1 General Information

VG safety gears consist of a pair of end assemblies which can bolt directly to the buffer channels or car frame. However, the top plate of the safety gear must be strengthened by an intermediate mounting plate if the distance between the car frame supports is too great. The maximum unsupported distance and the principal dimensions of the VG range are shown in Figure TD1.0. All channels and/or support plates must extend the full depth of the safety gear top plate (see figure TD 1.7.2).

Each end assembly has two spring loaded linkage mechanisms which carry and engage the friction gib. The linkage mechanisms are designed to centralise the safety gear when it is engaged. This feature, in conjunction with large running clearances, means that VG safety gears can be used with spring loaded roller guide shoes, sliding shoes or solid rollers.

The force needed to operate a pair of downward acting safety gear end assemblies is approximately 30 Newtons (disregarding the force of any torsion springs fitted) and several pairs can be operated by a single over-speed governor. The actuating arm may be mounted on either side of the safety gear depending on the location of the over-speed governor. The end assemblies are connected together by a screwed rod for easy and accurate synchronisation of the end assemblies.

The force needed to release the safety gear is also very low. This enables the safety gear to be disengaged by the lift machine and not to require special lifting tackle.

The braking force is controlled by the compression of the spring stacks. These are adjusted in accordance with the certification tests carried out by BSI. Tests were carried out on guide rails with a superior surface finish as this represents the best practice in modern guide rail technology. If the safety gear is used on rails with a standard finish, or if used with a mass different from that shown on the label, the braking force may need to be adjusted on site. (See relevant installation and adjustment data)

To comply with the harmonised version of EN81, a lift must prevent "uncontrolled upward movement". As all VG safety gears can be inverted to brake in the upward direction, code compliance can be obtained by fitting separate "upward acting" safety gear in tandem with a standard "downward acting" safety. This additional safety can either be attached directly to the downward acting safety gear or mounted separately on top of the crown channels.

The VG-5 safety gear is bi-directional safety gear and has two independent braking mechanisms within a common housing. Both bi-directional and "combined" safety gears can be operated from a single friction type, bi-directional over-speed governor.

VG-2a, VG-5 and VG-6 safety gears have a common footprint and mounting dimensions. The VG-4 has a narrower footprint more suited to smaller lifts. The VG-4 can be fitted with an extended shaft to match the rest of the VG range.
2.1 Over-speed governors

VG safety gears can be operated by either friction type or “drop jaw” type governors. However, when bi-directional operation is required, either two separate drop jaw governors must be fitted or a single friction type governor.

These governors have different operating characteristics which must be taken into account when deciding on the type of over-speed governor best suited for a particular application.

Regardless of the type of governor, EN81 requires that it will generate twice the force needed to engage the safety gear with a minimum value of 300 Newtons.

2.1.1 Friction Governors

These governors can operate in both directions and hence may be used to detect an over-speed in either the “up” or “down” directions. They operate by locking the governor wheel using a latch which engages when the governor reaches a specific speed. The force generated by the governor depends on:-

1. The governor rope tension. *This is controlled by the tension weight (see section TD 1.9 for design formulae)*

2. The groove profile of the governor. *Normally these are “V” grooves.*

3. The rope speed over the governor wheel. *The higher the speed, the lower the force generated by the governor.*

4. The direction of travel. *The governor generates a different force in the up and down directions. (refer to section TD1.9 for design formulae)*

This type of governor is very popular because of its low-cost. However, this type of governor can reset if:-

a) The governor rope tension is released thereby allowing the latch mechanism to disengage.

b) The governor is rotated backwards by only a few millimetres thereby allowing the latch to disengage.

*For the above reasons, friction type over-speed governors may release the safety gear under certain test conditions.*

This could happen if there is counterweight or car “bounce” following a safety gear test. Car bounce normally only happens if the lift car decelerates greater than 1g and where there are no spring anchorages fitted to the counterweight.

*It is stressed that this will not happen under the “free fall” test conditions that both the governor and safety gear have been tested and certified.*
2.1.2 Drop Jaw Governors

This type of governor is generally more expensive and only operates in one direction. When the governor reaches a specific speed, a separate gripping element (or “drop jaw”) is released which clamps the governor rope. The force generated will depend on:-

1. The gripping force of the drop jaw. This is normally adjustable by means of a compression spring to suit the requirements of the safety gear operating force. See note in section 2.1.
2. The speed of the rope passing through the gripping elements. The higher the speed, the lower the force generated by the governor.
3. The groove profile of the gripping elements. These are normally circular or semi-circular.

As the gripping force does not depend on the governor rope tension, lighter tension pulleys can be used than on friction type governors.

The response time of a drop-jaw governor may be higher than a friction type due to the time taken for the jaw to drop and start gripping the rope.

*However, regardless of any car or counterweight “bounce” which could cause a safety gear to release and a friction governor to reset, a “drop-jaw” governor will always ensure that the safety gear will re-engage.*

Drop jaw type governors are considered more reliable and are the preferred option for uni-directional applications.

2.2 Governor Rope Attachment

The total vertical movement of the safety gear actuating arm is 44 mm. The first 30 mm of movement brings the jaws into contact with the guide rail and only during the final 14 mm do the jaws start to grip the guide rail.

The governor rope can be attached either directly to the actuating arm or indirectly via an anchorage bracket bolted to the car frame.

a) If the governor rope is connected directly to the actuating arm the maximum force should not exceed 300 Newtons.

   If the force is greater than 300 Newtons, it is recommended that accessory kit SK3, or similar device, is used to take the applied force.

b) The preferred governor connection is via accessory kits SK2 or SK10. These have been designed to operate with governors producing a force between 300 to 600 Newtons (maximum 900 Newtons) and to limit the vertical movement to 44 mm.

These accessories are ideally suitable for friction type governors. If a drop-jaw governor is used it is recommended that it is set to generate a maximum force of 600 Newtons.
2.3 Inertia Springs

To ensure the safety gear does not operate during normal lift service, an “inertia force” is required to overcome the governor rope system inertia. This depends on the mass of the governor rope system and the lift acceleration to be opposed. This force is normally provided by an “inertia spring” fitted to the safety gear or a “bomb release” type mechanism. For a bi-directional safety gear, two inertia springs will be required, one for the up direction and one for the down direction.

The governor system must generate sufficient force to overcome the inertia spring and to operate the safety gear. Figure TD1.9 illustrates a schematic of a typical friction governor system together with the relevant technical information. Figure TD1.9.1 illustrates the governor and safety gear forces with kit SK10 needed to comply with the requirements of EN81.

For a downward acting safety gear, the force required to operate each safety gear end assembly is 15 Newtons. This is the force required to raise the gripping jaws into contact with the guide rail and does not take into account any imbalance forces of the lift car or any inertia spring force. When safety gears are inverted to act in the up direction, a biasing force of 15 Newtons is required to keep the jaws clear of the guide rail.

Torsion springs are now included as standard across the entire VG range to provide a biasing force and a governor inertia force. Two light springs are recommended when a safety gear is used in the “up” direction and only one fitted to a “down” acting safety gear. These springs will provide 100 Newtons inertia force in both up and down directions and hence will be suitable for lift travels up to 40 metres.

Stronger torsion springs can be fitted to increase this inertia force to permit travels up to 60 metres. Alternatively, auxiliary inertia springs kits SK2 and SK3 can be fitted to increase the maximum lift travels up to 100 metres.

When duplexing VG safety gears, it may be necessary to reduce the number of torsion springs fitted to each end assembly. These can either be removed or left in place but disengaged.

A spreadsheet programme is available for checking code compliance of different combinations of inertia springs and end units. This programme is available from Cameron Design if required (see section 4.3).

2.4 Guide Rail Type

VG safety gears were type-tested using class one rails from SAVERA having with a super-brushed finish. These rails have a lower friction coefficient than standard machined guide rails. However, all VG safety gears can be used with rails having a coarser surface finish. To compensate for different surface finishes, the braking force can easily be adjusted on site should this prove to be necessary.
2.5 Carbide Toothed Inserts

All current models of VG safety gears use a common carbide toothed insert. After extensive testing, Cameron Design is convinced these are the most reliable and safest gibs for use on lifts. On both dry and lubricated guides, these have demonstrated a consistency of braking force unmatched by plain gibs. Furthermore, they are less sensitive to rail contamination.

VG safety gears have been type-tested on class-one guide rails manufactured by SAVERA Ltd. Therefore, they should work on guide rails which have become burnished during the working life of the lift or. Some down-rating of the safety gears may be required on used guide rails which have been "work hardened" over time or have become impregnated by carbon liners.

The gibs brake by a combination of sliding friction and shearing as the teeth grip the guide rail. These teeth produce 8 shallow grooves some 0.15 mm deep by 0.25 mm wide in the rail surface. Guided by the gib stabilisers, these grooves remain parallel to the rail front edge and are easily dressed smooth by using emery paper. After dressing these grooves do not detract from the performance of either sliding or rolling shoes.

Repeat testing on a section of a (previously) grooved guide rail did not result in any deterioration of braking force. Cameron Design is therefore confident that the presence of grooves will not reduce the braking should a safety gear be required to brake over the same section of guide rail.

Carbide toothed inserts have demonstrated a superior wear characteristic over conventional steel gibs. The minimum life expectancy of the inserts is 10 full-load - full speed drop tests. A greater number of tests can be carried out on lifts with a lower mass and/or speed than the maximum permitted.

2.6 Guide Rail Lubricant

VG safety gears have been certified using different lubricants to determine their sensitivity to different types of rail lubricant. These include a mineral oil to ISO grade 68, an extreme pressure gear oil and a 5-50 multi-grade engine oil. Tests have also been carried out using other oils and greases on a hydraulic test rig.

As a result of these tests it has been confirmed that VG safety gears are insensitive to the grade of oil used. Furthermore, there is no significant braking difference between lubricated and non-lubricated guide rails.
2.7 Ascending Car Over-speed Protection

All VG safety gears can be inverted to operate in either the "up" or "down" directions. To comply with EN81, a lift manufacturer can choose either:

a) Separate Safety gears

One safety gear is used to brake in the "up" direction and an additional and separate safety gear used to brake in the "down" direction. The safety gears can either be combined in tandem below the lift car or alternatively, mounted separately with the "upward" braking safety gear fitted to the crown channels.

Examples of the different methods of combining "up" and "down" safety gears are illustrated in figures TD1.4 to TD1.6. Examples of safety gears mounted in tandem below the lift car are illustrated in figures TD1.10.1 and TD1.10.2.

The preferred arrangement is to have the "downward" safety gear mounted below the car and the "upward" acting mounted onto the crown channels. Mounted in this way, the safety gears are inherently stable and the loads imposed on the holding down bolts are low.

When combining safety gears below the lift car it is recommended that the flanges of the buffer channels be strengthened by fitting an adapter plate between the buffer channels and the safety gear. This is suitable for a maximum (P+Q) of 4500 kg. At higher loads, additional bracing will need to be incorporated and technical assistance from Cameron Design must be obtained.

b) Bi-directional safety gear

The VG-5 is a bi-directional safety gear and is illustrated in Figures TD1.7 and TD1.7.1. Essentially it combines two braking elements within a common housing. One mechanism is designed to brake in the "up" direction and the other in the "down" direction. Normally the bi-directional safety gear should only be fitted below the lift car. If required to be mounted above the lift car, technical assistance from Cameron Design must be obtained.

It is recommended that the VG-5 is mounted onto an intermediate adapter plate as per TD1.7.2 in order to strengthen the flanges on the buffer channels.

Regardless of whether separate safety gears or a bi-directional unit is used, the Braking Force needed in the "up" direction is substantially less than that required in the "down" direction. The braking force required to decelerate a lift car at 0.5g in the "up" direction is approximately half that required in the "down" direction. All bi-directional and combined safety gears are adjusted to generate 50% braking force in the up direction.

Both separate and bi-directional safety gears can be operated by a single friction type governor. However, to generate sufficient force in the up direction, the mass of the governor rope tension weight may need to be increased and should be fitted with a "lockdown" device to prevent it losing tension. A lock-down kit for attachment to a standard tension weight is available. See accessory kit SK8.
2.8 Environmental Protection

VG safety gears have been designed to operate in a benign environment and exposed to temperate climatic conditions. Consequently, environmental protection is achieved by zinc plating to a commercial standard, chemical blacking or by painting.

Should the safety gear be required to operate under more severe climatic conditions, then special finishes may be required and these are available to special order. All special operating environments should be brought to the attention of Cameron Design.

3 Design Features

1. 6 mm running clearance both sides - suitable for roller guide shoes or sliding shoes
2. Certified for both lubricated and dry rails on class one guide rails.
3. All single models can be duplexed to double their braking capacity.
4. VG safety gears can be inverted to prevent "upward falling". Either tandem mounted or separately mounted.
5. Special "dual acting" safety gear for upward and downward protection.
6. "See through" design for ease of inspection and maintenance.
7. Surface mounted for ease of design and installation.
8. Large running clearances between safety gear frame and guide fixings
9. Simple and accurate braking force adjustment to suit on-site conditions.
10. Rail widths 9 to 19 mm as standard - other widths to special order
11. Special configurations accommodated by means of accessory kits
12. Low operating force – up to 8 end assemblies can be operated by a single friction type governor.
13. Technical support by Cameron Design.
14. Non-handed and universal design
15. Low release force after engagement
17. Common spares on critical components across range.
4 Outline Data and Specification

The VG range has been re-certified by BSI:-

a) To harmonise the maximum governor tripping speed across the range. *All VG safety gears with toothed inserts can now operate at a maximum governor tripping speed of 4 m/sec. (see note 2 below)*

b) To restrict the disc spring compression to 75% of its maximum value. *This will permit harmonisation of the load ratings between the ANSI and EN81 codes.*

c) To allow different values of (P+Q) at different governor tripping speeds. *The entire range can now benefit from the enhanced braking effect at lower operating speeds.*

d) To have common values of (P+Q) for lubricated and non-lubricated guide rails. *The previous minor rating differences between lubricated and non-lubricated guide rails have been eliminated.*

The revised “down” ratings for the range are shown in the table below.

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<th>Governor Speed m/sec</th>
<th>Maximum Value of (P+Q) kg</th>
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<tr>
<td>4.0</td>
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</table>

Notes

1 The above (P+Q) loads are nominal values. These can be exceeded by a maximum value of 7.5% as permitted in EN81.

2 The first application above a tripping speed of 3.23 m/sec must be witness tested by BSI. Please contact Cameron Design when a suitable
installation has been identified.

3 The above values of \((P+Q)\) can be doubled when a safety gear is being used as an upward acting brake.

4 Duplexing of VG safety gears has been verified under drop test conditions to double the above ratings.

5 Rail widths greater or smaller than 16 mm are available to special order. Safety gears can be used on guide rails having a courser surface finish than Savera Class one.

5 Accessory Kits

The modular nature of the VG range means that several different mounting arrangements are possible by selecting from a range of accessory kits. The following is a list of the kits currently available. The diagrams show typical assemblies using standard kits.

Cameron Design can provide technical assistance to lift manufacturers on special applications. For example, figure TD1.8 illustrates a special car lift arrangement on a four guide system. This required double-duplexed VG safety gears in the down direction and single VG safety gears in the up direction.

SK1 Standard Operating Kit - Figure TD1.1

This kit comprises the actuating arm, transfer arms and clevis assemblies needed to operate a standard downward acting safety gear. It should be noted that the connecting rod between pairs of safety gears and the actuating rod is normally supplied by the car manufacturer but can be supplied to special order.

SK2 Inertia Bracket Assembly - Figure TD1.2 and TD-SK2

This is used for an indirect connection between the safety gear actuating rod and the governor rope. The position of the governor rope is offset by 61mm from the actuating rod.

The bracket is used only with downward acting safety gears which require a car-top connection. It must be bolted to the car sling as illustrated. The assembly does not include the connecting rods or wedge sockets (kit SK9) as standard although these are available to order.

The bracket has an auxiliary inertia spring to increase the maximum lift travels up to 75 metres. For travels below 40 metres, the torsion springs fitted within the brake units will be sufficient.

If no auxiliary inertia spring is required, it is recommended that accessory kit SK10 is used in preference to kit SK2. This kit can be used for a single direction only if this is required.
SK3 Auxiliary Inertia Spring Assembly - Figure TD1.3

This can be used with safety gears working either separately or as combined "up" and "down" safety gears. The inertia spring assembly bolts directly to the safety gear as illustrated and when fitted alongside the standard inertia springs, is suitable for lift travels up to 75 metres.

There are two versions of this kit. The standard version SK3 is suitable for all safety gears fitted with normal length connecting shafts. (see dimension "C" in figure TD1.0) However, safety gear VG-4 can be fitted with a longer shaft to enable it to work with the VG-2a for upward movements. The kit for this is SK3E.

If fitted and set to limit the vertical travel to 44 mm, the safety gear actuating arm can withstand a governor force of up to 3000 Newtons.

SK4 Pivot Bracket Assembly - Figure TD1.4

The pivot bracket is bolted direct to the car frame and is used to connect separate "up" and "down" safety gears requiring an indirect connection to the governor rope. The offset of 61 mm from the actuating rod is common with the inertia bracket assembly SK2. This bracket assembly can withstand a maximum governor force of 1200 Newtons.

It is recommended that the auxiliary spring kit SK3 is fitted to protect the operating linkage from being subjected to an excessive governor force.

The assembly is supplied with slotted link plates and clevises to connect top and bottom safety gears and the governor. The kit does not include the connecting rods or wedge sockets (kit SK9) as standard although these can be supplied if required.

SK5 Double stacking kit (duplexing) - Figure TD1.5

This kit is used to connect two safety gears working in tandem to double the load carrying capacity of the safety gear. Each kit comprises the additional clevises and linkages to enable the safety gears to be operated by a single governor.

When duplexing a pair of safety gears, only one standard operating kit SK1 and Switch kit SK7 will be provided for each duplexed pair.

SK6 Up-Down Connection kit - Figure TD1.6

Used to connect 2 sets of safety gears, one set fitted beneath the lift car to work in the down direction and the other mounted on the crown channels to work in the up direction. The kit includes the linkages and clevises to connect the separate "up" and "down" safety gears together. The kit does not include the connecting rod or wedge sockets (kit SK9) although these are available to special order.

It is recommended that the auxiliary spring kit SK3 is fitted to prevent the safety gear operating linkage from being subjected to an excessive governor force.
SK6C Combined Safety Linkage Kit - Figure TD 1.7

Actuating linkage for "combined" safety gears acting as bi-directional devices. Linkage kits are available for different combinations of VG safety gears.

SK7 Switch Kit

Safety switch, operating cam and fixings to connect to the safety gear. One kit is normally supplied for each set of safety gears.

SK8 Lock-down Kit

This is should be fitted to the tension weight used with all bi-directional governors to prevent it from lifting. The device is supplied with the fixing bolt to secure the unit to the tension weight but not for securing the device to the lift well or bracket structure.

SK9 Wedge Sockets

A pair of wedge sockets to suit 6-8 mm diameter governor rope.

SK10

This is a bi-directional version of kit SK2 but without an inertia spring. The kit is fitted with a balance spring to offset the mass of the connecting rod or link (provided by the lift manufacturer) The force needed to overcome the governor inertia is provided by the torsion springs fitted as standard to VG safety gears.

The kit can be used for combined safety gears fitted below the car or with dual acting safety gears. Examples of different applications is given in Figures 1.10.1 to 1.10.3.

AK- 7 Bi-directional kit

A kit of parts for the VG-5 bi-directional safety gear. The kit includes the actuating kits, switch kits and torsion springs. The kit can also be specified for combined safety gears. These have different link plates to suit the different sizes of safety gear.
### Application Summary Chart

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<thead>
<tr>
<th>Accessory kit</th>
<th>SK1</th>
<th>SK2</th>
<th>SK3</th>
<th>SK4</th>
<th>SK5</th>
<th>SK6</th>
<th>SK7</th>
<th>SK8</th>
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**Note** * Internal torsion inertia springs are now fitted as standard to all end assemblies. These are suitable for lift travels up to 40 metres. Stronger torsion spring kits are available for lift travels above 40 metres. Alternatively kit SK3 can be used to increase inertia force.
MAXIMUM RATED MASS (P+Q) kilogrammes

GOVERNOR TRIPPING SPEED metres/sec

VG-6
VG-2α
VG-5
VG-4
Operating linkage can be mounted either side

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<th>SAFETY GEAR</th>
<th>VG-2a</th>
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<td>100</td>
<td>200</td>
<td>100</td>
</tr>
</tbody>
</table>

Note: The VG-4 can be fitted with an extended shaft to increase dimension to 75

Extend channels and any support plate to front face of safety gear. See TD-1.7.2

Max dimension

If distance between supports is greater than Dim E, provide additional support plate between safety gear and car frame.

Face of guide rail

"A" 120

"B" 117

"C" 26

Note: REFER TO DATA SHEET TD1.01 FOR FULL LOAD SPEED ENVELOPE.
NOTE:

ACCESSORY KITS SUPPLIED AS STANDARD
1 OFF STANDARD OPERATING KIT - SK1
1 OFF SWITCH KIT - SK7
1 OFF TORSION SPRING PER END ASSEMBLY

ACTUATING ROD BY CAR MANUFACTURER
MANUFACTURED TO LIMIT MOVEMENT TO 44 mm
TO AVOID DAMAGING THE OPERATING LINKAGE

TRANSFER ARM (BELL CRANK)
2 OFF SUPPLIED

M12 CLEVIS ASSEMBLY
3 OFF SUPPLIED

CONNECTING ROD = DBG = 275
THREADED M12 x 30 mm BOTH ENDS
PROVIDED BY CAR MANUFACTURER

GUIDE SHOE ADAPTOR PLATE
BY CAR MANUFACTURER

CAR FRAME

SWITCH KIT - SK7
1 OFF SUPPLIED

213 (VC-4 is 168)

38/43
(45/50 ON VG-3 ONLY)

FACE OF GUIDE RAIL

213 (VC-4 is 168)
NOTE
THIS APPLICATION USES THE FOLLOWING KITS
1 OFF STANDARD OPERATING KIT - SK1
1 OFF SAFETY SWITCH KIT - SK7
1 OFF INERTIA BRACKET ASSEMBLY - SK2
1 PAIR 6/8 DIA WEDGE SOCKETS - SK9

SWITCH KIT - SK7

TO SUIT 6-8mm ROPE

WEDGE CLAMPS TO DIN 15315
ACCESSORY KIT SK9
OTHER SIZES AVAILABLE

MAXIMUM GOVERNOR FORCE
900 NEWTONS

INERTIA BRACKET ASSEMBLY SK2 KIT

INERTIA SPRING

MOVEMENT OF ACTUATING ROD

ACTUATING ROD THREADED M12 x 35mm BOTH ENDS
BY CAR MANUFACTURER

CONNECTING ROD : LENGTH = 880 - 275 THREAD M12 x 35 MIN BOTH ENDS
BY CAR MANUFACTURER

38/43 (45/50 ON VG-2)

FACE OF GUIDE

GOVERNOR ROPE

DIMENSIONS TO SUIT CAR GEAR

774

274 TO GOVERNOR ROPE

213

OPERATING FORCE
40 NEWTONS MAXIMUM

SWITCH KIT - SK7
NOTE
THIS APPLICATION USES THE FOLLOWING KITS
1 OFF STANDARD OPERATING KIT – SK1
1 OFF SAFETY SWITCH KIT – SK7
1 OFF INERTIA SPRING KIT – SK3

ACTUATING ROD
3500 N MAXIMUM FORCE

(45 TO 50 ON VG-3)

STOP NUTS
ROLLER GUIDE SHOE
BY CAR MANUFACTURER

INERTIA SPRING KIT – SK3
SPRING ADJUSTING NUTS

GUIDE SHOE ADAPTOR PLATE
BY CAR MANUFACTURER

STANDARD OPERATING KIT – SK1

ACTUATING ROD

213

Buffer channels
1200 Newtons Maximum

AN ALTERNATIVE ARRANGEMENT FOR DUAL SAFETY GEARS
IS TO USE ACCESSORY KIT SK10 — SEE SECTION TD–1.10.3

THIS APPLICATION USES THE FOLLOWING KITS
2 OFF STANDARD OPERATING KITS — SK1
2 OFF INERTIA SPRING KITS — SK3
1 OFF Pivot Bracket Assembly — SK4
1 OFF WEDGE CLAMP KIT — SK9

STOP NUT

INERTIA SPRING ADJUSTING NUT

OPERATING KIT SK1

4 OFF M12 CLAMP ARMS — SUPPLIED WITH KIT SKA

SAFETY SWITCH KIT — SK7

INERTIA SPRING KIT — SK3

CROWN CHANNELS

PULL UP TO OPERATE "DOWNWARD" ACTING SAFETY GEAR

PULL DOWN TO OPERATE "UPWARD" ACTING SAFETY GEAR

CONNECTING ROD BETWEEN UPPER AND LOWER SAFETY GEARS
PRODUCED BY OUR MANUFACTURER ON SPECIAL D&D ORDER

Pivot Bracket Assembly — SK4

WEDGE CLAMPS TO DIN 15315 ACCESSORY KIT SK9

GOVERNOR ROPE

AUXILIARY INERTIA SPRING KIT SK3

GUIDE SHOE ADAPTOR PLATE

Buffer channels
NOTE

THIS APPLICATION USES THE FOLLOWING KITS

2 OFF STANDARD OPERATING KITS – SK1
2 OFF INERTIA SPRING KITS – SK3
1 OFF CONNECTION KIT – SK9
2 OFF WEDGE CLAMPS – SK9
2 OFF SWITCH KITS – SK7

WEDGE CLAMPS TO DIN 15315
ACCESSORY KIT SK9

GUIDE SHOE ADAPTOR PLATE
BY CAR MANUFACTURER

M12 CLEVIS ASSY

LINK PLATES – KIT SK6

CROWN CHANNELS

INERTIA SPRING KIT – SK3
VG safety gears fitted with single torsion spring

PULL UP TO OPERATE "DOWNWARD" ACTING SAFETY GEAR

PULL DOWN TO OPERATE "UPWARD" ACTING SAFETY GEAR

CONNECTING ROD BETWEEN UPPER AND LOWER SAFETY GEARS
PROVIDED BY CAR MANUFACTURER OR SPECIAL D&B ORDER

STANDARD OPERATING KIT – SK1
VG safety gear with torsion springs fitted

Stop nuts

INERTIA SPRING KIT – SK3

3000 NEWTONS MAXIMUM FORCE

3000 NEWTONS MAXIMUM FORCE
100 Newtons DOWNWARD ACTING

4 clevises assemblies supplied

100 Newtons UPWARD ACTING

OPERATING KIT AK7 for VG–5
2 OFF OPERATING KIT – SK1 (4 clevises)
6 OFF TORSION SPRING
1 OFF LINK PLATE – SK6B
2 OFF SWITCH KIT – SK7

Switch kit SK7
Switch can be mounted horizontally

Torsion Springs – 2 off CDS05919
1 off CDS05920

Front view of safety gear

Rear view of safety gear

NOTE!
The VG–5 is fitted with integral inertia springs as illustrated. These have been designed to provide a 100 Newtons force at the operating linkage. This force is used to overcome governor system inertia. EN–B1 requires the governor to generate a minimum force of 300 Newtons. The integral inertia springs are suitable for lift travels up to 40 metres.
MAXIMUM GOVERNOR FORCE
1200 NEWTONS

To suit 6 – 8 mm diameter rope
Wedge clamps to DIN 15315
Accessory kit SK9
(Other sizes available)

Bracket can be rotated

Accessory kit SK-10
Wedge sockets not drawn

LENGTH OF CONNECTING LINK MUST
BE ADJUSTED SO THAT THE BRACKET
HAS 44 mm OF TRAVEL IN BOTH DIRECTIONS

Connecting link by lift manufacture
Refer to data sheet TD-SK10

Stabiliser bracket
Supplied with kit SK10

Studding and nuts with kit SK10

Clevis with kit SK1

Connecting rods by lift manufacturer

ACCESSORY KITS REQUIRED
2 OFF SWITCH KITS SK7
2 OFF STANDARD OPERATING KITS SK1
1 OFF ROPE SOCKET KIT SK9
1 OFF BI-DIRECTIONAL KIT SK10
2 OFF M12 x 30 Hex Head Screws
2 OFF M12 Nyloc nuts

Adaptor plate (see TD1.7.2)

Switch kit SK7

Link plate CDS10059

M12 screw and nyloc nut
Note

When combining safety gears beneath the lift car ensure that an adaptor plate 16 mm thick is fitted between the buffer channels and the safety gear to strengthen the channel flanges.

A minimum of 4 fixings should be provided to secure the adaptor plate to the buffer channels using M12 countersunk screws as illustrated.

Suitable for a maximum (P+Q) of 4500 kg

Please seek advice at higher loads
THIS ARRANGEMENT USES THE FOLLOWING
6 OFF INERTIA KITS – SK3
4 OFF STANDARD OPERATING KITS – SK1
4 OFF SWITCH KITS – SK7
2 OFF DUPLEXING KITS – SK5
2 OFF CONNECTION KITS – SK4
TRACTION RATIO = 2 (assumed)

BI-DIRECTIONAL GOVERNOR
Equivalent mass = m1

GOVERNOR ROPE MASS "M"
Mass = 2 x Travel x unit mass

FORCE "DOWN" = T3 + M/2
WHERE T3 = mgb/2c

FORCE "UP" = T3/2 + M/2

ROPE SYSTEM INERTIA FORCE = α(M + m1 + m2)
WHERE "α" = Maximum lift acceleration - m/sec/sec
M = Total rope mass - kg
m1 = equivalent mass of governor - kg
m2 = equivalent mass of tension pulley - kg

GOVERNOR ROPE TENSION WEIGHT PULLEY
Equivalent mass = m2

GOVERNOR TENSION WEIGHT "m" kg

TENSION WEIGHT LOCKDOWN (RECOMMENDED)
MAXIMUM GOVERNOR FORCE
900 NEWTONS

To suit 6 - 8 mm diameter rope
Wedge clamps to DIN 15315
Accessory kit SK9
(Other sizes available)

Bracket can be rotated

LENGTH OF CONNECTING LINK MUST
BE ADJUSTED SO THAT THE BRACKET
HAS 44 mm OF TRAVEL IN BOTH DIRECTIONS

Connecting link by lift manufacture
Refer to data sheet TD-SK10

Stabiliser bracket
Supplied with kit SK10

Switch kit SK7

Adapter plate (see TD1.7.2)

2 OFF SWITCH KITS SK7
2 OFF STANDARD OPERATING KITS SK1
1 OFF ROPE SOCKET KIT SK9
1 OFF BI-DIRECTIONAL KIT SK10
1 OFF LINK PLATE CDS10057
2 OFF SHOULDER SCREW CDS10012
2 OFF ADDITIONAL TORSION SPRINGS
(extra torsion springs fitted at factory)

Link plate CDS10057
Shoulder screw CDS10012

Double torsion springs needed for upward falling safety gear
Standard operating kit SK1
Connecting rods by manufacturer

INTERNATIONAL LIFT EQUIPMENT LIMITED
To suit 6 – 8 mm diameter rope
Wedge clamps to DIN 15315
Accessory kit SK9
(Other sizes available)

MAXIMUM GOVERNOR FORCE
900 NEWTONS

Bracket can be rotated

ACCESSORY KITS REQUIRED
2 OFF SWITCH KITS SK7
2 OFF STANDARD OPERATING KITS SK1
1 OFF ROPE SOCKET KIT SK9
1 OFF BI-DIRECTIONAL KIT SK10
1 OFF LINK PLATE CDS10058
2 OFF SHOULDER SCREW CDS10012
2 OFF ADDITIONAL TORSION SPRINGS,
(extra torsion springs fitted in factory)

Adaptor plate if required

280
219

210

98.2 metres max. without stabiliser bracket

Stabiliser bracket
Supplied with kit SK10

Connecting link by lift manufacturer
Refer to data sheet TD-SK10

Studding and nuts with kit SK10

Clevis with kit SK1

VG-2a

VG-4 with extended shaft – fitted with additional torsion springs for upward falling

Stud screw CDS10012

Guide shoe adaptor plate (by lift manufacturer)
Secure using 4 off M8 screws into frame (see TD-1.0)
and bolt through safety gear frame using M16 HT screws
MAXIMUM GOVERNOR FORCE
900 NEWTONS

Accessory kit SK9
(Wedge sockets to DIN 15315
Other sizes available)

VG Safety gear fitted with additional
torsion springs for upward falling

LENGTH OF CONNECTING LINK MUST
BE ADJUSTED SO THAT THE BRACKET
HAS 44 mm OF TRAVEL IN BOTH DIRECTIONS

Connecting link by lift manufacture
Refer to data sheet TD-SK10

Stabiliser bracket (optional)
Supplied with kit SK10

ADAPTOR PLATE (SEE TD-1.7.2)
BY LIFT MANUFACTURER

Switch kit SK7

CLERK'S WITH KIT SK10

Shoulder screw CDS10012

Connecting rods by manufacturer

ACCESSORY KITS REQUIRED
2 OFF SWITCH KITS SK7
2 OFF STANDARD OPERATING KITS SK1
1 OFF BI-DIRECTIONAL KIT SK10
1 OFF ROPE SOCKET KIT SK9
2 OFF LINK PLATES CDS10027
2 OFF SHOULDER SCREW CDS10012
2 OFF ADDITIONAL TORSION SPRINGS
(extra torsion springs fitted in factory)
IT IS RECOMMENDED THAT THIS BRACKET ASSEMBLY IS ONLY USED WITH OVERSPEED GOVERNORS WHICH GENERATE A FORCE BETWEEN 300 & 600 NEWTONS

FIXING HOLES

IT IS RECOMMENDED THAT THIS BRACKET ASSEMBLY IS ONLY USED WITH FRICTION TYPE GOVERNORS WITH A MAXIMUM FORCE OF 1200 NEWTONS

<table>
<thead>
<tr>
<th>ITEM</th>
<th>DESCRIPTION</th>
<th>DRG. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>M12 HEX NUT</td>
<td>1</td>
</tr>
<tr>
<td>10</td>
<td>M12 NYLOCK NUT</td>
<td>1</td>
</tr>
<tr>
<td>9</td>
<td>M12 x 30 HEX HEAD SCREW</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>M6 x 12 LG HEX HEAD SCREW</td>
<td>2</td>
</tr>
<tr>
<td>7</td>
<td>12 mm PLAIN WASHER – TYPE B</td>
<td>2</td>
</tr>
<tr>
<td>6</td>
<td>6mm x 35 LG SPIROL PIN</td>
<td>2</td>
</tr>
<tr>
<td>5</td>
<td>INERTIA SHAFT ASSEMBLY</td>
<td>CDS10049</td>
</tr>
<tr>
<td>4</td>
<td>INERTIA SPRING</td>
<td>CDS10005</td>
</tr>
<tr>
<td>3</td>
<td>SWIVEL LINK</td>
<td>CDS00934</td>
</tr>
<tr>
<td>2</td>
<td>INERTIA SPRING ADJUSTER</td>
<td>CDS10051</td>
</tr>
<tr>
<td>1</td>
<td>BRACKET</td>
<td>CDS10050</td>
</tr>
</tbody>
</table>

44mm OF TRAVEL UP DIRECTION ONLY

900 NEWTONS

30
61
38
7:9:10
1
6
5

2 Slots 11 x 30

37
76
Assemble and adjust safety gear as per installation data.
Bolt mounting plate to safety gear using M8 screws provided.
Assemble components as illustrated above.
Remove inertia spring and adjust stop nuts to obtain full travel of safety gear. (see chart above)
Locate top and bottom pairs of safety gears using pins provided and bolt pairs of safety gears together using M16 bolts provided.

Fit transfer arms to safety gears as illustrated.

The vertical connecting rods must be adjusted so that both safety gears operate together, i.e., that they both lift up at the same time.

The pairs of safety gears must be connected together using a connecting rod supplied by car manufacturer in accordance with standard data.
19 dia x 1.5 wall round tube — length to suit lift

CONNECTING LINK
MASS = 1 kg per metre

Provided by lift manufacturer

STABILISING BRACKET
FIT BEFORE WELDING NUTS TO EITHER END

WELD M12 NUT TO TUBE

Fixing Details
Balance spring fitted to offset mass of operating linkage (45 Newtons at position shown)

<table>
<thead>
<tr>
<th>Item Description</th>
<th>Code</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shaft Assembly</td>
<td>CDS10053</td>
<td>1</td>
</tr>
<tr>
<td>Bracket</td>
<td>CDS10050</td>
<td>1</td>
</tr>
<tr>
<td>Balance Spring</td>
<td>CDS10054</td>
<td>1</td>
</tr>
<tr>
<td>Link Plate</td>
<td>CDS00934</td>
<td>1</td>
</tr>
<tr>
<td>M12 x 30 Hex Head Screw</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>12 mm Plain Washer — Type B</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>M12 Nylock Nuts</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>6mm x 35 Long Spirol Pin</td>
<td></td>
<td>2</td>
</tr>
</tbody>
</table>

Maximum Design Load 900 Newtons

44 mm travel both directions

2 slots 11 x 30

20 dia hole

58

20 M12 Studging

4 OFF M12 Nuts

1 OFF Stabilising Bracket
CONTENTS

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Site Testing of Upward Acting Brakes 07 25 06
Safety Gear Adjustment Data 07 25 07
Outline Dimensions 07 25 08
VG2a Performance Data 07 25 09
VG-2a Safety Gear

Mounting and Installation

VG safety gears are designed to be bolted directly to the car frame or buffer channels using the slotted holes provided and must be supported by the car frame as illustrated in figure 2.2. If the distance between the support members is greater than 125 mm then a support plate must be provided by the car manufacturer.

The lower surface of the safety gear is used for mounting the bottom car guide shoes using an appropriate adapter plate. It is permitted to machine additional slots or holes in the top/bottom plates within 25 mm either side of the centreline of the fixing slots.

1. The mounting and adjustment of the safety gear should be carried out with the bottom guide shoes removed. The car balance should first be checked and any compensation weights added to ensure that the Out-of-balance load (OBL) is within the rating of the guide shoes.

2. The car frame must be correctly positioned relative to the guide rails in both planes and blocked to maintain correct location while the safety gear is being fitted. Each safety gear end unit should be loosely bolted to the buffer channels or sub-frame member using 16 mm diameter bolts.

3. Each end assembly must be set square and central to the guide rails in both planes before tightening the bolts. This can be done by raising both gibs until they are in contact with the guide rail before tightening the bolts. When located correctly, the gap between the top of the gib and the underside of the top plate is less than 12mm. (see figure 2.1)

4. With the gibs in contact with their respective guide rail, fit the guide shoes and clamp securely in place. Remove any blocking between sling and guide rail and release the gibs.

5. The operating arm should be fitted to the governor end and the lever crank fitted to the remote end as shown in figures 2.2 using the 8 mm screw sets provided. The arm can be fitted on either side of the safety gear to suit the location of the governor.

The connecting rod between the end assemblies should also be fitted. The length of the rod should be adjusted using the clevis ends so that both sets of gibs contact their respective guide rails simultaneously when the operating arm is lifted.

**IMPORTANT CHECK - All gibs MUST contact the guide rail when the operating arm is lifted.**

When correctly adjusted, the clevis ends should be locked using the nuts provided.

6. The rope anchorage bracket should be fitted to the sling and the operating rod length adjusted to suit the position of the operating arm. Check that the gibs are not being lifted and the complete assembly operates freely before connecting to the governor rope.
Over-speed Governor

The safety gear is designed to work with over-speed governors of either the drop-jaw type or friction type. The minimum force exerted by the governor must be at least twice that required to engage the safety gear subject to a minimum force of 300 Newtons. The mechanical tripping speed of the governor must be set in accordance with the current issue of EN81: part 1 or the equivalent National Standard.

Governor Rope Attachment

The standard arrangement of governor rope attachment is illustrated in figures 2.2. This shows a rope anchorage bracket (kit SK2) fitted to the crown channels or suspension members. The bracket also incorporates an auxiliary inertia spring for lift travels above 40 metres. The bracket permits full movement of the operating arm whilst preventing excess loads being applied to the operating linkage.

The total travel of the safety gear actuating rod is 44 mm. The first 30 mm is used to raise the gibs into contact with the guide rail. The gibs clamp the guide rail during the final 14 mm of travel. The standard bracket can withstand a governor pull of up to 1200 N.

Other operating arrangements are possible and reference should be made to "Application and Sales Data" sheets TD1.3. However, it is important that the safety gear operating linkage is not subjected to a load greater than 500 Newtons.

Inertia Spring Setting - Travels above 40 metres

Since 2001, all VG safety gears have been fitted with torsion springs to overcome the governor system inertia. One torsion spring is fitted to each end assembly when being used as a conventional safety gear. Two torsion springs are fitted when being used as an "up" brake. This arrangement provides sufficient inertia force for lift travels up to 40 metres with governor rope diameters of 6 or 8 mm. An auxiliary inertia spring should only be required for installations with governor rope diameters above 8 mm and/or lift travels above 25 metres.

To ensure that the safety gear does not operate during normal lift service, the auxiliary inertia spring on the rope anchorage assembly must be set correctly. This should only be carried out by a competent person.

With the operating rod to the safety gear connected, check whether the operating rod moves when the lift is started downwards under maintenance control. If any movement is detected, increase the compression of the inertia spring using the clamp collar until all movement is eliminated.

When testing counterweight buffers, it is recommended that the safety gear is disconnected as lift car bounce may cause spurious operation of the safety gear.
Guide Rail Type

The VG range of safety gears have all been type-tested using class one rails with a super-brushed finish. These rails have a lower friction coefficient than standard machined guide rails, however, the safety gears can be used with rails having a coarser surface finish. The safety gears are adjustable to enable the braking force to be adjusted on site should this prove to be necessary.

Note:- Sliding guide shoes running on standard finish guide rails may become polished in service. This may lower the braking force over time and it is recommended that the braking force is checked periodically to ensure that there has been no deterioration.

Guide Rail Installation

Guide rails should be designed and installed in accordance with EN81 or equivalent National Code. The running surfaces should be free from rust or other contamination which could effect the braking capacity of the lifts. The joints between adjacent sections must be checked to ensure that steps are below 0.25 mm.

Guide Rail Lubricant

VG safety gears have been tested using an ISO grade 68, an 80 grade EP gear oil and a general 15-50 grade engine oil. Cameron Design is confident that different grades of oil can be used if these are not available.

Safety gear switch

When the safety gear is engaged, a device mounted on the car shall initiate the stopping of the motor before or at the moment of safety gear operation. A suitable switch and operating cam can be mounted on either end or side of the safety gear end units as illustrated in figures 2.2.

On-site Testing and Adjustment

The safety gear has been adjusted to suit the load and Governor Tripping Speed stipulated on the serial label. CE marked safety gears are type tested under “free fall” conditions to achieve a deceleration rate of 0.6g. When tested with the counterweight connected, the deceleration rate will be approximately 15% higher at around 0.73g. Therefore, to compensate for the braking effect of the counterweight, the test mass should be at least 15% higher than the rated capacity of the lift.

The fall-back or “bounce” of a counterweight may cause the lift to be jerked upwards after a safety gear test. As VG safety gears have a low release force, this may cause the partial disengagement of the safety gear gibbs. This is not a problem provided that the governor system has not released the safety gear. Any attempt to drive the lift car down again will immediately cause the safety gear to re-engage.
The safety gear has been adjusted to suit the load and speed stipulated on the serial label. The braking force can be adjusted by a competent person in accordance with the data shown in figure 2.1.

On no account should the gib setting nuts be altered as this may cause the safety gear to fail.

Routine maintenance

At six monthly intervals, the following checks should be carried out:-

1. The actuating rod should be disconnected and the safety gear operated by hand to check all moving parts are free and that the safety switch is operating correctly. The pivot points on the gib and linkage and the disc springs should be sprayed with a water repellent lubricant if there is any sign of atmospheric corrosion.

2. Check that the gib contacts both faces of both guide rails when the actuating arm is raised. Adjust linkage rod and guide shoe location in accordance with installation data if the gibs are not clamping both guide rails correctly.

3. Inspect all pins and gib inserts for signs of corrosion, deformation or fractures and replace defective parts as required.

Periodic Safety Gear Operation

VG safety gears use a toothed carbide gib which cause localised and controlled grooving of the guide rail surface. Extensive development into various types of gib materials has confirmed that these provide the safest and most consistent braking on smooth guide rails independent of the type and degree of rail lubricant.

During safety gear operation, the gibs produce 8 parallel grooves approx 0.15 mm deep by 0.25 mm wide. These grooves can be smoothed quickly and easily using emery cloth without impairing the integrity of the guide rail. VG safety gears have been tested on a previously used section of guide rail without any loss of braking force.

Extensive type-testing has also confirmed that the wear rate of carbide inserts is much lower than cast iron or steel gibs. Each set of inserts should be capable of completing 10 full-load, full-speed safety gear checks before being replaced. However, the inserts should be inspected after each safety gear operation to confirm that they are in good condition.

Upward Acting Brake

VG safety gears have received CE marking for use as a "brake" to prevent uncontrolled upward movement of the lift car. When used as a brake, the force required in the up direction is less that required for the down direction. Dynamic testing witnessed by British Standard has confirmed that a setting of 50% in the "up" direction is sufficient to meet the code requirements. Consequently, the rated mass (P+Q) of all separate VG safety gears is doubled when they are used as a "brake" in the up direction. Settings higher than 50% are
possible if required to suit the specific installation or customer preference.

The table shown in figure 2.1 shows the rated mass for use as a conventional safety gear and when used as a brake for uncontrolled upward movement.

Site testing of Upward acting Brakes

It is not possible to simulate a complete loss of traction on geared machine lifts with single or double start worms. i.e. the lift will not move when the machine brake is lifted. Furthermore, dynamic tests must take account of the kinetic energy of the hoist motor and worm-shaft as these will increase the braking distance.

On geared lifts, the kinetic energy of the high-speed elements can be high when compared with the well masses.

The following tests were developed in the testing of its bi-directional and combined safety gears when used as a “brake” in the up direction.

1 Static Testing

With an empty car ascending under rooftop control, engage the safety gear (brake) by hand to confirm that it engages correctly.

Note: The "up" brake is set with a force of approx 4 times the OBL. If the maximum motor torque is less than 3 times the OBL or there is insufficient rope traction, the brake may not fully engage. If the motor stalls or rope slip is encountered before the brake has fully engaged, this is acceptable.

Conversely, if the lift has a high traction ratio plus a high motor starting torque, it may be possible to drive the lift car through the brake after it has fully engaged. Do not continue to drive the lift car after the brake has fully engaged. Remember, the “brake” is not required to stop the traction motor, only the Out of Balance Load (OBL).

2 Dynamic Testing

It is suggested that dynamic testing is carried out with the electrical safety switch to the over-speed governor disconnected but the safety switch to the safety gear left connected. The lift should be run with the governor rope running in the test groove so that the safety gear engages below normal contract speed. Power to the hoist motor and brake will then be disconnected when the brake engages.

It is recommended that the dynamic test is carried out with the machine brake in circuit so that this will assist in slowing down the kinetic energy of the motor and wormshaft. When tested in this way, the deceleration rate will be approximately 0.45g.

If the machine brake is held off during the dynamic test, the lift will decelerate at approximately 0.25g.
DRY OR LUBRICATED RAILS

NOTE: A TURN OF ONE FLAT OF THE NUT = 0.25 mm MOVEMENT

<table>
<thead>
<tr>
<th>RATED (P+Q) SAFETY GEAR</th>
<th>GOVERNOR SPEED</th>
<th>RATED &quot;UP&quot; BRAKE</th>
<th>MAXIMUM Slide Distance</th>
<th>MINIMUM Slide Distance</th>
</tr>
</thead>
<tbody>
<tr>
<td>3770 kg</td>
<td>0.5 m/sec</td>
<td>7540 kg</td>
<td>25 mm</td>
<td>18 mm</td>
</tr>
<tr>
<td>3500 kg</td>
<td>1.0 m/sec</td>
<td>7000 kg</td>
<td>100 mm</td>
<td>71 mm</td>
</tr>
<tr>
<td>3245 kg</td>
<td>1.5 m/sec</td>
<td>6490 kg</td>
<td>225 mm</td>
<td>161 mm</td>
</tr>
<tr>
<td>3000 kg</td>
<td>2.0 m/sec</td>
<td>6000 kg</td>
<td>400 mm</td>
<td>286 mm</td>
</tr>
<tr>
<td>2770 kg</td>
<td>2.5 m/sec</td>
<td>5540 kg</td>
<td>625 mm</td>
<td>446 mm</td>
</tr>
<tr>
<td>2550 kg</td>
<td>3.0 m/sec</td>
<td>5100 kg</td>
<td>800 mm</td>
<td>643 mm</td>
</tr>
<tr>
<td>2350 kg</td>
<td>3.5 m/sec</td>
<td>4700 kg</td>
<td>1225 mm</td>
<td>875 mm</td>
</tr>
<tr>
<td>2150 kg</td>
<td>4.0 m/sec</td>
<td>4300 kg</td>
<td>1600 mm</td>
<td>1143 mm</td>
</tr>
</tbody>
</table>

THE SLIDE DISTANCE WITH A FULL LOAD AND WITH THE SAFETY GEAR ENGAGED AT THE GOVERNOR SPEED SHOULD BE BETWEEN THE MAXIMUM AND MINIMUM VALUES GIVEN ABOVE. THESE VALUES REPRESENT DECELERATION RATES OF 0.5g AND 0.7g RESPECTIVELY.

SHOULD THE STOPPING DISTANCE BE OUTSIDE THE RANGE SHOWN, THE SAFETY GEAR CAN BE ADJUSTED BY INCREASING OR DECREASING THE SETTING DIMENSION "Y" SHOWN ABOVE. THE BRAKE ADJUSTING NUTS ON BOTH END ASSEMBLIES SHOULD BE ROTATED EQUALLY TO INCREASE OR DECREASE THE BRAKING FORCE.

THE LIFT SHOULD BE RE-TESTED AFTER EACH ADJUSTMENT UNTIL THE SLIDE DISTANCE FALLS BETWEEN THE TWO VALUES. NOTE! THE GIB INSERTS SHOULD BE CHANGED AFTER 10 TESTS.
### VG-2a SAFETY GEAR ACTING IN DOWN DIRECTION

<table>
<thead>
<tr>
<th>Dim &quot;Y&quot; (mm)</th>
<th>Governor Tripping Speed</th>
<th>Maximum (P+Q) kg</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.5 m/sec</td>
<td>1 m/sec</td>
</tr>
<tr>
<td>--------------</td>
<td>----------</td>
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</tr>
<tr>
<td>0</td>
<td>1160</td>
<td>1077</td>
</tr>
<tr>
<td>0.25</td>
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<tr>
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<td>1885</td>
</tr>
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<tr>
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<td>3338</td>
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<tr>
<td>3.75</td>
<td>3770</td>
<td>3500</td>
</tr>
</tbody>
</table>

**Procedure**

1. Select column with same or next highest governor tripping speed
   Example if tripping speed is 2.33 m/sec look-up value of (P+Q) in column for 2.5 m/sec

2. Read off setting for Dim "Y" corresponding to the same or next higher value of (P+Q)
   Example Dim "Y" for a safety gear with a (P+Q) of 2500kg at 2.33 m/sec will be 3.25 mm

---

### VG-2a SAFETY GEAR USED AS AN UPWARD ACTING BRAKE

<table>
<thead>
<tr>
<th>Dim &quot;Y&quot; (mm)</th>
<th>Governor Tripping Speed</th>
<th>Maximum (P+Q) kg</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.5 m/sec</td>
<td>1 m/sec</td>
</tr>
<tr>
<td>--------------</td>
<td>----------</td>
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<td>6354</td>
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<tr>
<td>3.5</td>
<td>7192</td>
<td>6677</td>
</tr>
<tr>
<td>3.75</td>
<td>7540</td>
<td>7000</td>
</tr>
</tbody>
</table>

The procedure is the same when the safety gear is being used as an upward acting brake. Example Dim "Y" for a (P+Q) of 5200kg at 1.5 m/sec will be 2.75 mm for upward braking.
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VG-4 Safety Gear

Mounting and Installation

VG safety gears are designed to be bolted directly to the car frame or buffer channels using the slotted holes provided and must be supported by the car frame as illustrated in figure 4.2. If the distance between the support members is greater than 100 mm then a support plate must be provided by the car manufacturer.

The lower surface of the safety gear is used for mounting the bottom car guide shoes using an appropriate adapter plate. It is permitted to machine additional slots or holes in the top/bottom plates within 25 mm either side of the centreline of the fixing slots.

1. The mounting and adjustment of the safety gear should be carried out with the bottom guide shoes removed. The car balance should first be checked and any compensation weights added to ensure that the Out-of-balance load (OBL) is within the rating of the guide shoes.

2. The car frame must be correctly positioned relative to the guide rails in both planes and blocked to maintain correct location while the safety gear is being fitted. Each safety gear end unit should be loosely bolted to the buffer channels or sub-frame member using 16 mm diameter bolts.

3. Each end assembly must be set square and central to the guide rails in both planes before tightening the bolts. This can be done by raising both gibs until they are in contact with the guide rail before tightening the bolts. When located correctly, the gap between the top of the gib and the underside of the top plate is less than 12mm. (see figure 4.1)

4. With the gibs in contact with their respective guide rail, fit the guide shoes and clamp securely in place. Remove any blocking between sling and guide rail and release the gibs.

5. The operating arm should be fitted to the governor end and the lever crank fitted to the remote end as shown in figures 4.2 using the 8 mm screw sets provided. The arm can be fitted on either side of the safety gear to suit the location of the governor.

The connecting rod between the end assemblies should also be fitted. The length of the rod should be adjusted using the clevis ends so that both sets of gibs contact their respective guide rails simultaneously when the operating arm is lifted.

**IMPORTANT CHECK - All gibs MUST contact the guide rail when the operating arm is lifted.**

When correctly adjusted, the clevis ends should be locked using the nuts provided.

6. The rope anchorage bracket should be fitted to the sling and the operating rod length adjusted to suit the position of the operating arm. Check that the gibs are not being lifted and the complete assembly operates freely before connecting to the governor rope.
Over-speed Governor

The safety gear is designed to work with over-speed governors of either the drop-jaw type or friction type. The minimum force exerted by the governor must be at least twice that required to engage the safety gear subject to a minimum force of 300 Newtons. The mechanical tripping speed of the governor must be set in accordance with the current issue of EN81: part 1 or the equivalent National Standard.

Governor Rope Attachment

The standard arrangement of governor rope attachment is illustrated in figures 4.2. This shows a rope anchorage bracket (kit SK2) fitted to the crown channels or suspension members. The bracket also incorporates an auxiliary inertia spring for lift travels above 40 metres. The bracket permits full movement of the operating arm whilst preventing excess loads being applied to the operating linkage.

The total travel of the safety gear actuating rod is 44 mm. The first 30 mm is used to raise the gibs into contact with the guide rail. The gibs clamp the guide rail during the final 14 mm of travel. The standard bracket can withstand a governor pull of up to 1200 N.

Other operating arrangements are possible and reference should be made to "Application and Sales Data" sheets TD1.3. However, it is important that the safety gear operating linkage is not subjected to a load greater than 500 Newtons.

Inertia Spring Setting - Travels above 40 metres

Since 2001, all VG safety gears have been fitted with torsion springs to overcome the governor system inertia. One torsion spring is fitted to each end assembly when being used as a conventional safety gear. Two torsion springs are fitted when being used as an "up" brake. This arrangement provides sufficient inertia force for lift travels up to 40 metres with governor rope diameters of 6 or 8 mm. An auxiliary inertia spring should only be required for installations with governor rope diameters above 8 mm and/or lift travels above 25 metres.

To ensure that the safety gear does not operate during normal lift service, the auxiliary inertia spring on the rope anchorage assembly must be set correctly. This should only be carried out by a competent person.

With the operating rod to the safety gear connected, check whether the operating rod moves when the lift is started downwards under maintenance control. If any movement is detected, increase the compression of the inertia spring using the clamp collar until all movement is eliminated.

When testing counterweight buffers, it is recommended that the safety gear is disconnected as lift car bounce may cause spurious operation of the safety gear.
Guide Rail Type

The VG range of safety gears have all been type-tested using class one rails with a super-brushed finish. These rails have a lower friction coefficient than standard machined guide rails, however, the safety gears can be used with rails having a coarser surface finish. The safety gears are adjustable to enable the braking force to be adjusted on site should this prove to be necessary.

Note:- Sliding guide shoes running on standard finish guide rails may become polished in service. This may lower the braking force over time and it is recommended that the braking force is checked periodically to ensure that there has been no deterioration.

Guide Rail Installation

Guide rails should be designed and installed in accordance with EN81 or equivalent National Code. The running surfaces should be free from rust or other contamination which could effect the braking capacity of the lifts. The joints between adjacent sections must be checked to ensure that steps are below 0.25 mm.

Guide Rail Lubricant

VG safety gears have been tested using an ISO grade 68, an 80 grade EP gear oil and a general 15-50 grade engine oil. Cameron Design is confident that different grades of oil can be used if these are not available.

Safety gear switch

When the safety gear is engaged, a device mounted on the car shall initiate the stopping of the motor before or at the moment of safety gear operation. A suitable switch and operating cam can be mounted on either end or side of the safety gear end units as illustrated in figures 4.2.

On-site Testing and Adjustment

The safety gear has been adjusted to suit the load and Governor Tripping Speed stipulated on the serial label. CE marked safety gears are type tested under “free fall” conditions to achieve a deceleration rate of 0.6g. When tested with the counterweight connected, the deceleration rate will be approximately 15% higher at around 0.73g. Therefore, to compensate for the braking effect of the counterweight, the test mass should be at least 15% higher than the rated capacity of the lift.

The fall-back or “bounce” of a counterweight may cause the lift to be jerked upwards after a safety gear test. As VG safety gears have a low release force, this may cause the partial disengagement of the safety gear gibs. This is not a problem provided that the governor system has not released the safety gear. Any attempt to drive the lift car down again will immediately cause the safety gear to re-engage.
The braking force of the safety gear can be adjusted by a competent person in accordance with the data shown in figure 4.1.

**On no account should the gib setting nuts be altered as this may cause the safety gear to fail.**

**Routine maintenance**

At six monthly intervals, the following checks should be carried out:-

1. The actuating rod should be disconnected and the safety gear operated by hand to check all moving parts are free and that the safety switch is operating correctly. The pivot points on the gibbs and linkage and the disc springs should be sprayed with a water repellent lubricant if there is any sign of atmospheric corrosion.

2. Check that the gibbs contact both faces of both guide rails when the actuating arm is raised. Adjust linkage rod and guide shoe location in accordance with installation data if the gibbs are not clamping both guide rails correctly.

3. Inspect all pins and gib inserts for signs of corrosion, deformation or fractures and replace defective parts as required.

**Periodic Safety Gear Operation**

VG safety gears use a toothed carbide gib which cause localised and controlled grooving of the guide rail surface. Extensive development into various types of gib materials has confirmed that these provide the safest and most consistent braking on smooth guide rails independent of the type and degree of rail lubricant.

During safety gear operation, the gibbs produce 8 parallel grooves approx 0.15 mm deep by 0.25 mm wide. These grooves can be smoothed quickly and easily using emery cloth without impairing the integrity of the guide rail. VG safety gears have been tested on a previously used section of guide rail without any loss of braking force.

Extensive type-testing has also confirmed that the wear rate of carbide inserts is much lower than cast iron or steel gibbs. Each set of inserts should be capable of completing 10 full-load, full-speed safety gear checks before being replaced. However, the inserts should be inspected after each safety gear operation to confirm that they are in good condition.

**Upward Acting Brake**

VG safety gears have received CE marking for use as a "brake" to prevent uncontrolled upward movement of the lift car. When used as a brake, the force required in the up direction is less that required for the down direction. Dynamic testing witnessed by British Standard has confirmed that a setting of 50% in the "up" direction is sufficient to meet the code requirements. Consequently, the rated mass (P+Q) of all separate VG safety gears is doubled when they are used as a “brake" in the up direction. Settings higher than 50% are possible if required to suit the specific installation or customer preference.

The table shown in figure 4.1 show the rated mass for use as a conventional safety gear and when used as a brake for uncontrolled upward movement.
Site testing of Upward acting Brakes

It is not possible to simulate a complete loss of traction on geared machine lifts with single or double start worms. ie the lift will not move when the machine brake is lifted. Furthermore, dynamic tests must take account of the kinetic energy of the hoist motor and worm-shaft as these will increase the braking distance.

On geared lifts, the kinetic energy of the high-speed elements can be high when compared with the well masses.

The following tests were developed in the testing of its bi-directional and combined safety gears when used a “brake” in the up direction.

1  Static Testing

With an empty car ascending under roof top control, engage the safety gear (brake) by hand to confirm that it engages correctly.

Note: The "up" brake is set with a force of approx 4 times the OBL. If the maximum motor torque is less than 3 times the OBL or there is insufficient rope traction, the brake may not fully engage. If the motor stalls or rope slip is encountered before the brake has fully engaged, this is acceptable.

Conversely, if the lift has a high traction ratio plus a high motor starting torque, it may be possible to drive the lift car through the brake after it has fully engaged. Do not continue to drive the lift car after the brake has fully engaged. Remember, the “brake” is not required to stop the traction motor, only the Out of Balance Load (OBL).

2  Dynamic Testing

It is suggested that dynamic testing is carried out with the electrical safety switch to the over-speed governor disconnected but the safety switch to the safety gear left connected. The lift should be run with the governor rope running in the test groove so that the safety gear engages below normal contract speed. Power to the hoist motor and brake will then be disconnected when the brake engages.

It is recommended that the dynamic test is carried out with the machine brake in circuit so that this will assist in slowing down the kinetic energy of the motor and wormshaft. When tested in this way, the deceleration rate will be approximately 0.45g.

If the machine brake is held off during the dynamic test, the lift will decelerate at approximately 0.25g.
DRY OR LUBRICATED RAILS

GOVERNOR FORCE
500 NEWTONS MAX

UNDERSIDE OF TOP PLATE

LINKAGE POSITION AT INITIAL CONTACT WITH GUIDE RAIL

DIMENSION "Y"

BRAKE FORCE ADJUSTMENT NUTS ARE FACTORY SET TO THE SPEED AND LOAD DATA IN TD-4.6. THE NUTS SHOULD ONLY BE ALTERED IN ACCORDANCE WITH THE TEST INSTRUCTIONS OUTLINED BELOW.

NOTE: A TURN OF ONE FLAT OF THE NUT = 0.25 mm MOVEMENT

<table>
<thead>
<tr>
<th>RATED (P+Q) SAFETY GEAR</th>
<th>GOVERNOR SPEED</th>
<th>RATED (P+Q) &quot;UP&quot; BRAKE</th>
<th>MAXIMUM Slide Distance</th>
<th>MINIMUM Side Distance</th>
</tr>
</thead>
<tbody>
<tr>
<td>1900 kg</td>
<td>0.5 m/sec</td>
<td>3800 kg</td>
<td>25 mm</td>
<td>18 mm</td>
</tr>
<tr>
<td>1810 kg</td>
<td>1.0 m/sec</td>
<td>3620 kg</td>
<td>100 mm</td>
<td>71 mm</td>
</tr>
<tr>
<td>1724 kg</td>
<td>1.5 m/sec</td>
<td>3448 kg</td>
<td>225 mm</td>
<td>161 mm</td>
</tr>
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<td>1639 kg</td>
<td>2.0 m/sec</td>
<td>3278 kg</td>
<td>400 mm</td>
<td>286 mm</td>
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<td>1556 kg</td>
<td>2.5 m/sec</td>
<td>3102 kg</td>
<td>625 mm</td>
<td>446 mm</td>
</tr>
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<td>2800 kg</td>
<td>1225 mm</td>
<td>875 mm</td>
</tr>
<tr>
<td>1326 kg</td>
<td>4.0 m/sec</td>
<td>2652 kg</td>
<td>1600 mm</td>
<td>1143 mm</td>
</tr>
</tbody>
</table>

THE SLIDE DISTANCE WITH A FULL LOAD AND WITH THE SAFETY GEAR ENGAGED AT THE GOVERNOR SPEED SHOULD BE BETWEEN THE MAXIMUM AND MINIMUM VALUES GIVEN ABOVE. THESE VALUES REPRESENT DECELERATION RATES OF 0.5g AND 0.7g RESPECTIVELY.

SHOULD THE STOPPING DISTANCE BE OUTSIDE THE RANGE SHOWN, THE SAFETY GEAR CAN BE ADJUSTED BY INCREASING OR DECREASING THE SETTING DIMENSION "Y" SHOWN ABOVE. THE BRAKE ADJUSTING NUTS ON BOTH END ASSEMBLIES SHOULD BE ROTATED EQUALLY TO INCREASE OR DECREASE THE BRAKING FORCE.

THE LIFT SHOULD BE RE-TESTED AFTER EACH ADJUSTMENT UNTIL THE SLIDE DISTANCE FALLS BETWEEN THE TWO VALUES. NOTE! THE GIB INSERTS SHOULD BE CHANGED AFTER 10 TESTS.
**VG-4 SAFETY GEAR ACTING IN DOWN DIRECTION**

<table>
<thead>
<tr>
<th>Dim &quot;Y&quot; mm</th>
<th>Governor Tripping Speed</th>
<th>0.5 m/sec</th>
<th>1 m/sec</th>
<th>1.5 m/sec</th>
<th>2.0 m/sec</th>
<th>2.5 m/sec</th>
<th>3.0 m/sec</th>
<th>3.5 m/sec</th>
<th>4.0 m/sec</th>
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<td>866</td>
<td>825</td>
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<td>1106</td>
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<td>1556</td>
<td>1477</td>
<td>1400</td>
<td>1326</td>
</tr>
</tbody>
</table>

**Procedure**

1) Select column with same or next highest governor tripping speed
   Example if tripping speed is 2.33 m/sec look-up value of (P+Q) in column for 2.5 m/sec

2) Read off setting for Dim "Y" corresponding to the same or next higher value of (P+Q)
   Example "Dim "Y" for a safety gear with a (P+Q) of 1350kg at 2.33 m/sec will be 2.75 mm

---

**VG-4 SAFETY GEAR USED AS AN UPWARD ACTING BRAKE**

<table>
<thead>
<tr>
<th>Dim &quot;Y&quot; mm</th>
<th>Governor Tripping Speed</th>
<th>0.5 m/sec</th>
<th>1 m/sec</th>
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</table>

The procedure is the same when the safety gear is being used as an upward acting brake.

Example Dim "Y" for a (P+Q) of 3250kg at 1.5 m/sec will be 3.25 mm for upward braking
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VG-5 Safety Gear

Introduction

The VG-5 is a "bi-directional" safety gear - This combines two independent braking elements within a common housing. This produces a more compact and cost effective option than 2 separate safety gears. Normally a bi-directional unit would be fitted below the lift car but it can be mounted on the crown channels if required. However, the crown channels flanges will need to be strengthened. (please consult Cameron Design)

The VG-5 bi-directional safety gear has been designed with a braking force in the “up” direction one half that in the “down” direction as standard. This is achieved by having double springs in the down direction and single springs in the up direction. Consequently, VG-5 safety gears are adjusted with the same “Y” setting (see figure 5.1) for both up and down spring stacks.

Over-speed Governor

The safety gear can be operated by either the drop-jaw type or friction type over-speed governors. The minimum force exerted by the governor must be at least twice that required to engage the safety gear subject to a minimum force of 300 Newtons. The force needed to engage a pair of VG-5 safety gears, with integral inertia springs fitted, is 100N in both directions.

The mechanical tripping speed of the governor must be set in accordance with the current issue of EN81: part 1 or the equivalent National Standard.

Governor System Requirements

The schematic layout of friction type governor roping system is illustrated in Figure TD1.9. This shows an over-speed governor, governor rope and tension weight and lockdown mechanism.

When this arrangement is used, the force generated in the "up" direction will be considerably less than the force available in the "down" direction. Governor rope tension weights may need to be increased to ensure that force generated complies with EN81.

During "upward" operation, there may be a tendency for the governor rope tension weight to lift. Should this occur then the governor rope may loose tension and the safety gear not operate correctly. This can be prevented by fitting a “lockdown” device such as kit SK8 which incorporates a means of compensating for governor rope stretch.

Mounting and Installation

The mounting of the VG-5 is similar "standard" downward acting safety gears. All VG safety gears are designed to be bolted directly to the car sub-frame or buffer channels using the slotted holes provided.
The safety gear must be supported by the car frame as illustrated. If the distance between the supporting frame is greater than 175 mm, then an additional support plate must be provided. The lower surface of the safety gear is used for mounting the bottom car guide shoes using an appropriate adapter plate. It is permitted to machine additional slots or holes in the top/bottom plates within 25 mm either side of the centreline of the fixing slots.

1. The actuating arms and cranks should be fitted to the governor end and the lever cranks fitted to the remote end as shown in figures TD1.7. The attachment of the actuating arm to the cranks has a slotted hole for later adjustment. The arm can be fitted on either side of the safety gear to suit the location of the governor.

2. The mounting and adjustment of the safety gear should be carried out with the bottom guide shoes removed. The car balance should first be checked and any compensation weights added to ensure that the Out-of-balance load (OBL) is within the rating of the guide shoes.

3. The car frame must be correctly positioned relative to the guide rails in both planes and blocked to maintain correct location while the safety gear is being fitted. Each safety gear end unit should be loosely bolted to the buffer channels or sub-frame member using 16 mm diameter bolts.

4. Each end assembly must be set square and central to the guide rails in both planes before tightening the bolts. This is done by lifting both sets of gibs for the "down" acting safety gear and checking that these contact with the guide rail before tightening the bolts. After tightening check that the gap between the top of the gib and the underside of the plate is within 12 mm when both gibs contact the guide rail.

5. With the gibs in contact with their respective guide rail, fit the guide shoes and clamp securely in place. Remove any blocking between sling and guide rail and release the gibs.

6. Fit the connecting rods to both "up" and "down" actuating arms and their respective end assemblies using the M12 clevis rods end provided. See figure 5.1. The length of the rods should be adjusted so that both sets of gibs contact their respective guide rails simultaneously when their respective actuating arm is operated.

**IMPORTANT CHECK - Check both "up" and "down" braking mechanisms independently.**

All gibbs in the MUST contact the guide rail when the operating arm for the "up" direction is lifted. Similarly all gibbs must contact the guide rail when the "down" actuating arm is operated.

7. The actuating linkage should now be fitted to actuating arms and adjusted to ensure that the gib inserts are fully disengaged. (ie resting on the safety gear frame). This is done by adjusting the M10 screws between the actuating arm and the cranked arm. Check that the gibs are not being lifted and the complete assembly operates freely before connecting to the governor rope.
Inertia Spring

The total travel of the link plate needed to fully engage the safety gear is 44 mm. The first 30 mm of the travel is used to raise or lower the gibbs into contact with the guide rail. The gibbs contact and clamp the guide rail during the final 14 mm of travel. The VG-5 has been fitted with integral inertia springs – 2 on the “up” brake section and 1 on the “down” safety gear section. This has been done to compensate for the gravitational effect of the gripping jaws. These will provide sufficient force to accelerate a governor rope system up to 40 metres high at 2.5 m/sec² acceleration. Additional inertia springs using standard kits SK3 can be fitted to the safety gear if required.

When testing counterweight buffers, it is recommended that the safety gear is disconnected as lift car bounce may cause spurious operation of the safety gear.

Guide Rail Type

VG safety gears have all been type-tested using class one rails with a super-brushed finish. These rails have a lower friction coefficient than standard machined guide rails, however, the safety gears can be used with rails having a coarser surface finish. The safety gears are adjustable to enable the braking force to be adjusted on site should this prove to be necessary.

Note:- Sliding guide shoes running on standard finish guide rails may become polished in service. This may lower the braking force over time and it is recommended that the braking force is checked periodically to ensure that there has been no deterioration.

Guide Rail Installation

Guide rails should be designed and installed in accordance with EN81 or equivalent National Code. The running surfaces should be free from rust or other contamination which could effect the braking capacity of the lifts. The joints between adjacent sections must be checked to ensure that steps are below 0.25 mm.

Guide Rail Lubricant

VG safety gears have been tested using an ISO grade 68, an 80 grade EP gear oil and a general 15-50 grade engine oil. Cameron Design is confident that different grade of oils can be used if these are not available.

Safety gear switch

When the safety gear is engaged, a device mounted on the car shall initiate the stopping of the motor before or at the moment of safety gear operation. A suitable switch and operating cam can be mounted on either end or side of the safety gear end units.
On-site Testing and Adjustment

The safety gear has been adjusted to suit the load and Governor Tripping Speed stipulated on the serial label. CE marked safety gears are type tested under “free fall” conditions to achieve a deceleration rate of 0.6g. When tested with the counterweight connected, the deceleration rate will be approximately 15% higher at around 0.73g. Therefore, to compensate for the braking effect of the counterweight, the test mass should be at least 15% higher than the rated capacity of the lift.

The fall-back or “bounce” of a counterweight may cause the lift to be jerked upwards after a safety gear test. As VG safety gears have a low release force, this may cause the partial disengagement of the safety gear gibs. This is not a problem provided that the governor system has not released the safety gear. Any attempt to drive the lift car down again will immediately cause the safety gear to re-engage.

The safety gear has been adjusted to suit the load and speed stipulated on the serial label. If testing indicates that the safety gear requires adjusting on-site, this should only be done by a competent person in accordance with the instructions given in figure 5.1. On no account should the gib setting nuts be altered as this may cause the safety gear to fail to operate correctly.

Routine maintenance

At six monthly intervals, the following checks should be carried out:-

1. The actuating rod should be disconnected and the safety gear operated by hand to check all moving parts are free and that the safety switch is operating correctly. The pivot points on the gibs and linkage and the disc springs should be sprayed with a water repellent lubricant if there is any sign of atmospheric corrosion.

2. Check that the gibs contact both faces of both guide rails when the actuating arm is raised. - Adjust linkage rod and guide shoe location in accordance with installation data if the gibs are not clamping both guide rails correctly.

3. Inspect all pins and gib inserts for signs of corrosion, deformation or fractures and replace defective parts as required.

Periodic Safety Gear Operation

VG safety gears use a toothed carbide gib which cause localised and controlled grooving of the guide rail surface. During safety gear operation, the gibs produce 8 parallel grooves approx 0.15 mm deep by 0.25 mm wide. These grooves can be smoothed quickly and easily using emery cloth without impairing the integrity of the guide rail.

VG safety gears have been tested on a previously used section of guide rail without any loss of braking force. Each set of inserts should be capable of completing a minimum of 10 full-load, full-speed safety gear operations before being replaced. However, the inserts should be inspected after each safety gear operation to confirm that they are in good condition.
Site testing of Upward acting Brakes

It is not possible to simulate a complete loss of traction on geared machine lifts with single or double start worms. i.e the lift will not move when the machine brake is lifted. Furthermore, the brake will have to decelerate the kinetic energy of the motor and gearbox in addition to the car and counterweight masses.

On geared lifts, the kinetic energy of the high speed elements can be high when compared with the well masses. A dynamic test which requires the car brake to decelerate the high speed elements will generate longer slide distances than would be experienced in practice.

The following tests were developed in the testing of its bi-directional and combined safety gears.

1  Static Testing

With an empty car under roof top control, engage the safety gear by hand to confirm that it engages correctly.

Note: As the "up" brake is set with a force of between 3 to 4 times the OBL, there may be insufficient motor torque and traction available to fully engage the brake. Alternatively, if the lift has a high traction ratio plus a high motor starting torque, it may be possible to drive the lift car through the car brake once it has fully engaged. Do not continue to run the motor once the brake has fully engaged.

2  Dynamic Testing

It is suggested that dynamic testing is carried out with the electrical safety switch to the over-speed governor disconnected but the safety switch to the safety gear left connected. The lift should be run with the governor rope running in the test groove so that the safety gear engages below normal contract speed. Power to the hoist motor and brake will then be disconnected when the safety gear engages.

It is recommended that the dynamic test is carried out with the machine brake in circuit so that this will assist in slowing down the kinetic energy of the motor and wormshaft. When tested in this way, the deceleration rate will be approximately 0.45g. If the machine brake is held off during the dynamic test, the lift will decelerate at approximately 0.25g.
**VG5 SAFETY GEAR ADJUSTMENT DATA TD 5.1C**

**INERTIA SPRING CONNECTION**

**LINKAGE ADJUSTMENT**

**ACTUATING LINKAGE**

**DOWNWARD ACTING**

**GIFF SETTING NUTS DO NOT ADJUST**

**"UP" BRAKE ADJUSTING NUT**

**"DOWN" BRAKE ADJUSTING NUT**

**UPWARD BRAKING**

**LINKAGE POSITION AT INITIAL CONTACT WITH GUIDE RAIL**

**DIMENSION "Y"**

**10 - 12 mm**

**NOTE:** A TURN OF ONE FLAT OF THE NUT = 0.25 mm MOVEMENT

---

**RATED (P+Q) SAFETY GEAR GOVERNOR SPEED**

<table>
<thead>
<tr>
<th>Rated (P+Q) Safety Gear</th>
<th>Governor Speed</th>
<th>Maximum Side Distance</th>
<th>Minimum Side Distance</th>
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<td>2405 kg</td>
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<td>100 mm</td>
<td>71 mm</td>
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<td>2270 kg</td>
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<td>225 mm</td>
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<td>2.0 m/sec</td>
<td>400 mm</td>
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<td>2.5 m/sec</td>
<td>625 mm</td>
<td>446 mm</td>
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<tr>
<td>1900 kg</td>
<td>3.0 m/sec</td>
<td>900 mm</td>
<td>643 mm</td>
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<td>1790 kg</td>
<td>3.5 m/sec</td>
<td>1225 mm</td>
<td>875 mm</td>
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<td>1680 kg</td>
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<td>1600 mm</td>
<td>1143 mm</td>
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</table>

**THE SLIDE DISTANCE WITH A FULL LOAD AND WITH THE SAFETY GEAR ENGAGED AT THE GOVERNOR SPEED SHOULD BE BETWEEN THE MAXIMUM AND MINIMUM VALUES GIVEN ABOVE. THESE VALUES REPRESENT DECELERATION RATES OF 0.5g AND 0.7g RESPECTIVELY.**

**SHOULD THE STOPPING DISTANCE BE OUTSIDE THE RANGE SHOWN, THE SAFETY GEAR CAN BE ADJUSTED BY INCREASING OR DECREASING THE SETTING DIMENSION "Y" SHOWN ABOVE. THE BRAKE ADJUSTING NUTS ON BOTH END ASSEMBLIES SHOULD BE ROTATED EQUALLY TO INCREASE OR DECREASE THE BRAKING FORCE.**

**THE LIFT SHOULD BE RE-TESTED AFTER EACH ADJUSTMENT UNTIL THE SLIDE DISTANCE FALLS BETWEEN THE TWO VALUES. NOTE! THE GIB INSERTS SHOULD BE CHANGED AFTER 10 TESTS**
NOTE!
The VG-5 is fitted with integral inertia springs as illustrated. These have been designed to provide a 100 Newtons force at the operating linkage. This force is used to overcome governor system inertia. EN-81 requires the governor to generate a minimum force of 300 Newtons. The integral inertia springs are suitable for lift travels up to 40 metres.
### VG-5 BI-DIRECTIONAL SAFETY GEAR

#### Maximum (P+Q) kg

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<th>1.5 m/sec</th>
<th>2.0 m/sec</th>
<th>2.5 m/sec</th>
<th>3.0 m/sec</th>
<th>3.5 m/sec</th>
<th>4.0 m/sec</th>
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<td>1668</td>
<td>1571</td>
<td>1478</td>
<td>1392</td>
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<td>1900</td>
<td>1790</td>
<td>1680</td>
<td>8.0 m/sec</td>
</tr>
</tbody>
</table>

#### Procedure

1) Select column with same or next highest governor tripping speed

Example if tripping speed is 2.33 m/sec look-up value of (P+Q) in column for 2.5 m/sec

2) Read off setting for Dim "Y" corresponding to the same or next higher value of (P+Q)

Example Dim "Y" for a safety gear with a (P+Q) of 2000 kg at 1.5 m/sec will be 3.75 mm
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VG-6 Safety Gear

Mounting and Installation

VG safety gears are designed to be bolted directly to the car sub-frame or buffer channels using the slotted holes provided. The frame is designed to be supported by the car frame as illustrated in figure 6.2. If the distance between the sling members is greater than 100 mm then a support plate must be provided by the car manufacturer.

The lower surface of the safety gear is used for mounting the bottom car guide shoes using an appropriate adaptor plate. It is permitted to machine additional slots or holes in the top/bottom plates within 25 mm either side of the centreline of the fixing slots.

1. The mounting and adjustment of the safety gear should be carried out with the bottom guide shoes removed. The car balance should first be checked and any compensation weights added to ensure that the Out-of-balance load (OBL) is within the rating of the guide shoes.

2. The car frame must be correctly positioned relative to the guide rails in both planes and blocked to maintain correct location while the safety gear is being fitted. Each safety gear end unit should be loosely bolted to the buffer channels or sub-frame member using 16 mm diameter bolts.

3. Each end assembly should be set square and central to the guide rails in both planes before tightening the bolts. This is done by raising both gibs until these are in contact with the guide rail before tightening the bolts and checking that the gap between the top of the gib and the underside of the plate is within the range specified in the safety gear data sheet.

4. With the gibs in contact with their respective guide rail, fit the guide shoes and clamp securely in place. Remove any blocking between sling and guide rail and release the gibs.

5. The operating arm should be fitted to the governor end and the lever crank fitted to the remote end as shown in figures 6.2 using the 8 mm screw sets provided. The arm can be fitted on either side of the safety gear to suit the location of the governor.

The connecting rod between the end assemblies should also be fitted. The length of the rod should be adjusted using the clevis ends so that both sets of gibs contact their respective guide rails simultaneously when the operating arm is lifted.

**IMPORTANT CHECK - All gibs MUST contact the guide rail when the operating arm is lifted.**

When correctly adjusted, the clevis ends should be locked using the nuts provided.

6. The rope anchorage bracket should be fitted to the sling and the operating rod length adjusted to suit the position of the operating arm. Check that the gibs are not being lifted and the complete assembly operates freely before connecting to the governor rope.
Over-speed Governor

The safety gear is designed to work with over-speed governors of either the drop-jaw type or friction type. The minimum force exerted by the governor must be at least twice that required to engage the safety gear subject to a minimum force of 300 Newtons. The mechanical tripping speed of the governor must be set in accordance with the current issue of EN81: part 1 or the equivalent National Standard.

Governor Rope Attachment

The preferred method of governor rope attachment is illustrated in figures 6.2. This shows a rope anchorage bracket fitted to the crown channels or suspension members which incorporates an inertia spring and rope clamps to suit a 6-8 mm diameter governor rope. This device has been designed to allow full movement of the operating arm whilst preventing excess loads being applied to the operating linkage. The standard bracket can withstand a governor pull of up to 1200 N.

Other operating arrangements are possible and reference should be made to "Application and Sales Data" sheets TD1.3. However, it is important that the safety gear operating linkage is not subjected to a load greater than 500 Newtons.

Inertia Spring Setting

Since 2001, all VG safety gears have been fitted with torsion springs to overcome the governor system inertia. One torsion spring is fitted to each end assembly when being used as a conventional safety gear. Two torsion springs are fitted when being used as an "up" brake. This arrangement provides sufficient inertia force for lift travels up to 40 metres with governor rope diameters of 6 or 8 mm. An auxiliary inertia spring should only be required for installations with governor rope diameters above 8 mm and/or lift travels above 25 metres.

To ensure that the safety gear does not operate during normal lift service, the auxiliary inertia spring on the rope anchorage assembly must be set correctly. This should only be carried out by a competent person.

With the operating rod to the safety gear connected, check whether the operating rod moves when the lift is started downwards under maintenance control. If any movement is detected, increase the compression of the inertia spring using the clamp collar until all movement is eliminated.

When testing counterweight buffers, it is recommended that the safety gear is disconnected as lift car bounce may cause spurious operation of the safety gear.
Guide Rail Type

The VG range of safety gears have all been type-tested using class one rails with a super-brushed finish. These rails have a lower friction coefficient than standard machined guide rails, however, the safety gears can be used with rails having a coarser surface finish. The safety gears are adjustable to enable the braking force to be adjusted on site should this prove to be necessary.

Note:- Sliding guide shoes running on standard finish guide rails may become polished in service. This may lower the braking force over time and it is recommended that the braking force is checked periodically to ensure that there has been no deterioration.

Guide Rail Installation

Guide rails should be designed and installed in accordance with EN81 or equivalent National Code. The running surfaces should be free from rust or other contamination which could effect the braking capacity of the lifts. The joints between adjacent sections must be checked to ensure that steps are below 0.25 mm.

Guide Rail Lubricant

VG safety gears have been tested using an ISO grade 68, an 80 grade EP gear oil and a general 15-50 grade engine oil. Cameron Design is confident that oils of different grades can be used if these are not available.

Safety gear switch

When the safety gear is engaged, a device mounted on the car shall initiate the stopping of the motor before or at the moment of safety gear operation. A suitable switch and operating cam can be mounted on either end or side of the safety gear end units as illustrated in figure 6.2.

On-site Testing and Adjustment

The safety gear has been adjusted to suit the load and Governor Tripping Speed stipulated on the serial label. CE marked safety gears are type tested under “free fall” conditions to achieve a deceleration rate of 0.6g. When tested with the counterweight connected, the deceleration rate will be approximately 15% higher at around 0.73g. Therefore, to compensate for the braking effect of the counterweight, the test mass should be at least 15% higher than the rated capacity of the lift.

The fall-back or “bounce” of a counterweight may cause the lift to be jerked upwards after a safety gear test. As VG safety gears have a low release force, this may cause the partial disengagement of the safety gear gibs. This is not a problem provided that the governor system has not released the safety gear. Any attempt to drive the lift car down again will immediately cause the safety gear to re-engage.

The braking force can be adjusted by a competent person in accordance with the data shown in figure 6.1.

On no account should the gib setting nuts be altered as this may cause the safety gear to fail.
Routine maintenance

At six monthly intervals, the following checks should be carried out:-

1. The actuating rod should be disconnected and the safety gear operated by hand to check all moving parts are free and that the safety switch is operating correctly. The pivot points on the gibbs and linkage and the disc springs should be sprayed with a water repellent lubricant if there is any sign of atmospheric corrosion.

2. Check that the gibbs contact both faces of both guide rails when the actuating arm is raised. Adjust linkage rod and guide shoe location in accordance with installation data if the gibbs are not clamping both guide rails correctly.

3. Inspect all pins and gib inserts for signs of corrosion, deformation or fractures and replace defective parts as required.

Periodic Safety Gear Operation

VG safety gears use a toothed carbide gib which cause localised and controlled grooving of the guide rail surface. Extensive development into various types of gib grooving has confirmed that these provide the safest and most consistent braking on smooth guide rails independent of the type and degree of rail lubricant.

During safety gear operation, the gibbs produce 8 parallel grooves approx 0.15 mm deep by 0.25 mm wide. These grooves can be smoothed quickly and easily using emery cloth without impairing the integrity of the guide rail. VG safety gears have been tested on a previously used section of guide rail without any loss of braking force.

Extensive type-testing has also confirmed that the wear rate of carbide inserts is much lower than cast iron or steel gibbs. Each set of inserts should be capable of completing 10 full-load, full-speed safety gear checks before being replaced. However, the inserts should be inspected after each safety gear operation to confirm that they are in good condition.

Upward Acting Brake

VG safety gears have received CE marking for use as a "brake" to prevent uncontrolled upward movement of the lift car. When used as a brake, the force required in the up direction is less that required for the down direction. Dynamic testing witnessed by British Standard has confirmed that a setting of 50% in the "up" direction is sufficient to meet the code requirements. Consequently, the rated mass (P+Q) of all separate VG safety gears is doubled when these are used as a brake in the up direction. Settings higher than 50% are possible if required to suit the specific installation or customer preference.

The tables shown in figure 6.1 show the rated mass for use as a conventional safety gear and when used as a brake for uncontrolled upward movement.
Site testing of Upward acting Brakes

It is not possible to simulate a complete loss of traction on geared machine lifts with single or double start worms. ie the lift will not move when the machine brake is lifted. Furthermore, dynamic tests must take account of the kinetic energy of the hoist motor and worm-shaft as these will increase the braking distance.

*On geared lifts, the kinetic energy of the high-speed elements can be high when compared with the well masses.*

The following tests were developed in the testing of its bi-directional and combined safety gears when used a “brake” in the up direction.

1 **Static Testing**

   With an empty car ascending under roof top control, engage the safety gear (brake) by hand to confirm that it engages correctly.

   Note: The "up" brake is set with a force of approx 4 times the OBL. If the maximum motor torque is less than 3 times the OBL or there is insufficient rope traction, the brake may not fully engage. If the motor stalls or rope slip is encountered before the brake has fully engaged, this is acceptable.

   Conversely, if the lift has a high traction ratio plus a high motor starting torque, it may be possible to drive the lift car through the brake after it has fully engaged. Do not continue to drive the lift car after the brake has fully engaged. Remember, the “brake” is not required to stop the traction motor, only the Out of Balance Load (OBL).

2 **Dynamic Testing**

   It is suggested that dynamic testing is carried out with the electrical safety switch to the over-speed governor disconnected but the safety switch to the safety gear left connected. The lift should be run with the governor rope running in the test groove so that the safety gear engages below normal contract speed. Power to the hoist motor and brake will then be disconnected when the brake engages.

   It is recommended that the dynamic test is carried out with the machine brake in circuit so that this will assist in slowing down the kinetic energy of the motor and wormshaft. When tested in this way, the deceleration rate will be approximately 0.45g.

   If the machine brake is held off during the dynamic test, the lift will decelerate at approximately 0.25g.
THE SLIDE DISTANCE WITH A FULL LOAD AND WITH THE SAFETY GEAR ENGAGED AT THE
GOVERNOR SPEED SHOULD BE BETWEEN THE MAXIMUM AND MINIMUM VALUES GIVEN ABOVE.
THESE VALUES REPRESENT DECELERATION RATES OF 0.5g AND 0.7g RESPECTIVELY.

SHOULD THE STOPPING DISTANCE BE OUTSIDE THE RANGE SHOWN, THE SAFETY GEAR CAN
BE ADJUSTED BY INCREASING OR DECREASING THE SETTING DIMENSION "Y" SHOWN ABOVE.
THE BRAKE ADJUSTING NUTS ON BOTH END ASSEMBLIES SHOULD BE ROTATED EQUALLY TO
TO INCREASE OR DECREASE THE BRAKING FORCE.

THE LIFT SHOULD BE RE-TESTED AFTER EACH ADJUSTMENT UNTIL THE SLIDE DISTANCE FALLS
BETWEEN THE TWO VALUES. NOTE! THE GIB INSERTS SHOULD BE CHANGED AFTER 10 TESTS

<table>
<thead>
<tr>
<th>RATED (P+Q) SAFETY GEAR</th>
<th>GOVERNOR SPEED</th>
<th>RATED (P+Q) &quot;UP&quot; BRAKE</th>
<th>MAXIMUM Slide Distance</th>
<th>MINIMUM Slide Distance</th>
</tr>
</thead>
<tbody>
<tr>
<td>5800 kg</td>
<td>0.5 m/sec</td>
<td>11600 kg</td>
<td>25 mm</td>
<td>18 mm</td>
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<tr>
<td>5400 kg</td>
<td>1.0 m/sec</td>
<td>10800 kg</td>
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<td>71 mm</td>
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<td>1.5 m/sec</td>
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<td>4660 kg</td>
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<td>400 mm</td>
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<td>2.5 m/sec</td>
<td>8640 kg</td>
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<td>446 mm</td>
</tr>
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<td>3.0 m/sec</td>
<td>8000 kg</td>
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<td>875 mm</td>
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<td>3410 kg</td>
<td>4.0 m/sec</td>
<td>6820 kg</td>
<td>1600 mm</td>
<td>1143 mm</td>
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</table>
STANDARD KITS ILLUSTRATED
TOP ROPE ANCHORAGE ASSEMBLY SK2
STANDARD OPERATING KIT - SK1
SAFETY SWITCH KIT SK7
PAIR OF WEDGE SOCKETS KIT SK9

WEDGE CLAMPS TO DIN 15315
BY CAR MANUFACTURER OR KIT SK9

ROPE ANCHORAGE ASSEMBLY
ACCESSORY KIT SK2

VG-6 SAFETY GEAR DATA

<table>
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<th>SAFETY GEAR</th>
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<tr>
<td>MINIMUM MASS</td>
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<td>MAX (P+Q) @ 1m/sec</td>
<td>5400 kg</td>
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<tr>
<td>MAX (P+Q) @ 2m/sec</td>
<td>4560 kg</td>
</tr>
<tr>
<td>MAX (P+Q) @ 3m/sec</td>
<td>4000 kg</td>
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<td>RAIL CONDITION</td>
<td>DRY OR OILED</td>
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<td>GUIDE RAILS</td>
<td>TB9 to T127-1/8</td>
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<td>SAFETY SWITCH</td>
<td>IP67 220V-4A</td>
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<tr>
<td>OPERATING FORCE</td>
<td>30 NEWTONS</td>
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<td>WEIGHT</td>
<td>23 kg PER END</td>
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TO SUIT 6 - 8 MM ROPE

BRACKET CAN BE ROTATED

INERTIA SPRING

2 HOLES 11 DIA

M12 CLEVIS ASSEMBLY TO DIN 71752 - 3 SUPPLIED WITH KIT SK1

SWITCH CAN BE MOUNTED EITHER END

2 HOLES 11 DIA

NOTE:
PURCHASER TO ENSURE SAFETY GEAR
CLEARS GUIDE CLIPS, JOINT PLATE
BOLTS AND GUIDE FIXINGS

DBG - 120 FIXING CENTRES

GOVERNOR ROPE

274 TO CENTRE OF GOVERNOR ROPE

DIMENSION "X" TO SUIT CAR DESIGN

MOVEMENT OF ACTUATING ROD

ACTUATING LINKAGE
CAN BE FITTED ON EITHER
SIDE TO SUIT GOVERNOR

FACE OF GUIDE RAIL

INTERMEDIATE ROD SUPPORT AS REQUIRED
BY CAR MANUFACTURER

CONNECTING ROD: LENGTH = DBG - 270 THREADED M12 x 35 BOTH ENDS
BY CAR MANUFACTURER

M12 CLEVIS ASSEMBLY TO DIN 71752 - 3 SUPPLIED WITH KIT SK1
### VG-6 SAFETY GEAR ACTING IN DOWN DIRECTION

**Maximum (P+Q) kg**

<table>
<thead>
<tr>
<th>Dim &quot;Y&quot; (mm)</th>
<th>0.5 m/sec</th>
<th>1 m/sec</th>
<th>1.5 m/sec</th>
<th>2.0 m/sec</th>
<th>2.5 m/sec</th>
<th>3.0 m/sec</th>
<th>3.5 m/sec</th>
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<td>4000</td>
<td>3700</td>
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</table>

**Procedure**

1) Select column with same or next highest governor tripping speed
Example if tripping speed is 2.63 m/sec look-up value of (P+Q) in column for 3.0 m/sec

2) Read off setting for Dim "Y" corresponding to the same or next higher value of (P+Q)
Example Dim "Y" for a safety gear with a (P+Q) of 4000kg at 2.63 m/sec will be 4.5 mm

### VG-6 SAFETY GEAR USED AS AN UPWARD ACTING BRAKE

**Maximum (P+Q) kg**

<table>
<thead>
<tr>
<th>Dim &quot;Y&quot; (mm)</th>
<th>0.5 m/sec</th>
<th>1 m/sec</th>
<th>1.5 m/sec</th>
<th>2.0 m/sec</th>
<th>2.5 m/sec</th>
<th>3.0 m/sec</th>
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<td>8000</td>
<td>7400</td>
<td>6820</td>
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</table>

The procedure is the same when the safety gear is being used as an upward acting brake.
Example Dim "Y" for a (P+Q) of 8500kg at 1.5 m/sec will be 3.5 mm for upward braking