

**EXPLANATORY MEMORANDUM TO**  
**THE MOTOR VEHICLES (EC TYPE APPROVAL) (AMENDMENT No.2)**  
**REGULATIONS 2007**

**2007 No. 3135**

1. This explanatory memorandum has been prepared by the Vehicle Certification Agency, an Executive Agency of the Department for Transport, and is laid before Parliament by Command of Her Majesty.
2. **Description**

These Regulations amend the Motor Vehicles (EC Type-Approval) Regulations 1998 (“the 1998 Regulations”), in order to implement four Directives.
3. **Matters of special interest to the Joint Committee on Statutory Instruments**

None.
4. **Legislative Background**
  - 4.1 These Regulations implement:
    - (a) Directive 2006/40/EC, on emissions from air conditioning systems;
    - (b) Directive 2007/15/EC, amending Directive 74/483/EEC on external projections of vehicles; and
    - (c) Directives 2006/81/EC and 2006/96/EC, amending a number of Directives by reason of the Accession of Bulgaria and Romania to the European Union.
  - 4.2 Directive 70/156/EEC provides for a system of vehicle type approval. Light passenger vehicles (i.e. passenger vehicles with no more than 8 seats, referred to in Directive 70/156/EEC as Category M1) must be of a type approved as conforming to this Directive before being registered, sold or entered into service for the first time. In order to be so approved, a vehicle must comply with technical requirements specified in other Directives, called the “Separate Directives”, listed in an Annex to Directive 70/156/EEC.
  - 4.3 Directive 2006/40/EC introduces a new set of requirement. The three other Directives amend Separate Directives already listed in the Annex.
  - 4.4 It is a requirement of the EC type approval system that transposition of those Directives must be carried out.
  - 4.5 The 1998 Regulations implement Directive 70/156/EEC, and the related Separate Directives, in respect of the EC type approval of light passenger vehicles.
  - 4.6 Like the 1998 Regulations, these Regulations are made under the powers conferred by section 2(2) of the European Communities Act 1972.

## **5. Extent**

This instrument extends to all of the United Kingdom.

## **6. European Convention on Human Rights**

As the instrument is subject to negative resolution procedure and does not amend primary legislation, no statement is required.

## **7. Policy background**

7.1 Member States are required to transpose the type approval requirements. These requirements are constantly being updated.

7.2 Under Directive 2006/40/EC, a vehicle fitted with an air conditioning system designed to contain fluorinated greenhouse gases with a global warming potential greater than 150 will be able to obtain EC type approval only if it can be shown that the rate of leakage from that system does not exceed a certain amount of fluorinated gases per year. Then, from 1<sup>st</sup> January 2011 for new types, and 1<sup>st</sup> January 2017 for existing types, the rate of leakage will become irrelevant, and it will no longer be possible to obtain EC type approval for a vehicle fitted with an air conditioning system designed to contain fluorinated greenhouse gases with a global warming potential greater than 150.

7.3 Directive 2007/15/EC amends Directive 74/483/EC, which relates to external projections of vehicles, in order to align some requirements for bumper dimensions with the requirements of the similar United Nations European Commission for Europe (UNECE) Regulation 26.

7.4 Directives 2006/81/EC and 2006/96/EC amend a number of separate Directives, in order to recognize the accession of Romania and Bulgaria to the European Union at the start of 2007. These changes are very minor in nature; most of them consist in providing for a specific code in respect of Romania and Bulgaria on certain labels or certain information documents.

7.5 Representatives of the Industry participate actively in the development of European legislation, and close contact has been maintained during the decision-making process that led to the adoption of the Directives. Although implementation of these Directives is mandatory, and it is considered that there is no alternative option but to amend the 1998 Regulations, it has become usual to advise the United Kingdom's automotive industry of the necessary changes and ask for their opinions. Following this practice, a consultation letter was circulated by the Vehicle Certification Agency on 2<sup>nd</sup> July 2007 to the Society of Motor Manufacturers and Traders (SMMT) in order to advise of the imminent transposition and to invite any comment. They have responded to say they have no concerns.

7.6 By inserting a reference to the Directives in the appropriate place in a Schedule to the 1998 Regulations, these Regulations ensure that they will be taken into account as far as the type approval of M1 vehicles is concerned.

## **8. Impact**

8.1 Compliance with the requirements of 2006/40/EC will entail costs to manufacturers. A Regulatory Impact Assessment (RIA) has been prepared to

explain the impact and is attached. No RIA has been produced in respect of Directives 2007/15/EC, 2006/81/EC or 2006/96/EC, as these have a negligible effect on the costs or savings of businesses, the voluntary sector or the public sector.

8.2 There should be no impact on the public sector.

## **9. Contact**

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# FINAL REGULATORY IMPACT ASSESSMENT

## REDUCTION OF GREENHOUSE GAS EMISSIONS FROM MOBILE AIR- CONDITIONING SYSTEMS (MACs) IN MOTOR VEHICLES

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## **1. TITLE OF PROPOSAL**

Transposition of Directive 2006/40/EC, relating to emissions from mobile air-conditioning systems in motor vehicles, into domestic law.

## **2. PURPOSE AND INTENDED EFFECT**

### **2.1. Objective**

This measure will bring stricter controls on fluorinated greenhouse gases (f-gases) used in air conditioning systems used in vehicles - generally referred to as mobile air conditioning systems or MACs. There are two objectives. Firstly, it will ban the most environmentally destructive f-gases used in such equipment. Secondly, while the ban is being progressively put in place, more stringent standards for the leakage of these gases from MAC systems will be introduced.

### **2.2. Background**

#### **2.2.1. General use of F-gases**

Fluorinated gases (f-gases) are man-made substances, consisting of hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF<sub>6</sub>). In the 1990s, f-gases were introduced to replace Chlorofluorocarbons (CFCs) and Hydrochlorofluorocarbons (HCFCs), which were seriously depleting the ozone layer. F-gases removed this risk and were low in toxicity and flammability. They are now used mainly as a refrigerant and flame protector in air conditioning and industrial refrigeration systems, heat pumps, fire extinguishers and high voltage switchgear and for making products such as foams, sport shoe "air soles" and car tyres.

Unfortunately, the advantages of f-gases are offset by the serious dangers they pose for global warming. Although they account for just 2% of total EU greenhouse gas emissions, including carbon dioxide (CO<sub>2</sub>), their impact is vastly greater than CO<sub>2</sub> as they have a much greater global warming potential (GWP).<sup>1</sup> For example, in the most extreme case, SF<sub>6</sub> has a GWP that is 23,900 times larger than CO<sub>2</sub>. The Government therefore considers that they should only be used where other safe, technically feasible, cost-effective and more environmentally acceptable alternatives do not exist and that, through technological developments, they may eventually be able to be replaced in the applications where they are used. Also, while HFC emissions reduction strategies should not undermine its commitment to phase out ozone depleting substances HFC emissions should not be allowed to rise unchecked.

Under the Kyoto Protocol 1997, the European Union is committed to reducing greenhouse gas emissions to 8% below 1995 levels by 2008-12. The UK is subject to the burden-sharing agreement, which has a target of 12.5%

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<sup>1</sup> "Global Warming Potential" (GWP) expresses the climatic warming potential of a greenhouse gas relative to carbon dioxide. The standard GWP is calculated in terms of the 100 year warming potential of one kilogram of a gas relative to one kilogram of CO<sub>2</sub>.

reductions, equating to a 93 million tonne reduction of CO<sub>2</sub>. Action to reduce emission of f gases should be considered as part of the wider efforts being undertaken in the UK and the EU to combat climate change.

The European Union has adopted two separate mandatory measures aimed at substantially reducing f-gas emissions. Firstly, a Regulation which will restrict, and in some cases ban, certain f-gases in specific, mainly industrial but also certain consumer product applications. The Regulation is beyond the scope of this RIA and is a matter for the Department of the Environment, Food and Rural Affairs (DEFRA).

Secondly, Directive 2006/40/EC which introduces stricter f-gas controls for MAC systems used in vehicles; this measure is the subject of this RIA. The EU considered that provisions relating solely to air conditioning systems used in vehicles were best treated separately and included in the established European type approval system for new vehicles under directive 70/156/EEC, as amended.

There has been a rapid rise in emissions due to the growth of HFC-based air conditioning in new cars. UK research suggests that the percentage of new vehicles having MAC systems in the UK will reach 75% by 2010 as MACs become a standard feature in vehicles. It is important therefore to ensure that MAC emissions do not rise unchecked.

### **2.2.2. Controlling f-gases in MAC systems**

MAC systems leak refrigerant in normal use as they cannot be hermetically sealed. This is due to such factors as the need to facilitate assembly and future servicing and to allow for engine and road vibration.

The EU agreed to phase out emissions of refrigerant f-gases from MAC systems by 2017 and the European Commission, the US Environmental Protection Agency, and the California Air Resources Board have agreed a global standard, (SAE-J-2763<sup>2</sup>) aimed at reducing leakage rates of HFC 134a, which should apply to all new cars sold in Europe after 2008. European Directive 2006/40/EC to limit f-gas emissions from MACs, incorporating this standard, was subsequently adopted on 17 May 2006 and is required to be implemented by Member States by 5 January 2008.

### **2.2.3. Intended effect of 2006/40/EC**

The directive applies to passenger vehicles with up to 9 seats and to new light goods vehicles up to 1034 kg unladen weight. It introduces a global warming threshold for f gases used in MACs and also introduces leakage limits and controls on refilling and retrofitting for these systems.

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<sup>2</sup> The SAE standard specifies that the rate of leakage from an air conditioning system designed to contain f gases with a global warming potential higher than 150 must not exceed 40 grammes of f gases per year for a single evaporator or 60 grammes of f gases per year for a dual evaporator system.

There are several stages to the introduction of the requirements -

- 1a) From 21 June 2008<sup>3</sup>, EC or national type approval may no longer be granted for a type of vehicle fitted with a MAC designed to contain f gases with a global warming potential greater than 150, unless the rate of leakage from that system meets the SAE-J-2763 leakage standard.
- 1b) From 21 June 2009 new vehicles fitted with a MAC designed to contain f gases with a global warming potential greater than 150 shall not be permitted to be registered for road use unless the rate of leakage from that system meets the SAE-J-2763 standards.
2. From 1 January 2011,
  - a) EC or national type approval may no longer be granted for a type of vehicle fitted with a MAC designed to contain f gases with a global warming potential greater than 150.
  - b) MACs designed to contain f gases with a global warming potential greater than 150 may not be retrofitted to vehicles type approved from that date.
  - c) MACs in vehicles type approved from that date may not be filled with an f- gas with a global warming potential greater than 150.
3. From 1 January 2017
  - a) New vehicles fitted with a MAC designed to contain f gases with a global warming potential higher than 150 shall not be permitted to be registered for road use.
  - b) MACs designed to contain f gases with a global warming potential higher than 150 shall not be retrofitted to any vehicles.
  - c) MACs in any vehicles may not be filled with an f gas with a global warming potential greater than 150 unless the MACs already contained such gases and were fitted to vehicles before 1 January 2017.

The phase out dates are staggered as new MAC systems have to be built into new product design. New MAC systems will need to be fully tested for durability and safety and the new design integrated into the mass production line. 2011 is a reasonable timescale to introduce such changes. Also, as it is not feasible to simply fill an existing MAC with a different, more environmentally responsible refrigerant, existing vehicles on the production lines would need to undergo significant re-engineering and redesign to accommodate a new MAC. However, as each model is planned and built on a roughly 6-year cycle, allowing a delay of this order will enable industry to develop future generations of MACs as part of their natural product cycle with minimum negative impact on the functioning of the automotive industry.

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<sup>3</sup> Commission Regulation No 706/2007 of 21 June 2007 establishes a harmonised detection test for measuring the leakage rate of f gases. .

### **2.3.3. Implementation**

Through amendments to:-

The Motor Vehicles (EC Type Approval) Regulations 1998 (construction requirements)

The Motor Vehicles (Type Approval for Goods Vehicles) Regulations 1982 (construction requirements)

The Road Vehicles (Construction and Use) Regulations 1986 (retrofitting and refilling requirements).

This RIA accompanies the regulations amending the EC type approval Regulations and includes the costs and benefits of constructing new vehicles to incorporate the new MAC requirements. These include those for vehicles which are subject to the Type Approval for Goods Vehicles Regulations.

## **3. CONSULTATION**

### **Within Government**

Following the Commission's publication of its original proposal on f-gases from both stationary and mobile sources, an inter-departmental Steering Group and project team led by DEFRA involving key Departments, Devolved Administrations and Environment Agency was set up. Departments consulted were:

Cabinet Office	Department for the Environment, Food and Rural Affairs
Department for Transport	Former Department of Trade and Industry (BERR)
Environment Agency	Foreign and Commonwealth Office
HM Revenue and Customs	HM Treasury
Ministry of Defence	Office of Fair Trading
Scottish Environment Protection Agency	Scottish Executive
Small Business Service	UK Permanent Representative to the EU (UKRep)
Welsh Assembly	

Table 1

DEFRA's consultants identified the sectors which would be affected by the Commission's proposals. They then worked with the former DTI, especially the Small Business Service, on analyzing stakeholder impacts.

### **Outside Government**

In early December 2003, DEFRA issued a consultation paper, inviting comments from 211 organisations and individuals on proposed f-gas

measures. A Government-led stakeholder group has been created to update stakeholders and seek their views on emerging issues. Meetings of this group continued beyond closure of public consultation. It has proved to be a very effective form of dialogue.

The UK motor industry and the Society of Motor Manufacturers and Traders (SMMT) and the main European organizations representing motor manufacturers were all involved in discussions during the development of the directive. Industry is content with the directive and has had adequate opportunity to participate and comment. Manufacturers have known for some time the technical details of the directive. No concerns of substance were raised by industry following notification to the Society of Motor Manufacturers and Traders of the Department's intention to prepare the necessary regulations to implement the directive.

#### **4. OPTIONS**

Option 1: Do Nothing

Option 2: Implement the Directive

#### **5. COSTS AND BENEFITS**

##### **5.1. Sections and groups affected**

The affected sector includes car and van manufacturers, specialist car and van air conditioning component and system manufacturers, car and van servicing organisations and vehicle dismantlers. The measure will also benefit society in general and the economy by contributing to reduction in global warming,

##### **5.2 Options**

###### **5.2.1 Option 1: Do nothing**

Removal of all HFCs from MAC systems at the end of the vehicle's life would still be mandatory under the End of Life Vehicles (ELV) Directive, effective since spring 2004. It is also standard practice, although not mandatory, for all responsible service companies to use refrigerant recovery equipment. From 2004 to 2025 emissions from this sector are projected to increase and then fall again.

As the transposition of directive 2006/40/EC, is mandatory, non-implementation would very likely lead to infraction proceedings before the European Court of Justice and significant pecuniary damages for the UK. It would also affect the UK's position within the EU, since it would be in a weaker position to demand compliance of other EU countries with European law.

## **5.2.2. Option 2: Implement the Directive - Analysis of costs and benefits**

The results of a recent research project<sup>4</sup> examining leak flow rates (LFRs) from road vehicles suggested that average leakage from MACs is already below the maximum level specified in the Directive. The costs and benefits presented below assume, therefore, that there would be no greenhouse gas savings from the maximum leakage element of the regulations but also that there would be no additional capital costs to manufacturers in complying with the leakage requirements of the directive. This has resulted in a reduction in the maximum cost estimate of about one third but also a halving of CO2 emission reductions directly attributable to the measure. Details of the cost and benefit calculations may be found in the Annexes to this RIA.

The costs and benefits in the Table below are those resulting from the incorporation of compliant MAC systems in new vehicles. Actual costs and benefits will depend upon the type of system used.

<b>ACTIVITY</b>	<b>CO2 EMISSION REDUCTION 2005-2025 (Tonnes)</b>	<b>ANNUALISED COSTS (£)</b>	<b>ANNUALISED BENEFITS (£)</b>
The requirements as regards prohibition, recovery, maximum leakage and containment. of non-complaint f-gases	7.2m to 9.3m tonnes	£17.6m to £66.9m	£3.1m to £15.2m

**Table:2. Emission reduction, annualised costs and benefits from implementing Directive 2006/40/EC**

Costs for retrofitting and refilling to the new directive requirements are being assessed for the purposes of separate regulations which are being prepared to cover these requirements; these costs are expected to be minimal.

No estimates have been made of enforcement costs. Implementation costs for testing compliance of MAC systems with type approval requirements are potentially significant. However, they will take place under existing testing procedures in the Type Approval Directive, which is enforced by the Vehicle Certification Agency. Implementation of the directive into domestic law would mean that type approval could not be granted unless the MAC system is verified as meeting the required standards. Costs per vehicle are expected to be small however, as there are usually thousands of vehicles of a type sold, but only one test.

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<sup>4</sup>Clodic, D., Treloumet, A., Palandre, L., Fayolle, F., Castel, J., Lallemand, J., & Dujardin, B., (2006) 'Research study on the definition of the implementation of a method of measurement of annual leak flow rates (LFRs) of MAC systems', Centre Energetique et Procédes

## **6. ADMINISTRATIVE BURDENS**

As indicated above, applications for type approval of new MACS will be made through the existing type approval system with additional administrative costs being minimal.

## **7. SMALL FIRMS IMPACT TEST**

Vehicles likely to be produced by small businesses are likely to be subject to “Single Vehicle Approval” procedures or to “Small series approval” procedures, neither of which require MACs to be designed to the new standards.

Trade associations and small firms in the sectors likely to be affected by the proposals have been contacted as part of stage one of the Small Firms Impact Test. Respondents have not highlighted any disproportionate impacts on small firms from the proposed regulation. The Small Business Service (SBS) has been consulted on a number of occasions during stage one. They agreed that there is no requirement to carry out further impact test analysis.

## **8. COMPETITION ASSESSMENT**

The MAC sector includes car manufacturers, specialist car component and system manufacturers, car servicing organisations and vehicle dismantlers. Such firms are likely to offer very different levels of service or products, and should be considered as separate markets. That means there is little chance for customers to substitute one company which is supplying a product or service for another. Likewise, the possibility of one firm substituting another on the supply side is limited.

Car and component manufacturing markets are unlikely to be concentrated, as the relevant geographic market is likely to be much wider than the UK. Overall, any noticeable impact might be proportionate to output. This is unlikely to significantly affect competition in these markets. Firms involved in vehicle dismantling would be unlikely to be affected by this proposal, as the removal of all refrigerants has been mandatory under the End of Life Vehicles Directive (ELV) since 2004.

## **9. ENFORCEMENT, SANCTIONS AND MONITORING**

Enforcement will be mainly through the existing type approval regime, to which new motor vehicles and their components are already subject. Before new models of road vehicle or their components can enter service, they must satisfy the Vehicle Certification Agency that they meet regulatory standards for construction, safety and the environment. By virtue of Directive 2006/40/EC improved standards on MAC systems would simply be included in type approval testing. Checks on approval documentation will be made by the Driver and Vehicle Licensing Agency at the time of registration. No other monitoring or evaluation would be required.

## 10. IMPLEMENTATION AND DELIVERY PLAN

The Vehicle Certification Agency would implement the Regulations as part of the mechanism for type-approving new light-duty vehicles. Motor manufacturers' representatives were fully involved in the development of the requirements over a considerable period of time and manufacturers will be aware of the new provisions.

## 11. POST- IMPLEMENTATION REVIEW

By VCA through the type approval process generally and by the Department through participation in the EU Commission's Comitology working groups where any necessary changes to technical specifications are reviewed. The European Commission are required to review the directive and publish a report by 2011.

## 12. SUMMARY COSTS AND BENEFITS TABLE

Option	Total benefit per annum: economic, environmental, social	- Total cost per annum: economic, environmental, social; policy and administrative.
Do nothing	Negative benefit.	Not addressed but negative environmental costs in terms of increased levels of greenhouse gases from new passenger cars. Costs of EC infraction actions - daily fine level unknown
Implement Directive 2006/40/EC	<p>Maintenance of the EU single market for motor vehicles.</p> <p>Achievement of an estimated reduction in CO2 emissions in the period 2005- 2025 of 7.2million to 9.3 million tonnes</p> <p>Monetised benefits of CO2 savings in the period 2005 to 2025 estimated at £3.1m to £15.2m.</p>	<p>Minimal administrative costs</p> <p>Annualised costs to industry of £17.6m to £66.9m.</p> <p>.</p>

### **13. SUMMARY AND RECOMMENDATION**

The regulations will result in stricter controls on the use of fluorinated gases used in mobile air conditioning systems, resulting in a reduction in greenhouse gas emissions from the UK passenger car fleet.

Since the directive was drawn up, manufacturers have made some progress towards meeting the standards so that the benefits (and costs) of meeting the measure are significantly less than was originally envisaged. Nevertheless the measure will still bring worthwhile benefits at a proportionate cost, and will be introduced under a timescale which will allow industry sufficient time to adapt. The competitiveness of individual companies is not expected to be affected and it will not impact adversely on small business. Industry has been fully involved in the development of the measure and no concerns of substance have been raised in consultation. No significant issues for implementation, enforcement or review are anticipated. Accordingly it is recommended that the regulations be made.

### **14. DECLARATION AND PUBLICATION**

I have read the regulatory impact assessment and I am satisfied that the benefits justify the costs.

Signed Jim Fitzpatrick.

Date 30th October 2007.

Jim Fitzpatrick  
Parliamentary Under Secretary of State  
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### **15. CONTACT DETAILS**

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## ANNEX 1

### ESTIMATES OF COSTS AND BENEFITS

- MAC/A: CO<sub>2</sub> systems, best-case scenario.  
 MAC/B: CO<sub>2</sub> systems, mid-case scenario.  
 MAC/C: CO<sub>2</sub> systems, worst-case scenario.  
 MAC/D: HFC 152a systems, best-case scenario.  
 MAC/E: HFC 152a systems, mid-case scenario.  
 MAC/F: HFC 152a systems, worst-case scenario.

**Table 4 - Benefits**

Alternative scenarios	Emission reductions '000 tonnes CO <sub>2</sub> 2005- 2025	Annualised benefits £'000		
		Based on £41	Based on £78	Based on £153
MAC/A	9,338	4,043	7,768	15,216
MAC/B	8,920	3,851	7,398	14,492
MAC/C	8,503	3,658	7,028	13,767
MAC/D	7,409	3,182	6,113	11,975
MAC/E	7,325	3,144	6,039	11,830
MAC/F	7,242	3,105	5,965	11,685

**Table 5 - Costs**

Alternative scenarios	Annualised costs (£k)	Lifetime cost-effectiveness £/tonne CO <sub>2</sub> saved	2010 CE £/tonne CO <sub>2</sub> saved*
MAC/A	36,492	57.4	-
MAC/B	47,013	77.5	-
MAC/C	66,917	115.7	-
MAC/D	17,587	34.9	-
MAC/E	22,959	46.1	-
MAC/F	28,331	57.5	-

\*carbon savings aren't expected until 2011 onwards.

## ANNEX 2

### METHODOLOGY AND ASSUMPTIONS

1. This note sets out the methodology and assumptions behind the modelling of the impact of a reduction of GHG emissions from mobile air conditioning (MAC) systems in motor vehicles. The original analysis of the measure was undertaken by Defra as part of a range of f-gas measures.
2. This note also describes an update to the previous work to include new evidence on the leakage rate from MACs in the counterfactual scenario.

### Directive 2006/40/EC

3. The Directive will bring about stricter controls in fluorinated greenhouse gases (f-gases) in MAC systems. There are two objectives:
  - To ban the most environmentally-destructive f-gases used in MAC systems: from January 1<sup>st</sup> 2006, the use of f-gases with a global warming potential (GWP) over 150 will be banned from new vehicles. By January 1<sup>st</sup> 2017, the above ban will apply to all vehicles - this will mean the retrofitting of high GWP MACs or that the refilling of MACs with higher GWP refrigerants will be banned.
  - To reduce the leakage of f-gases from MAC systems: from 1<sup>st</sup> January 2007, type approval will not be granted for vehicles fitted with an MAC that contains an f-gas with GWP greater than 150 unless the leakage rate from that system does not exceed 40g of f-gas per year for a single evaporator system or 60g per year for a dual evaporator system. This regulation comes into force for all new vehicles from 1<sup>st</sup> January 2008.
4. Recent research commissioned by ACEA<sup>5</sup> examined leak flow rates (LFRs) from 39 vehicles. The results of the testing suggested that average leakage rates are already below the maximum levels specified in the MAC regulation. The original Defra analysis has, therefore, been altered so that there is no GHG saving due to the leakage requirement (since manufacturers are currently using compliant MACs) but also no additional capital and revenue costs of this part of the regulation.

### Key modelling assumptions

#### Prohibition, recovery, maximum leakage and containment provisions

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<sup>5</sup> Centre Energetique et Procédés (2006) 'Research study on the definition of the implementation of a method of measurement of annual leak flow rates (LFRs) of MAC systems', ACEA/ARMINES

## Costs

- The costs of the regulation are split into capital and revenue costs. The capital costs represent the technology costs of adopting MACs that use f-gases with lower GWP. The assumed profile of revenue costs used in the analysis is shown in Table 6. It is assumed that the capital costs of the less environmentally damaging MACs depend on which type of refrigerant is used in the new MAC systems. The analysis assumes that manufacturers will use either f-gas (152a) or CO<sub>2</sub> at the MAC refrigerant - the capital cost of using the 152a MACs is assumed to be £20mn over six years and the capital costs of using the CO<sub>2</sub> MAC systems is £30mn over 6 years.

**Table 6 - capital costs (£mn)**

	2005	2006	2007	2008	2009	2010
<b>CO<sub>2</sub> mid case</b>	0.9	1.7	1.7	8.6	8.6	8.6
<b>152a mid case</b>	0.8	1.6	1.6	4.8	5.6	5.6

- The revenue costs represent the on-going costs of checking compliance. It is assumed that the revenue cost on the CO<sub>2</sub> MAC would be £45 per vehicle and the revenue cost associated with the 152a MAC would be £20 per vehicle.

## Carbon saving

- There are expected to be (equivalent) carbon savings from both the ban on the most environmentally destructive f-gases. The impact of the regulation banning the use of the most environmentally destructive f-gases is based on an assumption about the rate at which the new less-damaging f-gas MACs enter the vehicle fleet.
- The assumptions about the number of new vehicles with MACs and the number of vehicles with the old-style MACs in the regulated scenario are shown in Table 7. Taking the difference between the business as usual (BAU) and regulated scenarios for a particular year gives the number of new vehicles that use the less damaging f-gases in their MAC system. Multiplying this value by the f-gas saving in the new system compared to the old system<sup>6</sup> gives the total amount of f-gas that is saved through the regulation.

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<sup>6</sup> This value will depend on which type of technology is used, e.g. the CO<sub>2</sub> MACs are assumed to save 36.4kg of f-gas (mid-case) compared with the old style MACs while the 152a MACs are assumed to save just 11.2kg (mid-case).

**Table 7 - new MAC vehicles in BAU and regulated scenarios**

	2010	2011	2012	2013	2014	2015	2016	2017
<b>BAU (mn)</b>	1.74	1.76	1.77	1.79	1.81	1.83	1.85	1.86
<b>Regulation (mn)</b>	1.74	1.61	1.33	1.05	0.75	0.46	0.15	0.00
<b>Proportion of old style MACs (%)</b>	100%	91%	75%	59%	41%	25%	8%	0%

**Results**

9. The costs and benefits of the measure are presented in Table 8. The range for CO<sub>2</sub> reductions represents the different outcomes from different technologies, e.g., for the carbon savings from prohibiting the most damaging f-gases, the lower bound represents the emissions saved from 152a MACs (worse case estimate) and the upper bound represents the CO<sub>2</sub> MACs (best case estimate).

**Table 8 - costs and benefits of implementing MAC directive**

<b>Activity</b>	<b>CO<sub>2</sub> emissions reduction 2005-2025 (Mt)</b>	<b>Annualised cost (£mn, 2005 prices)</b>	<b>Annualised benefits (£mn, 2005 prices)</b>
Prohibition, recovery, maximum leakage and containment provision	7.2 - 9.3	17.6 - 66.9	3.1 - 15.2