the first model to allow intelligent all-wheel-drive to be combined with Integral Active Steering – that is to say with passively steering rear wheels.



### **3. From the BMW 325i “Allrad” to the BMW X5 xDrive40e. BMW all-wheel drive across the model series.**

BMW has been offering all-wheel-drive models for the past 30 years. From the start, one of the objectives was to improve cornering dynamics. That is why BMW's all-wheel-drive system started out in life as an option confined to specific models – the first of which, perhaps not surprisingly, was a BMW 3 Series Sedan. This was long before the first dedicated BMW X models took to the stage. Over the years the number of all-wheel-drive models in both categories – X models (or Sports Activity Vehicles, as they are also known) and all-wheel-drive models derived from the other model series – has steadily continued to grow. All-wheel drive is currently available for the BMW 1 Series, 2 Series, 3 Series, 4 Series, 5 Series, 6 Series and 7 Series, and – as electrified all-wheel drive – for the BMW i8 and BMW 225xe.

#### **BMW 3 Series: sixth generation of a trendsetter. E21 (1975), E30 (1982), E36 (1990), E46 (1998), E90 (2005), F30 (2012).**

The brand's first ever all-wheel-drive model, the BMW 325i “Allrad” (E30, 1982–1994), was first unveiled at the Frankfurt Motor Show (IAA) in 1985. From the outside this pioneering model didn't immediately reveal its inner qualities, so its performance on the test track was even more of an eye-opener. “The new BMW is the new champion when it comes to handling,” was the verdict of the testers from German car magazine Auto Zeitung not long after the first unveiling.

#### **1985: the BMW 325i is the brand's first all-wheel-drive model.**

The new BMW 325i Allrad came with a newly developed 126 kW/171 hp 2.5-litre six-cylinder engine. Instead of an equal front-rear power split, the new model's full-time all-wheel-drive system sent 37 per cent of the drive power to the front wheels and 63 per cent to the rear wheels. The front wheels were driven via a toothed chain-driven auxiliary driveshaft and a shaft to the front differential. This preserved the typical BMW precise turn-in to corners without torque steer at the front wheels. In extreme conditions, or if a very sporty driving style was adopted, visco locks in the transfer case and rear differential varied the front-rear power split. When necessary, for example if the rear wheels started to spin, more power was sent to the front wheels. It was also possible to redirect power from one spinning rear wheel to the other rear wheel. Strikingly, for 1985, the automatic locking differentials were integrated

with a standard-fitted Anti-lock Braking System, which remained fully functional in all conditions.

Typically of BMW, drivers were only aware of the all-wheel-drive system of the BMW 325i Allrad when it was delivering benefits – such as greater traction out of corners, slip-free acceleration in the wet and exceptionally sure-footed handling on snow and ice. In 1988, the new all-wheel-drive technology was also made available for the BMW 3 Series touring, whose model designation had been changed in 1986 to the BMW 325iX.

By autumn 2000, a model-specific version of the further improved all-wheel-drive system in the first BMW X5 was offered for the BMW 3 Series (**E46**, 1998–2006). One of the highlights was a planetary centre differential. The system also dispensed with conventional differential locks. Instead, the locking function was implemented by means of automatic braking pulses at selected wheels. Once again, all-wheel drive was offered for both the Sedan and touring models.

In 2005, one year after BMW xDrive made its debut, xDrive was introduced in a model-specific version for the fifth generation of the BMW 3 Series (**E90**, 2005–2013). Initially, the intelligent all-wheel-drive system was available for one diesel model and two petrol models. Later, xDrive was also supplied for the BMW 3 Series Coupe.

In 2012, the trend-setting, best-selling 3 Series entered its sixth generation, initially in Sedan version. Before long, many of these models were also being offered with BMW xDrive. Today (7/2015) models in the current BMW 3 Series (**F30**, introduced in 2012) are available with this system. As well as Sedan and Touring models, they also include the BMW 3 Series Gran Turismo, first presented in 2013. The 2015 facelift for the Sedan and Touring models has raised the bar not only for finish and ergonomics but also for dynamic performance. All models in the series, apart from the 3.0-litre diesel model, are now powered by three-, four- and six-cylinder engines from the new modular BMW EfficientDynamics engine family.

## **BMW 4 Series: “4” stands for extra sportiness. F32 (2013), F33 (2014), F36 (2014).**

2013 and the following year saw the successive launch of the BMW 4 Series Coupe (**F32**), the BMW 4 Series Convertible (**F33**) and the BMW 4 Series Gran Coupe (**F36**). The new model series offers uncompromising premium-class design quality and sporty performance, and corroborates BMW's

position as the world's leading premium carmaker. The "4", which stands for a new era of models, emphasises not only the stand-alone design of this model but also its extra-sporty performance, exclusiveness and clear differentiation from the BMW 3 Series. From the start, numerous engine versions could be specified with BMW xDrive. Today, the intelligent all-wheel-drive system is an option for 15 different models in the sporty BMW 4 Series.

**BMW 5 Series: sporty and elegant bestseller.**  
**E12 (1972), E28 (1981), E34 (1988), E39 (1995),**  
**E60 (2003), F07 (2009), F10 (2010).**

1991 saw the arrival of the first all-wheel-drive model in the BMW 5 Series, the BMW 525iX (**E34**, 1988–1996). The electronic all-wheel-drive control system monitored the driving situation using wheel speed information from the anti-lock braking system, supplemented by information about throttle valve position and brake status. The system implemented a 36:64 front-to-rear power split under normal conditions, but varied this as necessary using a continuously adjustable multi-plate clutch in the transfer case, while a hydraulically controlled multi-plate clutch at the rear differential controlled the power flow so as to prevent wheel spin at one wheel.

In 2005, shortly after the launch of the fifth generation of the BMW 5 Series (**E60/E61**, 2003–2010), BMW xDrive intelligent all-wheel drive became available for these models as well. In 2010, it was also offered for an all-new body style in the 5 Series, the BMW 5 Series Gran Turismo (**F07**, introduced in 2009), and later for the Sedan and Touring versions of the sixth-generation BMW 5 Series (**F10**, introduced in 2010). Over the years, the BMW 5 Series' highly attractive mix of dynamism, comfort, efficiency and cutting-edge innovations has made it a bestseller in the premium mid-range segment and the most popular business model in its class. Following the facelift, the number of xDrive-equipped models in the BMW 5 Series now stands at eight Sedans, seven Touring models and four Gran Turismo models.

**BMW 6 Series: elite athletes in the luxury class.**  
**E24 (1976), E63/64 (2003), F06 (2012), F12/13 (2011).**

Spring 2012 saw the market launch of the BMW 640d xDrive Coupe and the BMW 640d xDrive Convertible, the first ever all-wheel-drive versions of the BMW 6 Series (**F12/F13**, introduced in 2011). Both these models are powered by a six-cylinder in-line diesel engine that combines power with refinement. A little later, the BMW 650i xDrive Coupe was added to the line-up. Enhanced performance, efficiency, exclusivity and innovation introduced in

the 2015 model year facelift have confirmed the BMW 6 Series as a benchmark in sporty performance, luxurious driving pleasure and individualistic styling in the luxury segment. Today, all engine versions in the BMW 6 Series Convertible, Coupe and Gran Coupe (**F06**, introduced in 2012) range are optionally available with intelligent BMW xDrive all-wheel drive.

## **BMW 7 Series: the ultimate in sporty luxury.** **E23 (1977), E32 (1986), E38 (1994), E65 (2001), F01/F02 (2008), G11/G12 (from 2015).**

The first all-wheel-drive models in the BMW 7 Series (**F01/F02**, 2008–2015) were introduced in 2009, with all-wheel drive offered as an option for three models: the V8 petrol-engined BMW 750i xDrive and long-wheelbase BMW 750Li xDrive, as well as the six-cylinder diesel-engined BMW 740d xDrive and BMW 730d xDrive. A further model, the BMW 750d xDrive, the world's most powerful straight-six diesel car, comes equipped with the intelligent all-wheel-drive system as standard. In September 2015, the sixth generation of the BMW 7 Series (**G11/G12**, from 10/2015), makes its world debut at the Frankfurt Motor Show (IAA). The new top-of-the-line flagship model series from BMW, which like its predecessor will also be offered in a long-wheelbase version, bristles with innovative technologies and sets new benchmarks in luxury, comfort and engine technology. From market launch in October, two models in this luxury sedan series are available with intelligent BMW xDrive all-wheel drive, which for the first time will be combinable with Integral Active Steering, that is to say with passively steering rear wheels. With its unique combination of driving comfort, refinement and performance, the innovation-packed BMW flagship scales new pinnacles.

## **BMW 1 Series: extra-sporty compact models.** **E87 (2004), E81/82 (2007), F20 (2011), F21 (2012).**

The first BMW 1 Series, which made its debut in late summer 2004, brought hallmark BMW sporty performance, distinctive design and cutting-edge efficiency to the premium compact segment. The initial five-door hatchback version was followed by a three-door model, a Coupe and a Convertible. By 2013, the first all-wheel-drive BMW 1 Series models – five-door and three-door versions of the second-generation BMW 1 Series (**F20**, 2011–2015, **F21**, 2012–2015) – were ready to roll. The xDrive versions of the BMW 120d and BMW M 135i M Performance model were followed in summer 2014 by an all-wheel-drive BMW 118d. The latest BMW 1 Series models introduced in 2015 are powered by a new generation of three- and four-cylinder engines, with all-wheel drive options as before.

## **BMW 2 Series: new Coupe, Active Tourer (with front-wheel drive) and Grand Tourer. F22 (2014), F45 (2014), F46 (2015).**

The successor to the popular BMW 1 Series Coupe arrived on the market in March 2014. It was named the BMW 2 Series Coupe and set new benchmarks for performance, design and emotionality in the premium compact segment. A few months after the launch, the top-of-the-line M235i Coupe (**F22**, introduced in 2014) became the first model in this series to be offered with optional BMW xDrive. In spring 2015, the second all-wheel-drive variant in this all-new, sporty model series entered the fray: the BMW 220d xDrive.

In 2014, the all-new BMW 2 Series Active Tourer (**F45**, introduced in 2014) provided impressive evidence of how BMW is continuously developing and refining the intelligent all-wheel-drive system and adapting it to fit different model formats. The main difference compared with all previous BMW model series is that here BMW xDrive is combined with a front-wheel-drive setup and transverse-mounted engine. Initially, two models were available with xDrive: the top-powered BMW 225i xDrive Active Tourer and BMW 220d xDrive Active Tourer, and in some markets the BMW 218d xDrive Active Tourer as well. Their extra traction, stability and cornering performance also had benefits for safety and driving enjoyment. In 2015 a plug-in hybrid and all-wheel-drive variant joined the range: the BMW 225xe. The combination of a BMW TwinPower Turbo petrol engine and BMW eDrive allows for locally emission-free driving. Electric rear-wheel drive in conjunction with the front-wheel drive gives rise to a so-called electrified xDrive system. 2015 also saw the launch of the BMW 2 Series Gran Tourer (**F46**, introduced in 2015), seating up to seven people. It was available with all-wheel drive from launch.

With its lean, space-saving architecture and lightweight, compact components, the new all-wheel-drive system dovetails perfectly with the space-efficient overall layout of the BMW 2 Series Active Tourer and BMW 2 Series Grand Tourer. Power is sent from the front wheels to the rear wheels via power take-off bevel gearing on the front differential, and a two-part drive shaft. The cornerstone of the system is an electro-hydraulically controlled hang-on clutch in the rear differential, which seamlessly varies the power split between the front and rear wheels. In extreme scenarios, such as the front wheels sitting on a patch of ice, up to 100 per cent of the power can be sent to the rear wheels. The driving situation is monitored using a wide range of data from the Dynamic Stability Control System (DSC), as well as information from the Dynamic Traction Control (DTC), Electronic Differential Lock Control

(EDLC) and Performance Control systems. Typically of BMW xDrive, the all-wheel-drive system adapts to the changing road and driving conditions in fractions of a second.

The BMW xDrive system used in the BMW 2 Series Active Tourer/Gran Tourer features an exceptionally energy-efficient control strategy. Whenever it is not necessary to drive both axles, the system is depressurised, making the car front-wheel drive only. Further savings are achieved with the aid of a spring-loaded Efficient valve that lowers the oil level in the multi-plate clutch, for significantly reduced churning losses.

## **BMW i8: the best of both worlds. I12 (from 2014).**

The BMW i8 is the BMW Group's first plug-in hybrid vehicle, and the second model from the BMW i sub-brand. The lightweight LifeDrive architecture of this cutting-edge 2+2-seater consists of a CFRP passenger cell mounted on an aluminium chassis. Further features are an aerodynamically groundbreaking body design and a visionary interior design including a new instrumentation and display system. The sports car's plug-in hybrid system comprises a three-cylinder petrol engine and an electric motor, and combines agile performance with outstanding efficiency. The innovative approach also extends to the all-wheel-drive system, where an internal combustion engine drives the rear wheels via a six-speed automatic transmission and an electric motor drives just the front wheels, via a two-speed automatic transmission. As a result, the BMW i8 delivers an electric all-wheel-drive experience, with a sporty-biased power split for dynamic cornering. This is backed up by variable power-sharing that keeps pace with changing driving conditions. On entering the corner, the power split is rear-biased for a more precise turn-in. As soon as the steering angle becomes smaller again, the system then returns to the default split for more vigorous acceleration out of the corner.

## **From strength to strength: the BMW X models.**

In the run-up to the new millennium, BMW demonstrated its unusual talent for building innovative vehicles geared to the needs of the future when it ushered in a whole new genre of vehicle. The BMW X5, presented in 1999, was the world's first Sports Activity Vehicle (SAV). Designed to attract a new breed of customer, the SAV was soon launched on a fast-moving and uniquely successful career. The most distinctive features of the BMW X5 were its driving dynamics, which were unmatched by any other all-terrain vehicle in this class. The story continued with the launch of the BMW X3 in 2003. More

compact than the BMW X5, and with even more agile handling, the BMW X3 set new benchmarks. It added to BMW's competitive advantage in the all-wheel-drive segment by ushering in the newly developed xDrive system. This system was also introduced in the BMW X5 in parallel with the BMW X3 launch.

The X model concept packed so much potential that in due course it spawned further innovations and new segments. In 2008, the first Sports Activity Coupe – the BMW X6 – arrived on the market. Dynamic Performance Control and the combination of all-wheel drive and hybrid drive were further milestones, while 2009 saw the launch of the BMW X1, the only vehicle of its kind in the premium compact segment. In 2014 the winning streak continued with the roll-out of the new BMW X4, while in 2015 the BMW X5 xDrive40e launched a new era in drive technology. Today, the range comprises five BMW X model series as well as two all-wheel-drive performance sports cars from BMW M GmbH: the BMW X5 M and the BMW X6 M. More than 3.9 million BMW X models have so far been sold worldwide. These models now account for almost one in four of all new BMW registrations.

## **BMW X5: a new form of driving enjoyment. E53 (1999), E70 (2006), F15 (2013), F85 (2014).**

Unlike conventional off-road vehicles, the BMW X5 was equipped right from the first series – BMW X5 (**E53**, 1999-2006) – with a safety body with integral frame and independent wheel suspension. The all-wheel-drive system with planetary centre differential split the drive torque in a ratio of 38:62 between the front and the rear wheels. Dynamic Stability Control (DSC), Automatic Differential Brake (ADB-X) and Hill Descent Control (HDC) were standard specification, which meant that the BMW X5 not only offered sporty on-road driving dynamics but was able to take off-road challenges in its stride as well. “BMW parado X” was the headline in the German motoring magazine Auto Bild at the time, which went on to report that the X5 was an all-rounder that combined sure-footed traction, dynamics and comfort.

Shortly before the BMW X5 went on sale in Europe, BMW revealed a stunning Sports Activity Vehicle concept model at the 2000 Geneva Motor Show. Dubbed the “BMW X5 Le Mans”, its bonnet sheltered a 515 kW/700 hp 12-cylinder engine borrowed from the BMW V12 LMR, the winner of the previous year’s 24 Hours of Le Mans.

As the first in a new genre of automobile, the BMW X5 saw overwhelming demand from the USA, Europe and other world markets. And in 2003, the

BMW X5 and the new BMW X3 were the first two models to get the new intelligent all-wheel-drive system known as BMW xDrive. xDrive controlled the front-rear power distribution using an electronically controlled multi-plate clutch instead of a planetary centre differential. For the first time, the all-wheel-drive system now also worked in tandem with the Dynamic Stability Control system (DSC).

By 2006, the second generation of the BMW X5 (**E70**, 2006–2013) was rolling off the assembly lines at the BMW plant in Spartanburg, South Carolina, USA. With its more spacious interior seating up to seven people, its luxurious ambience, even more sure-footed all-wheel-drive technology and innovative chassis and driver assistance systems, this new model was once again a milestone. The power flow through the drivetrain was controlled even more precisely thanks to the optimised teamwork between BMW xDrive and DSC in the new Integrated Chassis Management (ICM) system.

Since 2009, the BMW X5 M has been one of two all-wheel-drive performance sports cars offered by BMW M GmbH. These models for the first time fuse the BMW X concept with the typical performance qualities of M Automobiles. A 408 kW/555 hp V8 M TwinPower Turbo engine specially developed for these elite sports cars, and a specially calibrated BMW xDrive system including Dynamic Performance Control, provide the basis for an unsurpassed driving experience.

14 years after the first X model made its debut, it was time for a third generation of the BMW X5 (**F15**, introduced in 2013) to continue the good work. Despite bigger dimensions, the new X5 is around 90 kilograms lighter than its predecessor. Also new are the optional Adaptive Suspension Packages for enhanced sporty handling and comfort, featuring rear axle air suspension, Dynamic Damper Control, Dynamic Performance Control and Active Roll Control. 2014 also heralded a new chapter for the performance models, as the second generation of the BMW X5 M (**F85**, introduced in 2014) took to the stage.

### **BMW X5 xDrive40e.**

In 2015, BMW took yet another opportunity to showcase innovative and pioneering drive technology in a Sports Activity Vehicle – this time with the launch of the new BMW X5 xDrive40e (**F15 PHEV**, introduced in 2015). This model had the distinction of being the first production plug-in hybrid model from the BMW core brand. Its combination of BMW xDrive and BMW eDrive opens a new chapter in the Sports Activity Vehicle segment. Using technology derived from the BMW i8, the BMW X5 xDrive40e is capable of

driving on electric power only, which means zero emissions at the point of use. The new SAV offers thrillingly sporty performance, effortless power delivery and sure-footed traction, while efficiency is equally outstanding.

The four-cylinder BMW TwinPower Turbo petrol engine and synchronous electric motor powering the BMW X5 xDrive40e deliver a combined output of 230 kW/313 hp and return combined fuel consumption of 3.4–3.3 litres per 100 km (83–85.6 mpg imp), with combined electricity consumption of 15.4–15.3 kWh/100 km. CO<sub>2</sub> emissions are 78–77 grams per kilometre (figures according to EU test cycle for plug-in hybrid vehicles, may vary depending on tyre format).

## **BMW X3: debut for BMW xDrive intelligent all-wheel drive.**

**E83 (2003), F25 (2010), F25N (2014).**

In 2003, BMW kept up the pioneering work by launching a further SAV model series in a new segment. The BMW X3 (**E83**, 2003–2010) was a highly attractive newcomer, boasting more compact dimensions than the BMW X5 and even more agile handling. It also marked the debut of the BMW xDrive intelligent all-wheel-drive system, technology that established the BMW X3 as a trendsetter and as the only premium model in this mid-sized segment for many years to come. The X3 was soon a bestseller, and by the time the first-generation models bowed out in autumn 2010, 610,000 units had left the production lines in Graz, Austria.

### **Proactive: BMW xDrive intelligent all-wheel drive.**

Unlike conventional all-wheel-drive systems, the electronically controlled BMW xDrive system is designed not only for improved grip in low-traction conditions, but also for improved cornering dynamics. The all-wheel-drive system interacts with the Dynamic Stability Control (DSC) system to assess all driving situations in good time, so that appropriate action can be taken at an early stage. The necessary control interventions are carried out by xDrive either on its own or in combination with DSC/Performance Control. The power split is varied quickly and precisely, maintaining typical BMW handling performance even under extremely dynamic cornering. BMW xDrive technology is now perfectly calibrated to suit the characteristics of the individual models in which it is used. In principle, BMW xDrive does not set a fixed ratio of drive power distribution; under normal conditions the system splits the power in a ratio of 60:40 per cent between the rear and front axles. This ratio is permanently altered in fractions of a second to suit changed

driving conditions. In the most extreme scenarios, all the drive power can be sent to just one axle.

As an “intelligent” all-wheel-drive system, BMW xDrive is able to identify the risk of traction loss at an early stage and to counteract wheelspin at one or more wheels by precisely regulating the amount of power sent to different wheels. The system proactively monitors the driving situation, always taking into account engine management data, accelerator pedal position, steering angle, wheel speeds and the lateral acceleration of the vehicle. Thanks to all this input, BMW xDrive is able to control front-rear drive power distribution so precisely that engine power is always fully utilised. Unlike conventional all-wheel-drive systems, which only react when at least one wheel is already spinning, xDrive is able to sense and prevent incipient oversteer or understeer at the very first signs. Only if optimised drive power distribution is insufficient to keep the vehicle on track does DSC intervene by reducing engine power and/or selectively braking individual wheels. The finely controlled braking interventions and torque control are handled by Performance Control. This system is also interconnected with the BMW xDrive electronics via the Integrated Chassis Management (ICM) system. In vehicles with Dynamic Performance Control, the resulting loss of propulsion is compensated for by an increase in engine power.

The second generation of the BMW X3 (**F25**, introduced in 2010) seamlessly continued the success of its predecessor. Although other premium manufacturers had entered the fray in the meantime, the further improved BMW xDrive system, operating in tandem with ICM, set new standards in this segment. In addition to enhanced sporty performance and optimised driving comfort, standout features of the new BMW X3 also included increased interior space and unprecedented interior flexibility. The optional Performance Control system also increased agility. In terms of appearance and specification, the new model offered clear parallels with the larger BMW models. And like the other X models, it too was now built at BMW’s plant in Spartanburg in the USA. Since 2014, the BMW X3 (**F25N**) has been on the market, with revised design and functionality and new-generation engines.

## **BMW X6: debut of the Sports Activity Coupe. E71 (2008), E72 (2010), F16 (2014), F86 (2014).**

In spring 2008, BMW once again launched a new market segment when it unveiled the world’s first Sports Activity Coupe. Combining the brawny physique of a BMW X model with the lithe and elegant lines of a BMW Coupe, the BMW X6 (**E71**, 2008–2014) expresses the characteristic driving dynamics

of the BMW X models in a new high-octane form. It also marked the debut of Dynamic Performance Control (DPC) in the premium segment, which was combined with BMW xDrive all-wheel drive to enhance the driving experience further.

### **Introduction of Dynamic Performance Control.**

With finely controlled braking intervention and drive torque management, this electronically controlled system allows the torque split between the left and right rear wheels to be seamlessly varied. System functions include active speeding up of the rear wheel on the outside or inside of the turn ("torque vectoring"). This brings major improvements, particularly in terms of handling and cornering safety.

Even at moderate speeds, Dynamic Performance Control significantly improves steering precision, cornering traction and agility. It also increases stability when cornering at speed, even if the driver makes an abrupt steering manoeuvre or suddenly lifts off the throttle. And these new gains in driving dynamics are never at the expense of safety. Understeer tendencies are efficiently counteracted at the very first signs, thanks to selective braking of the wheel on the inside of the turn by the interacting electronic control systems. Dynamic Performance Control compensates for the resulting loss of propulsion by simultaneously increasing engine power, thereby further improving grip on low- or split-traction surfaces.

### **High-performance and hybrid versions.**

Since 2009, BMW M GmbH has been offering the BMW X6 M performance model, featuring a V8 408 kW/555 hp engine with M TwinPower Turbo technology and model-specific BMW xDrive system including Dynamic Performance Control.

The first, trend-setting Sports Activity Coupe was even offered in a hybrid version. This BMW ActiveHybrid X6 model (**E72**, 2010–2014) was powered by an eight-cylinder petrol engine and two electric motors. Torque delivery to the front and rear wheels was varied in line with changing driving conditions by the intelligent BMW xDrive system. With a combined output of 357 kW/485 hp, the BMW ActiveHybrid X6 was the world's most powerful hybrid-drive production model. By the time the second generation of this model series arrived, 260,000 units of the BMW X6 had been sold worldwide.

The next generation of the BMW X6 (**F16**, introduced in 2014) built on the success of its predecessor. This Sports Activity Coupe is still one of a kind in its segment. The second-generation BMW X6 boasts impressive presence,

superior performance and innovative specification. The sharper, crisper looks are combined with an extrovert athletic character, and the attractive, luxurious interior boasts considerably more extensive standard specification. Despite their significantly enhanced performance, the new versions are up to 22 per cent more economical on fuel. The standard-fitted all-wheel-drive system can be combined with a choice of three optional Adaptive Suspension packages. The Professional package, for example, includes Dynamic Damper Control, rear axle air suspension, Dynamic Performance Control and Dynamic Drive active roll stabilisation. Along with the new BMW X6, 2014 also saw the arrival of a second-generation high-performance model from BMW M GmbH, with the new version of the BMW X6 M (**F86**).

## **BMW X1: the first X model in the premium compact segment.**

**E84 (2009), F48 (from 2015).**

In 2009, BMW introduced its first premium compact Sports Activity Vehicle. From the launch date the new BMW X1 (**E84**, 2009–2015), the fourth member of the BMW X family, boasted outstanding agility, confident traction, flexible interior configuration, outstanding efficiency and a BMW xDrive system with improved transfer case efficiency. Performance Control was optionally available too. In spring 2014, the BMW X1 went one better with new exterior highlights, further interior refinements and innovative specification features. Although the Leipzig-built BMW X1 now had a number of competitors in its segment, it continued to set standards in its class in sporty dynamism, ride comfort and adaptability. By the time the new generation took over in 2015, BMW had sold more than 730,000 units of the compact five-door model worldwide, making it the best-selling vehicle in the premium compact segment.

The second generation of the BMW X1 (**F48**, introduced in 2015) is more spacious, more imposing and more versatile than ever before. Now built in Regensburg, Germany, this compact Sports Activity Vehicle is for the first time based on an all-new front-wheel-drive platform. It also comes with a new, lightweight, more efficient BMW xDrive intelligent all-wheel-drive system. Power is sent from the front wheels to the rear wheels via power take-off bevel gearing on the front differential and a two-part drive shaft. The cornerstone of the all-wheel-drive system is an electrohydraulically controlled hang-on clutch in the rear differential, which seamlessly varies the front-rear drive power split. In the new BMW X1, too, the BMW xDrive system features an exceptionally energy-efficient control strategy. Whenever it is not necessary to drive both axles, the system is depressurised, making the car

front-wheel drive only. Further savings are achieved with the aid of a spring-loaded Efficient valve that lowers the oil level in the multi-plate clutch for significantly reduced churning losses. As a result, the system offers best possible traction and directional stability in all types of terrain, while the Performance Control system also enhances driving dynamics on asphalt.

## **BMW X4: sporty newcomer offers unadulterated driving enjoyment. F26 (2014).**

In summer 2014, the new BMW X4 (**F26**, introduced in 2014) imported the successful concept of the BMW X6 into a further segment. The world's first premium mid-sized Sports Activity Coupe took the total number of BMW X models to five. This too was a model with no direct competitors in its segment. Technically, this SAC is closely related to the BMW X3, though its dynamic lines and coupe-style silhouette emphasise an exceptionally sporty personality. The BMW X4's sharp handling is further enhanced by powerful engines, standard-fitted BMW xDrive complete with Performance Control, and Variable Sports Steering.



## 4. BMW xDrive glossary. Key terminology.

### **Automatic Differential Brake (ADB-X).**

The Automatic Differential Brake ADB-X ensures optimal traction in adverse conditions such as sand, snow or mud. It is a component of the Dynamic Stability Control (DSC) system and provides – by electronic means – a comparable function to that of a mechanical differential lock, but without the associated penalties on weight and driving dynamics. If a wheel is on the point of spinning, controlled braking pressure is applied, creating a locking effect between the spinning wheel and the wheel on the opposite side of the vehicle, thereby restoring optimal traction. If the DSC or Dynamic Traction Control (DTC) systems are switched on, engine power is automatically adjusted at the same time. If the driver has switched off DSC or DTC to increase traction or for extreme sporty on-road or off-road driving, ADB-X focuses on maximising traction and only acts on the brakes. A temperature control mechanism monitors temperatures at all times in order to prevent the overheating of the brakes.

### **Differentials and differential locks.**

The front and/or rear differential manages the differences in rotational speed between the wheels on the inside and outside of a turn when cornering. Locking differentials have the job of preventing one of the wheels on a drive axle from spinning. If a wheel starts to lose grip, the locking differential directs more drive power to the wheel with better traction. Some locking differentials, incorporating an electrohydraulic visco- or multi-plate clutch, operate automatically. The benefits of differential locks are not confined to off-road driving: they also offer advantages on asphalt, increasing traction and stability particularly when taking a series of bends at speed.

### **Dynamic Performance Control (DPC).**

By seamlessly varying the drive power split between the rear wheels, Dynamic Performance Control provides optimal driving dynamics and makes for noticeably sportier handling. In association with the other chassis control systems, it reduces the amount of steering effort required and improves tracking stability. The rear differential is augmented with two additional electronically controlled sets of gears that allow DPC to transfer more drive power to the rear wheel on the outside of the turn, as required by the driving situation. As with Performance Control (see below) the interacting electronic control systems apply controlled braking to the wheel on the inside of the

turn. Dynamic Performance Control compensates for the resulting loss of propulsion by simultaneously increasing engine power. The resulting additional torque generates a yawing or steering motion (torque vectoring), making for a much more precise and effortless turn-in to corners.

### **Dynamic Stability Control (DSC).**

Using a variety of sensors, Dynamic Stability Control continuously monitors the driving situation and automatically stabilises the vehicle via engine and braking management at the first signs of instability. DSC also performs numerous other functions, such as Brake Drying. When the windscreen wipers are switched on, the brakes are dried at intervals by the light application of the brake pads to the brake discs. This ensures that full braking power is always available instantly when required, even in the wet. A Brake Standby function, meanwhile, moves the brake pads up to the brake discs if the accelerator is suddenly released, so that full braking power is instantly available the moment the brake pedal is depressed. A further function is Start-off Assist, which automatically maintains brake pressure for a short period when starting on a hill to prevent the vehicle from rolling backwards.

### **Dynamic Traction Control (DTC).**

DTC, a special Dynamic Stability Control mode, delivers an even sportier driving experience at the press of a button. When activated, DTC delays DSC intervention, allowing controlled drifting. On loose snow or sand, this mode improves traction by allowing more wheel slip and reducing the risk of wheelspin.

### **Efficient valve.**

By lowering the oil level in the electrohydraulically controlled hang-on multi-plate clutch in the rear differential (see Hang-on clutch), the BMW-developed Efficient valve reduces churning losses whenever all-wheel drive is not required and the system is depressurised. This offers additional fuel savings in everyday operation.

### **Electronic Differential Lock Control (EDLC).**

EDLC simulates the action of a mechanical differential lock by applying braking pressure to the front wheels. It offers significantly improved traction out of corners.

### **Hang-on clutch.**

On vehicles where BMW xDrive is combined with a front-wheel-drive setup, the conventional transfer case is replaced by an electrohydraulically controlled hang-on multi-plate clutch in the rear differential, which seamlessly varies the

front-rear drive power split. In extreme scenarios, such as the front wheels sitting on a patch of ice, it allows up to 100 per cent of the power to be sent to the rear wheels. Whenever all-wheel drive is not required, the hydraulic pump switches off, depressurising the system. At the same time the Efficient valve (see above) lowers the oil level in the multi-plate clutch, which reduces churning losses. The hang-on clutch offers the advantage of a leaner all-wheel-drive architecture, with lightweight, compact components.

### **Hill Descent Control (HDC).**

Hill Descent Control prevents the wheels from locking on a downhill gradient, thereby maintaining steerability and helping drivers achieve a controlled descent, particularly in steep and difficult terrain. HDC automatically decelerates the vehicle to a constant speed, which can be adjusted in increments, allowing the driver to concentrate on the task of steering. The benefits of HDC are particularly evident on fast-changing, low-traction surfaces such as rock, grass or snow. The system works in tandem with ABS to perform very efficient and controlled stabilisation when braking on a descent, using specially adapted slip thresholds. This prevents skidding and sliding, and maintains steerability.

### **Integral Active Steering.**

Integral Active Steering for rear-wheel-drive vehicles combines passively steering rear wheels with a variable steering ratio at the front wheels. At low speeds, the rear wheels steer in the opposite direction to the front wheels. The vehicle then effectively drives as if the wheelbase has been shortened, reducing the turning circle and improving manoeuvrability and agility. At higher speeds, the rear wheels steer in the same direction as the front wheels. This produces the effect of a longer wheelbase, improving stability and comfort – particularly when performing fast, abrupt lane changes. In the new BMW 7 Series (G11/G12), Integral Active Steering is for the first time combinable with BMW xDrive all-wheel drive.

### **Integrated Chassis Management (ICM).**

The Integrated Chassis Management system acts as a master control module for all the various vehicle dynamics control systems. With split-second speed, this high-performance electronic control system coordinates the interaction of the drivetrain and suspension functions so as to provide maximum stability and performance across all driving situations. When conditions change suddenly – for example due to a sudden surface change, sudden steering input or abrupt acceleration or braking – ICM sends precise commands to the Performance Control/Dynamic Performance Control system, while also closely coordinating their interaction with the DSC and xDrive functions.

### **Multi-plate clutch.**

A multi-plate clutch is a hydraulically or electronically controlled component whose function is to connect two shafts in order to transmit drive power. Typical applications for multi-plate clutches include all-wheel-drive systems, locking differentials and automatic transmissions. The BMW xDrive system uses an electronically controlled multi-plate clutch in the transfer case to vary the drive power split between the front and rear wheels. Unlike a visco-clutch system, this system also takes into account sensor-based information about the vehicle's overall dynamic status.

### **Performance Control.**

Performance Control precisely proportions the drive torque and braking pressure between the individual wheels when cornering. Bearing in mind that the wheel on the outside of a turn travels further than the wheel on the inside of the turn, Performance Control adjusts the engine power and applies selective wheel braking to send more power to the outer wheels and less to the inner wheels, keeping all the wheels at maximum traction. The system effectively "turns" the vehicle into the corner, improving handling safety and vehicle dynamics. See also Dynamic Performance Control.

### **Planetary gear system.**

A planetary gear system is a compact and highly efficient type of gear system in which the gears are arranged in the form of a solar system. Gear ratios are shifted without interrupting the power flow, using brakes or clutches that hold certain gears or groups of gears stationary, while others rotate.

### **Power take-off.**

Power take-off bevel gearing on the front differential sends power via a drive shaft to the rear axle, where a hang-on clutch matches the power split to the driving situation.

### **Transfer case.**

In a full-time all-wheel-drive system, the transfer case splits the drive power in a variable ratio between the front and rear wheels. Depending on whether the transfer case is designed as a differential or a planetary gear system, the power split may be controlled by a visco clutch or an electronically controlled, electrohydraulic multi-plate clutch. In the case of BMW xDrive, an electric stepper motor is used to adjust a multi-plate clutch in the transfer case. The higher the pressure on the clutch plates the more power is transferred via a gear system to the front wheels. Conversely, when the clutch is completely open, all power goes to the rear wheels. It takes just fractions of a second to fully open or fully close the clutch.

### **Visco clutch/locks.**

The visco clutch transfers drive torque by means of fluid friction, using a system of circular discs (plates) immersed in a silicone fluid whose viscosity increases as the fluid heats up and as the viscous shear effects between the plates increase. Visco clutches can be used both for automatic drive torque splitting and for automatic operation of inter-axle or inter-wheel differential locks. For this purpose the viscous clutch is combined with a differential (inter-wheel or transfer case differential) or a planetary gear system with transfer case function.

## 5. Appendix. Current models with all-wheel drive.



Model series	Type	Output kW/hp Nm		0–100 km/h	Top speed	Fuel consumption l/100 km	Emissions CO <sub>2</sub> g/km
<b>BMW 1 Series</b>							
Three-door	M135i xDrive	240/326	450	4.7	250	7.8–7.8	182–182
	118d xDrive	110/150	320	8.4	210	4.7–4.3	123–113
	120d xDrive	140/190	400	6.8	222	4.7–4.3	124–113
Five-door	M135i xDrive	240/326	450	4.7	250	7.8–7.8	182–182
	118d xDrive	110/150	320	8.4	210	4.7–4.3	123–113
	120d xDrive	140/190	400	6.8	222	4.7–4.3	124–113
<b>BMW 2 Series</b>							
Coupe	M235i xDrive	240/326	450	4.6	250	7.8–7.8	182–182
	220d xDrive	140/190	400	6.9	225	4.7–4.3	124–113
Active Tourer	225i xDrive	170/231	350	6.3	237	6.5–6.4	152–148
	225xe	165/224	385	6.7	202	2.1–2.0	49–46
	218d xDrive	110/150	330	8.6	208	5.4–4.7	131–124
	220d xDrive	140/190	400	7.3	223	4.8–4.6	127–122
Gran Tourer	220d xDrive	140/190	400	7.6	218	5.1–4.9	134–128
<b>BMW 3 Series</b>							
(LCI model)							
Sedan	320i xDrive	135/184	270	7.5	232	6.8–6.4	159–149
	330i xDrive	185/252	350	5.8	250	6.2–5.9	144–138
	340i xDrive	240/326	450	5.0	250	7.9–7.7	185–179
	318d xDrive	110/150	320	8.8	212	4.8–4.5	127–117
	320d xDrive	140/190	400	7.4	233	4.8–4.4	126–116
	330d xDrive	190/258	560	5.3	250	5.3–5.2	139–137
	335d xDrive	230/313	630	4.8	250	5.5–5.4	145–143
Touring	320i xDrive	135/184	270	7.7	225	7.3–6.8	169–159
	330i xDrive	185/252	350	6.0	250	6.5–6.2	152–144
	340i xDrive	240/326	450	5.0	250	7.6–7.2	176–168
	318d xDrive	110/150	320	9.2	206	5.1–4.7	133–123
	320d xDrive	140/190	400	7.6	228	5.0–4.7	133–123
	330d xDrive	190/258	560	5.4	250	5.5–5.4	145–142
	335d xDrive	230/313	630	4.9	250	5.7–5.6	151–148
Gran Turismo	320i xDrive	135/184	270	8.0	227	7.2–7.0	167–164
	328i xDrive	180/245	350	6.2	247	7.0–6.8	162–159
	335i xDrive	225/306	400	5.3	250	8.1–8.0	190–187
	320d xDrive	135/184	380	8.0	230	5.2–5.1	136–133
	330d xDrive	190/158	560	5.4	250	5.6–5.4	146–142
	335d xDrive	230/313	630	4.9	250	5.7–5.6	151–149
<b>BMW 4 Series</b>							
Coupe	420i xDrive	135/184	270	7.4	233	7.0–6.8	163–159
	428i xDrive	180/245	350	5.6	250	6.9–6.8	161–159
	435i xDrive	225/306	400	5.2	250	8.3–8.2	194–193
	420d xDrive	140/190	400	7.4	236	4.7–4.4	125–117
	430d xDrive	190/158	560	5.2	250	5.4–5.2	142–137

	435d xDrive	230/313	630	4.7	250	5.6–5.4	147–143
Convertible	428i xDrive	180/245	350	6.5	250	7.2–7.0	167–163
Model series	Type	Output kW/hp	Nm	0– 100 km/h	Top speed	Fuel consumpti on l/100 km	Emissions CO <sub>2</sub> g/km
	435i xDrive	225/306	400	5.6	250	8.7–8.5	203–199
	435d xDrive	230/313	630	5.2	250	5.9–5.7	155–151
Gran Coupe	420i xDrive	135/184	270	7.6	233	7.1–6.9	164–161
	428i xDrive	180/245	350	5.8	250	7.0–6.8	163–159
Gran Coupe	435i xDrive	225/306	400	5.3	250	8.5–8.3	198–194
	420d xDrive	140/190	400	7.6	235	4.9–4.6	129–121
	430d xDrive	190/158	560	5.3	250	5.5–5.3	145–140
	435d xDrive	230/313	630	4.8	250	5.7–5.6	150–146
<b>BMW 5 Series</b>							
Sedan	528i xDrive	180/245	350	6.3	250	6.8–6.4	159–149
	535i xDrive	225/306	400	5.6	250	8.1–7.6	188–178
	550i xDrive	330/449	650	4.4	250	9.3–9.2	218–214
	520d xDrive	140/190	400	7.9	230	4.9–4.5	129–119
	525d xDrive	160/218	450	7.0	240	5.4–5.1	143–133
	530d xDrive	190/258	560	5.7	250	5.8–5.4	152–142
	535d xDrive	230/313	630	5.1	250	6.0–5.6	157–147
	M550d xDrive	280/381	740	4.7	250	6.2	162
Touring	528i xDrive	180/245	350	6.6	244	7.2–6.7	167–157
	535i xDrive	225/306	400	5.7	250	8.5–8.1	198–188
	520d xDrive	140/190	400	8.2	220	5.2–4.8	137–127
	525d xDrive	160/218	450	7.3	231	5.8–5.4	152–142
	530d xDrive	190/258	560	5.9	250	6.0–5.7	159–149
	535d xDrive	230/313	630	5.3	250	6.2–5.9	164–154
	M550d xDrive	280/381	740	4.9	250	6.3	166
Gran Turismo	535i xDrive	225/306	400	6.1	250	8.6–8.5	205–199
	550i xDrive	330/450	650	4.8	250	9.9–9.6	230–224
	530d xDrive	190/258	560	6.2	243	6.4–6.2	169–163
	535d xDrive	230/313	630	5.6	250	6.6–6.4	174–168
<b>BMW 6 Series</b>							
Coupe	640i xDrive	235/320	450	5.2	250	8.2–8.0	191–187
	650i xDrive	330/450	650	4.4	250	9.3–9.1	217–213
	640d xDrive	230/313	630	5.1	250	5.8–5.6	154–149
Convertible	640i xDrive	235/320	450	5.4	250	8.4–8.2	195–191
	650i xDrive	330/450	650	4.5	250	9.5–9.3	221–217
	640d xDrive	230/313	630	5.3	250	6.0–5.8	158–154
Gran Coupe	640i xDrive	235/320	450	5.3	250	8.2–8.1	192–188
	650i xDrive	330/450	650	4.4	250	9.4–9.2	219–215
	640d xDrive	230/313	630	5.2	250	6.0–5.8	158–153
<b>BMW 7 Series</b>							
Sedan	750i xDrive	330/450	650	4.4	250	8.3–8.1	194–189
Short (G11)	730d xDrive	195/265	620	5.8	250	5.2–4.8	137–132
	740d xDrive	235/320	680	5.2	250	5.3–4.9	139–129
Sedan	750Li xDrive	330/450	650	4.5	250	8.5–8.3	197–192
Long (G12)	740Le xDrive	240/326	500	5.5	>240	2.3	53
	730Ld xDrive	195/265	620	5.9	250	5.2–4.8	137–127
	740Ld xDrive	235/320	680	5.3	250	5.4–5.0	142–132
<b>BMW X1</b>							
(F48)							

	X1 xDrive20i	141/192	280	7.4	223	6.4–6.3	149–146
	X1 xDrive25i	170/231	350	6.5	235	6.6–6.4	152–149
	X1 xDrive18d	110/150	330	9.2	204	5.0–4.8	132–127
Model series	Type	Output kW/hp Nm		0– 100 km/h	Top speed	Fuel consumpti on l/100 km	Emissions CO <sub>2</sub> g/km
	X1 xDrive20d	140/190	400	7.6	219	5.1–4.9	134–129
	X1 xDrive25d	170/231	450	6.6	235	5.2–5.0	137–132
<b>BMW X3</b>							
	X3 xDrive20i	135/184	270	8.4	210	7.9–7.4	183–173
	X3 xDrive28i	180/245	350	6.5	230	7.4–7.3	172–169
	X3 xDrive35i	225/306	400	5.6	245	8.3	193
	X3 xDrive20d	140/190	400	8.1	210	5.6–5.1	146–135
	X3 xDrive30d	190/258	560	5.9	232	6.1–5.9	159–156
	X3 xDrive35d	230/313	630	5.3	245	6.0	157
<b>BMW X4</b>							
	X4 xDrive20i	135/184	270	8.1	212	7.3–7.2	171–169
	X4 xDrive28i	180/245	350	6.4	232	7.4–7.3	172–169
	X4 xDrive35i	225/306	400	5.5	247	8.3	193
	X4 xDrive20d	140/190	400	8.0	212	5.5–5.4	145–142
	X4 xDrive30d	190/258	560	5.8	234	6.1–5.9	159–156
	X4 xDrive35d	230/313	630	5.2	247	6.0	157
<b>BMW X5</b>							
	X5 xDrive35i	225/306	400	6.5	235	8.5–8.5	199–197
	X5 xDrive50i	330/450	650	4.9	250	9.7–9.6	226–224
	X5 xDrive25d	160/218	450	8.1	220	5.9–5.8	156–154
	X5 xDrive30d	190/258	560	6.8	230	6.0–5.9	158–156
	X5 xDrive40d	230/313	630	5.9	236	6.0–6.0	159–157
	X5 M50d	280/381	740	5.3	250	6.6	173
	X5 M	423/575	750	4.2	250	11.1	258
	X5 xDrive40e	230/313	450	6.8	210	3.4–3.3	78–77
<b>BMW X6</b>							
	X6 xDrive35i	225/306	400	6.4	240	8.6–8.5	200–198
	X6 xDrive50i	330/450	650	4.8	250	9.7–9.7	227–225
	X6 xDrive30d	190/258	560	6.7	230	6.0–6.0	159–157
	X6 xDrive40d	230/313	630	5.8	240	6.3–6.2	165–163
	X6 M50d	280/381	740	5.2	250	6.6	174
	X6 M	423/575	750	4.2	250	11.1	258
<b>BMW i8</b>							
		266/362	320 <sup>1)</sup> 250 <sup>2)</sup>	4.4	250	2.1	49

\* Fuel consumption figures (combined) based on the ECE test cycle, may vary depending on the tyre format specified.

<sup>1)</sup> Torque petrol engine <sup>2)</sup> Torque electric motor





## 6. Appendix. Timeline.

### Timeline of BMW all-wheel-drive technology.

Year	Series and model	Notes
1985	BMW 325i Allrad (E30)	Permanent all-wheel drive (37:63), automatic visco locks in the main gear unit and final drive, toothed
1988	BMW 325iX touring (E30)	chain-driven auxiliary driveshaft and shaft to the front differential.
1991	BMW 525iX Sedan (E34) and touring	Multi-plate clutch in the transfer case (36:64), electronically controlled locks for transfer case and rear differential, data provided by ABS and engine management.
1999	BMW X5 (E53)	First Sports Activity Vehicle (SAV), planetary centre differential (38:62), ADB-X, DSC, HDC
2000	BMW 325xi, 330xi, 330xd (E46) Sedan and touring	Model-specific variants of the all-wheel-drive system without conventional differential locks. Instead, automatic braking pulses applied to selected wheels
2003	BMW X3 (E83), BMW X5 (E53)	BMW xDrive (40:60) debuts in the X3 and X5; electronically controlled multi-plate clutch linked to DSC for the first time
2005	BMW 3 Series (E90) Sedan and Touring, later Coupe BMW 5 Series Sedan and Touring (E60, E61)	Model-specific versions of BMW xDrive
2006	BMW X5 (E70)	
2007	BMW X6 (E71)	First Sports Activity Coupe (SAC), debut of Dynamic Performance Control (DPC)

	BMW X1 (E84)	
2009	BMW X5 M (E70), BMW X6 M (E71)	New X model, Performance Control, high-performance versions
	BMW 7 Series (F01, F02)	BMW xDrive debuts in the BMW 7 Series
	BMW ActiveHybrid X6 (E72),	All-wheel drive and hybrid drive combined for the first time
2010	BMW 5 Series Gran Turismo (F07), BMW X3 (F25)	
2011	BMW 5 Series Touring (F11)	
	BMW 3 Series Sedan (F30)	
2012	BMW 6 Series Coupe, Convertible and Gran Coupe (F12/13, F06)	
	BMW 3 Series Touring (F31)	
2013	BMW 4 Series Coupe (F32)	Debut of BMW 4 Series
	BMW X5 (F15)	
	BMW 3 Series Gran Turismo (F34),	
	BMW 1 Series (F20, F21)	BMW xDrive debuts in the BMW 1 Series
	BMW X3 (F25N)	
	BMW X4 (F26),	Debut of BMW X4
2014	BMW X6 (F16)	Debut of BMW xDrive in conjunction with front-wheel- drive concept
	BMW 2 Series Active Tourer (F45),	
	BMW 4 Series Coupe	

(F33) and Gran Coupe	
(F36)	
BMW X5 M (F85),	
BMW X6 M (F86)	
BMW M235i Coupe (F22)	BMW 1 Series Coupe discontinued
BMW i8 (I12)	Plug-in hybrid with combustion engine driving the rear wheels and electric motor driving the front wheels

	BMW 2 Series Coupe	
	BMW 225xe	
	BMW 2 Series Gran	Plug-in hybrid drive in conjunction with front-wheel-drive concept, electrified xDrive.
	Tourer (F46)	
2015	BMW 7 Series (G11, G12)	With up to seven seats for the first time
	BMW X1 (F48)	BMW xDrive combined with Integral Active Steering
	BMW X5 xDrive40e (F15PHEV)	Debut of BMW X1 with front-wheel-drive concept
		BMW xDrive combined with BMW eDrive