

APPENDIX 1, BMW 330 Cup

1.: TECHNICAL REGULATIONS

1.1.: INTRODUCTION:

- a) The following Technical Regulations are set out in accordance with the Motorsport UK specified format and it should be clearly understood that if the following texts do not clearly specify what modifications or upgrades can be made to the car, then the principle is that chosen alternatives will not be permitted. The fact that some modifications are mentioned as prohibited does not imply that others are allowed.

Where nothing is listed for a reference number and heading, the subject is "free" within Motorsport UK regulations. If any doubt exists about the legality or acceptability of any modification, then please request clarification from the Eligibility Scrutineer **prior** to any work being undertaken.

- b) **STANDARD:** The word 'standard' used within these technical regulations as a description of components, is to be interpreted as per 'Standard Part' defined in Section B – Nomenclature & definitions in the Motorsport UK Yearbook. Checking will be by comparison to spare parts supplied by the manufacturer's official agent/s, comparison to standard parts or by any other means necessary to ensure compliance. **Standard Part:** Is a part, the specification, features, location and method of operation of a part are as provided when new by the motor manufacturer for the model and date of car as shown on the entry form.

- c) **STANDARD PATTERN:** The phrase 'standard pattern' used within these technical regulations as a description of components, is to be interpreted as per 'Standard Pattern Part' defined in Section B - Nomenclature & definitions in the Motorsport UK Yearbook. Checking will be by comparison to standard pattern part or any other means necessary to ensure compliance.

Standard Pattern Part: A replacement part that has a similar form, shape and features as the standard part and is made using similar materials and manufacturing processes e.g. a standard part manufactured by a non original equipment supplier that is fully interchangeable with the standard part.

2: GENERAL DESCRIPTION:

2.1. The 330i Cup cars will be BMW E46 3 Series in four door Saloon, Compact, Coupe or Touring variants made from 1998 - 2006 with the 3.0i M54B30 petrol engine. Cars and engines must be as per UK & European domestic market specification. Gear boxes must be standard five speed OE specification and must have OE gear ratios. Final drive / differential ratios must range between 2.93 and 4.4 and must be a standard BMW E46 OE unaltered non limited slip differential. Welded or Limited Slip Differentials are not permitted.

2.2. Examination of vehicles. The Championship Co-ordinator (in addition to any other powers held under these regulations) reserves the right before or after any race in the 330 Cup to designate any one or more of the competing cars for special eligibility scrutineering. Competitors must be prepared, with tools and spare parts as necessary, to enable inspection of components, or to have units sealed at the circuit for later inspection by an Eligibility Scrutineer at the Competitor's expense. Upon such selection being made the competitor shall immediately place the car under the control of the Championship Co-ordinator / designate and be deemed to have permitted all such scrutineering, examination and testing as the organisers may reasonably require. The Championship officials have the right to:

- a) Examine the car at the circuit for such period as may be reasonably required and take fuel samples.
- b) Retain the car for detailed examination at premises chosen by the Championship Co-ordinator. If the Championship Co-ordinator elects to retain the car it shall be made available for collection by the competitor at least seven days prior to the qualification session for the next race in the championship unless the car is found to be in breach of these regulations.
- c) Seal the car and any of its components in such a manner as chosen and require the competitor at their own expense to present the car to any other premises chosen by the organisers for detailed examination within a specified period and / or remove the car by transporter at no expense to the competitor to an appointed location. The competitor will be advised in writing of the time, date and location of the subsequent testing or eligibility examination. The overseen stripping of the engine or any required component will be undertaken by the competitor and / or mechanic / technician nominated by the competitor.
- d) The scrutineer can at their discretion request the removal of any part for their further inspection and testing.

3.: SAFETY REQUIREMENTS:

The following Articles of Motorsport UK Section K Safety Criteria Regulations will apply: - K drawings 1 – 6 with compulsory ‘side-entry’ bar on both the driver and passenger side of the car and spreader plates welded to the floor; K5, K6, K8 – K11, K13– K14 and with the minimum safety requirements listed in section Q. Extinguishers must be as per K 3.1.3. Large, Plumbed-In and for discharge into both cockpit and engine compartment and be FIA homologated. The fire extinguisher must be mounted either in the front or the rear (RHD n/s or LHD o/s) passenger foot well. Seat belts must be as per K2.1.2, K2.1.3 or K2.1.4 and be FIA homologated. All MSA Section K Safety criteria regulations apply as relevant. Particularly, competitors should note; (the following are minimum requirements)

K1	Roll bar	K9	Overalls – FIA 8856-2000
K2	Seatbelts – 6-point	K10	Helmet
K3	Fire extinguisher	K11	Goggles or visor
K5	Rear light	K12	Propeller Shaft Restraint
K6	Tank Fillers, Vents and Caps	K13	Head restraint
K8	Circuit breaker	K14	Fuel Tank

Please note regulations in Section J and specifically J5.2.1

In addition, competitors are reminded that Yearbook regulations Section J apply. The wearing of the following flame resistant race wear is mandatory for this series, as per K14, i.e. gloves, balaclava, socks or shoes. The wearing of flame resistant underwear is recommended.

4.: GENERAL TECHNICAL REQUIREMENTS & EXCEPTIONS:

All cars must comply with the requirements of sections J and Q19 of the current Motorsport UK Yearbook. All vehicles must be of sound construction and mechanical condition and be well maintained. There is no requirement for an MOT Certificate, Road Tax or Insurance. The Championship Co-ordinator reserves the right to refuse the entry of any car of which the preparation is of a poor standard (including the external appearance) and which is likely to bring the Championship into disrepute.

5.: CHASSIS:

5.1. The E46 Chassis must be as per manufacturers design for the body style, other than:

- i. the roll cage (mandatory)
- ii. a repair plating kit to repair/reinforce the rear under boot floor sub frame mounting points (recommended)
- iii. stitch welding of areas to the rear of the fuel tank to reinforce the turret seams and the supporting structure of the turrets (recommended)
- iv. front and / or rear strut brace (optional)

No other chassis modification or stiffening is permitted.

5.2. Extensions of the cage into the engine bay are not permitted. Other seam-welding or the addition of spot welds to the shell is prohibited.

5.3. TOWING EYES - (As per Motorsport UK Yearbook Q 13.1.) (a) There must be substantial towing eyes securely fixed to the main structure of the vehicle, front and rear, within the confines of the body to enable the vehicle to be moved. Cars of periods A to F and single seater racing cars are exempt from this requirement subject to a suitable towing point being clearly identified. Towing eyes must have a minimum internal diameter of 60mm. Towing eyes/towing points should be painted a contrasting bright colour (dayglo red, orange or yellow, marked with an arrow and the word “tow”. (b) The following configuration and specifications are strongly recommended: Vehicles to be equipped with two front and two rear towing eyes positioned equally either side of the longitudinal center line. The towing eyes to be made of steel wire rope of at least 6mm diameter with a 6x19 wire core. Each towing eye to have a breaking-strain of at least 2 tons and allow the passage of a cylinder with a diameter of 60mm. The towing eye to be fixed to a structural part of the chassis with a minimum of M10 (Grade 8.8) fixings, the inner part must be flexible in order for the towing eye to be retracted inside the bodywork profile. Towing eyes should be situated 25mm forward of the adjacent bodywork with clearance of 100mm above and below to enable recovery crews to attach straps and shackles. A “pull-cord” to be attached to the towing eye to enable the marshals to access it. The end attached to the chassis may be either ‘thimble’ or ‘open-loop’ style.

6.: BODYWORK:

6.1. Modifications Permitted: **6.1.1. General:** A laminated front windscreen is a mandatory fitment. The driver, front and rear passenger side windows and rear windscreens may remain as OEM or be replaced with Perspex / Lexan / Polycarbon in accordance with Motorsport UK regulations. The addition of colourless safety film to the glass is permitted.

6.1.2. Interior: Driver's seat must be replaced with a competition seat and fitted in accordance with K2.2. All passenger seats, floor coverings and roof lining must be removed. Redundant interior metal bracketry such as rear seat mountings may be removed. Spare wheel & associated parts, and all tools must be removed. Additional instruments are permitted, but the original dash binnacle and instrument cluster, must be retained and fitted in their original positions. The internal anti-intrusion door reinforcements (within the door) may be removed and some localised trimming of the inner door skins, tailgate and bonnet for lightening purposes is permitted. The main body of the standard dashboard must be retained and securely fitted in its original position, however localised trimming is permitted to allow roll cage fitment and the addition of aftermarket switchgear or pull cables. The removal of the glove box, lid and hinges is permitted. Steering wheel may be changed (compulsory if an air bag is fitted as original equipment). A glass sunroof must be removed or replaced as per Motorsport UK regulation Q13.10.6. The driver's and passenger's door windows may remain fully operational. The electric window winding mechanisms may be retained. It is permitted to remove air-conditioning if fitted, but the original heater matrix, mechanism and blower must be fitted and operational. The removal of dashboard air vents and associated pipe work is permitted, however the heating system must be able to demonstrate the ability to blow hot air onto the front windscreen to aid demisting. The original interior door panels may be removed and must be replaced with strong sheeting - this must be executed to a high standard with no sharp edges and with smooth surface.

6.1.3. Exterior: Door mirrors must be fitted on both sides of the vehicle and the choice is free. The original number of windscreen wiper arms/blades must remain and be fully functioning. Front windscreen washer systems must be fully operational. All external weather strips/channels may be removed. The standard engine bay cover and boot / tailgate locking mechanism must be disabled; only bonnet pins may be used to secure the engine bay cover in the closed position and pins/springs to secure the boot/tailgate in the closed position. Removal of impact absorbing materials from the internals of the rear bumper is permitted. Under car weather shields, wheel liners or any other OEM fitted under car shielding may be retained or removed. If retained OEM parts in original OEM materials only may be used. Front Splitters and Rear Wings are permitted. Front Chin Spoilers or Splitters must not extend further than 100mm beyond the standard bumper face and must remain within the body line of the car. The height of a rear wing must not exceed the height of the roof, must not extend rearward further than 100mm beyond the standard bumper face and the width must remain within the body line of the car.

6.1.4. Silhouette: All cars must have the appearance of the original E46 BMW Saloon / Coupe / Compact / Touring silhouette style which the car is based on. The front and rear bumpers and wheel arches may be replaced with OEM E46 or OEM M3 parts or fibreglass / carbon fibre replicas of same; or other modified or aftermarket bumpers or arches, provided the maximum tracking and / or car width measurements are not exceeded. Localised trimming is permitted to allow fitment of towing straps. Holes for brake ducting may be made in the front bumper. Brake ducting may not be installed. Other than the additions specified it is not permitted to add any materials to the inside or outside of the bumpers. The use of tape to bridge gaps between panels is not permitted unless accepted to be for reasons of safety by the scrutineer. Fibreglass / Carbon fibre doors, bonnets, boots, panels and / or wheel arches may be used for weight reduction. Wheel wells may be removed. The use of roof and / or window ventilation scoops and / or vents, for cabin / cockpit ventilation only, is permitted.

6.1.5. Ground Clearance: It is permitted to adjust the ride height. Under no circumstances must any part of the bodywork, or suspended part of the car, including the exhaust system, sump, sump guard or any nut/bolt protrusion, be below a horizontal plane passing 50mm above the ground. There is no minus tolerance to this measurement.

The car should be in normal racing trim with the driver aboard and steering in straight ahead position. A gauge of 50mm may be used by Scrutineers before or after races or practice to check the ground clearance; the vehicle may be stationary or moving during any testing and steering must be in a straight ahead position.

6.2. Modifications Prohibited:

- 6.2.1. General** - The exterior of the car must have the appearance of the E46 variant being raced.
- 6.2.2. Interior** – Door trim panels may not be removed unless they are replaced by appropriate material as detailed above.
- 6.2.3. Exterior** – Non OEM standard Under trays, Diffusers and Flat Floors are prohibited.
- 6.2.4. Silhouette** – any in contravention of 6.1.4.
- 6.2.5. Ground Clearance** – any in contravention of 6.1.5.

7. ENGINE:

- 7.0.1.** The only permitted engine for use in the 330i Cup championship is the BMW E46 330i M54B30 UK & European domestic market engine. Engine parts must be standard unmodified OEM parts or standard unmodified pattern parts manufactured for the UK & European domestic market spec.
- 7.0.2.** The use of parts derived from the ZHP model is prohibited. Verification of legality of OEM engine parts will be by comparison to standard unmodified OEM parts. Verification of legality of pattern engine parts will be by comparison to standard unmodified pattern parts. Verification will be by dimensional, weight and visual comparison.
- 7.0.3.** The cylinder head may not be skimmed.
- 7.0.4.** The fitment of a modified oil pump is not permitted. The standard pump must be fitted in the original location.
- 7.0.5.** The fitment of an aftermarket crankshaft damper is not permitted.
- 7.0.6.** All competing vehicles must be fitted with unmodified OEM or unmodified standard pattern exhaust manifolds as fitted to a Right Hand Drive European domestic market spec cars irrespective of the car being Left or Right Hand Drive.
- 7.0.7.** The metal treatment commercially identified as 'super finishing' is not permitted on any internal or external metallic components of a 330i Cup car.
- 7.0.8.** All competitors must have available on race days, at least two bolts/nuts for the rocker cover. Two bolts for the sump. Two bolts for the timing cover and two bottom bell housing bolts. All should be cross-drilled with a hole of minimum 1/16th" diameter to accept scrutineer's locking wire.
- 7.0.9. Pistons and Liners:** Only standard Pistons and Liners are permitted.
- 7.0.10. Sumps/Billet Sumps:** Only standard OE unmodified sumps are permitted. The OE sump may be baffled with standard baffles.
- 7.0.11. Modifications Prohibited:**
Any and all that are not expressly permitted within these regulations. No machine polishing, no cam profiles to be used other than OE spec.

7.1. Engine Seals: General

Any engine (including any engine used for qualifying) may be sealed by officiating scrutineers at any event. Where fitted, and as of that instant, engine seals will be considered as a mandatory part of the scrutineering requirement for that vehicle. Submission of a previously sealed engine at a subsequent scrutineering inspection which is displaying broken or omitted seals, will be in breach of Scrutineering requirements and as such be liable to the penalties outlined in these regulations and in accordance with the MSA 'Blue Book'. Should a previously sealed engine be replaced by another engine then the following will apply:

- a. The use of the replacement engine shall be at the discretion of the Eligibility Scrutineer.
- b. The previously sealed engine must be inspected and proven to be legal.
- c. Failure of either of the above will entail implementation of the penalties outlined.
- d. The replacement engine will be sealed.

7.2. Engine Mounts

Position and mounting method must be standard for the model. The engine mounts must be standard or standard pattern.

7.3. Oil/Water cooling:

- 7.3.1.** The standard water pump and drive must be retained.
- 7.3.2.** Water radiators must be standard or standard pattern. The radiator must stay within the original mounting points and positioned within the periphery of the vehicle.
- 7.3.3.** OEM or aftermarket electric fans are permitted. An oil cooler is not permitted.

7.4. Induction Systems:

The choice of air filter is free.

Cold air ducting is permitted but must be a minimum of 100mm from the air filter.

No ram air system is permitted.

7.5. Exhaust systems:

Exhaust manifolds must be the standard and unmodified OEM genuine BMW part or unmodified standard pattern part, with the same form, length and diameter dimensions and measurements as per OEM.

Exhaust systems from the manifold back are free. Exhausts must comply with Motorsport UK noise restrictions as per MSA yearbook. Noise testing will be carried out at each race meeting to ensure compliance and emissions testing may also be carried out.

7.6. Ignition systems:

The only ECU permitted is the standard factory fitted MS43 ECU. No alternative, additional or modified ECU is permitted.

All ECU's will be programmed by a designated ECU mapping service provider with a set mapping for the championship.

7.6.1. This ECU's rev limiter must remain in operation with the standard stated settings for the championship and be the only non-mechanical means of controlling engine speed (excepting functions of the ECU for the engine). Ignition-cutting systems other than the rev-limiter are not permitted. The main control of engine management must be made easily accessible for scrutineering purposes. The use of 'piggy-back' devices is not permitted. The ignition system/map must be retained and no modification to timing is permitted (including modification to sensors, pickups, trigger wheels, maps etc).

7.6.2. Spark plugs are free. Other than the above mentioned, the ignition system must remain as OEM.

7.7. Fuel delivery systems:

Fuel injection must be standard for the engine. It is not permitted to substitute the fuel lines and filter. The pressure regulator must be standard OEM and unmodified. The fuel filter must remain in the OEM location. The standard fuel pump (in standard location) may not be replaced with an alternative fuel pump. The only permitted location for the fuel pump is as per the standard factory position.

8.: SUSPENSIONS:

8.1. Modifications Permitted:

Suspension must be modified only with the fitment of solely the following coilover shock absorber Suspension Control Kit options:

Either: (i) Pro Sport E46 Coilover Suspension Kit

Or: (ii) Yellowspeed Pro Sport with rear all in one Coilover.

The Yellowspeed kit comes complete with front pillow upper mounts for camber adjustment and is available from Street Racer Ltd at the discounted price of £591.67 + vat* (* correct at time of print). This will also include a free set of rear camber arms to any class member.

8.1.1. Spring poundage rates are Open / Free

8.1.2. Damping settings are open / free.

8.1.3. Rear adjustable camber arms are optional as per the specified Control Kit.

8.1.4. Polybushes are optional.

8.1.5. Anti roll bars must be production BMW E46 330i UK & European domestic market cars: 24mm dia Front/18mm dia Rear.

8.2. Modifications Prohibited:

8.2.1. No further adjustment, alteration or machining of parts or the use of eccentric bushes is permitted on the rear suspension.

8.2.2. It is prohibited to alter the front camber by any method other than adjustment afforded by the Control Kit specified.

Modifications to the suspension pick-up points are prohibited; this includes the 'slotting' or 'shimming' of suspension mounting points.

8.3. Wheelbase/track:

8.3.1. Wheelbase: All cars must not exceed a maximum wheelbase of 2760 mm, + or – a 10mm tolerance, centre to centre of hub.

8.3.2. Track: The maximum permitted Track measurements are: Front Track 1855 mm and Rear Track 1900 mm.

8.3.3. All wheels and tyres must remain within the body line of the car.

8.3.4. Wheel Spacers are permitted.

9: TRANSMISSIONS:

9.1. Permitted modifications:

9.2. Flywheel and clutch assembly – The Flywheel must be a standard or standard pattern Solid or Dual Mass, unmodified BMW steel flywheel. The Clutch must be a BMW standard or standard pattern part. The Clutch must be a standard style clutch in tapers of operation. The choice of Friction material is free together with the clutch cover to suit.

9.3. Clutch operation - Must be hydraulic and under the direct control of the driver with no electrically or electronically controlled assistance. No alternative competition items are permitted.

9.4. Gearbox - A standard 5 (five) speed BMW OEM UK & European domestic market gearbox must be fitted.

9.5. Gearbox Ratios and all internals must remain as standard. Aftermarket gear sets and syncros are permitted, provided they are standard ratios for the engine model.

9.6. Gear Lever - A 'quickshift' gear lever system is permitted. However, the system must replicate the OEM gear linkage system and be contained within the standard centre/gearshift console without modification to the standard centre/gearshift console.

9.7. Differential - The differential must be any standard BMW OEM non limited slip differential, with a Final Drive Ratio no lower than 2.93 and no higher than 4.4. The differential must be used as supplied by the manufacturer. Modification, adjustment or mechanically interfering with the differential in any way, including welding, is strictly prohibited. Limited Slip Differentials are not permitted.

9.8. Prohibited modifications:

Other than as stated at 9.6., gear selection, clutch and throttle operation must be as standard and solely under direct control of the driver. The gear linkage and clutch system must be as standard. Only the OEM standard Electronic traction control is permitted and operation is optional. The Flywheel must be as standard and not be lightened or modified.

10.: ELECTRICS

10.1. Exterior Lighting: Headlights and Tail Light clusters must be as per standard fitment location and be fully operational. Aftermarket fully plastic headlamp units are permitted. Front lights/lamps must be taped to Motorsport UK regulations or covered with a transparent protective plastic / vinyl film.

10.2. Rear Warning (Rain) Light: Cars must be fitted with a manually switchable rearward facing red warning light which must be fully compliant with the Motorsport UK Year Book ruling: Section K 5.1A. The high level OEM rear brake light or fog light may be used for this purpose.

10.3. Batteries: An on-board battery and standard electric starter motor must be fitted and be capable of repetitive starts. It is permitted to mount the battery inside the car. In this instance a dry cell battery or a motorsport battery box and standard battery must be used and securely fitted.

11.: BRAKES

11.1. Permitted Modifications

11.1.1. Anti-lock braking system – Disabling the ABS system is optional by way of removal of the speed sensors from the hubs of all wheels. The left rear ABS wheel speed sensor may be retained to allow the electronic speedometer to function. The retention of the standard brake ABS valve/system and all associated wiring is optional but if retained, must be unmodified.

11.1.2. Brake Pipes - All brake pipes must input, exit and direct brake fluid as per the standard layout.

11.1.3. Brake bias setup or pedal box - is not permitted.

11.1.4. Brake pads - are free.

11.1.5. Back Plates - Deformation or removal of back plates is permitted

11.1.6. Brake Piping / Hosing - the fitment of alternative brake piping/hosing is permitted.

11.1.7. Discs must be standard or standard pattern and of standard size. Front discs must be a diameter of 325mm. Rear discs must be a diameter of 320mm.

11.1.8. Discs may be cross-drilled and/or grooved.

11.1.9. Calipers - Standard E46 330i front and rear brake callipers must be used.

11.1.10. Brake Fluid – must be to competition specification, choice is open / free.

11.1.11. The braking system must remain fully operational in all aspects at all times, except the ABS system as detailed above and the handbrake which is optional.

11.2. Prohibited Modifications:

11.2.1. A hydraulically-operated handbrake is not permitted. A rear brake hydraulic line lock is not permitted.

11.2.2. Brake ducting may not be installed

12.: WHEELS / STEERING

12.1. Permitted Modifications:

12.1.1. Steering Lock - If fitted with a steering lock, this must be rendered inoperative.

12.2. Prohibited Modifications;

12.2.1. Modification of the rack is prohibited.

12.2.2. Power assistance may not be disabled and must remain as OEM standard.

12.3. Construction & Materials;

12.3.1. The choice of wheels is free.

12.3.2. Wheels and tyres must remain inside the lines of the body and not protrude beyond the arches, whether standard arches or modified to M3 styled OE or aftermarket wings.

12.3.3. Wheel Spacers are permitted, provided that the wheels and tyres remain within the body line of the car and the Front and Rear Track measurements do not exceed the maximum measurements permitted at 8.3.

12.4. Dimensions:

12.4.1. Wheels must be 18" diameter and up to a maximum width of 10J and be able to accommodate the specified control tyres.

13.: TYRES

The control tyres are as follows:

13.1. Dry Tyre – Used BTCC Dunlop 245/650R18 or 265/660R18 slicks, second hand only. The choice of compound is free.

13.2. Wet Tyre – Either (i) Yokohama 225/40/18 AD08 (Available from Street Racer, Bangor; at £95 +vat each* (* correct at time of print)

Or (ii) Westlake Sport RS 235/40/18 Front, 265/35/18 Rear.

Any other tyre is prohibited.

13.3. It is prohibited to buff, cut or mechanically interfere with the tyres in any manner.

13.4. The original tread pattern of the wet tyre must remain visible at all times, and with a minimum tread depth of 1.6mm.

13.5. The use of tyre heating/heat retention devices, chemical tyre treatments and compounds is strictly prohibited.

14.: VEHICLE WEIGHT:

14.1. The Minimum Weight of the car, including driver with race overalls, helmet, fuel, fluids, etc.; and in normal post practice and race trim, will be: 1300 kgs.

14.2. Checks will be carried out and no car/driver combination shall be below this minimum weight. All minimum weights are including driver and race overalls, helmet, fuel etc.

15.: FUEL TANK / FUEL

15.1. Types - Standard fuel tank must be fitted.

15.2. Locations: Tank must remain in standard location.

15.3. Fuel: Only petrol as defined in Section B Nomenclature & Definitions, Pump Fuel a) section of the Motorsport UK Yearbook for the current year and complying with, BSEN228 may be used. The use of additives by competitors which boost the octane rating (RON) in any petrol is prohibited. At the end of practice and the race at least 3 litres of petrol from the tank of the competing car must be available to the scrutineers for analysis. Compliance with minimum weight for the car will be taken before the petrol is removed.

15.4. Modification - The standard fuel tank may be modified to be a "half tank".

15.5. Baffle foam – fuel tank baffle foam may be fitted.

15.6. Fuel Pumps - The standard fuel pump (in standard location) may not be replaced with an alternative fuel pump. The only permitted location for the fuel pump is as per the standard factory position.

16.: SILENCING:

All vehicles must comply with the relevant maximum noise limits set out in Motorsport UK Blue Book regulation J. Chart **5.16.1.** The method of silencing is free.