



perma Automatic Lubrication Systems

perma



Reliable products. Practical lubrication solutions.

perma-tec GmbH & Co (Germany)

Based in Germany, perma-tec GmbH & Co is the global leader in the research, development and manufacturing of automatic, single-point lubricators.

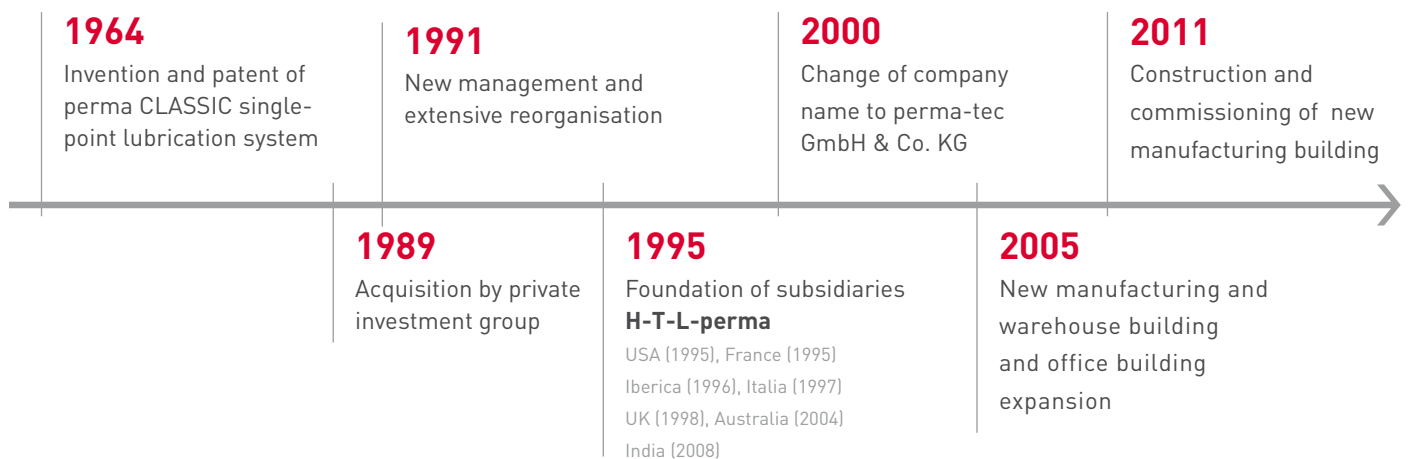
perma lubrication systems can be found in all types of industries and applications around the world. perma-tec has a network of subsidiaries and distribution partners in more than 60 countries.

perma lubrication systems are manufactured in Germany in state-of-the-art facilities. In order to conform to globally accepted manufacturing standards, perma products are continuously tested and inspected. perma-tec has been certified according to DIN EN ISO 9001 since 1997.

HTL perma Australia Pty Ltd

As a wholly owned subsidiary of perma-tec GmbH & Co, HTL perma Australia Pty Ltd has direct access to the Research & Development Centre and Engineering Group in Germany.

HTL perma Australia Pty Ltd responds to the demands of preventative maintenance programs by focusing on service, customised solutions and knowledge sharing. We understand that our products deliver maximum value when combined with robust installation systems, a practical approach to maintenance scheduling and ongoing technical support.



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1

Benefits of Automated Lubrication

1.1. Bearing life extension



Lubrication systems which deliver small volumes of lubricant at short time intervals extend bearing service life and deliver a reliability advantage.

The example below provides a statistical demonstration of a single point lubricator program at work:

A site with 500 perma single-point lubricators*, with an average setting of 3 months, reveals the following statistics.

- 1,946 injections of grease per year to each point.
- An injection of grease, somewhere on site, every 32 seconds.
- 2,667 individual injections per day.
- Almost 1 million individual injections each year.

* For this example perma STAR VARIO L250

perma

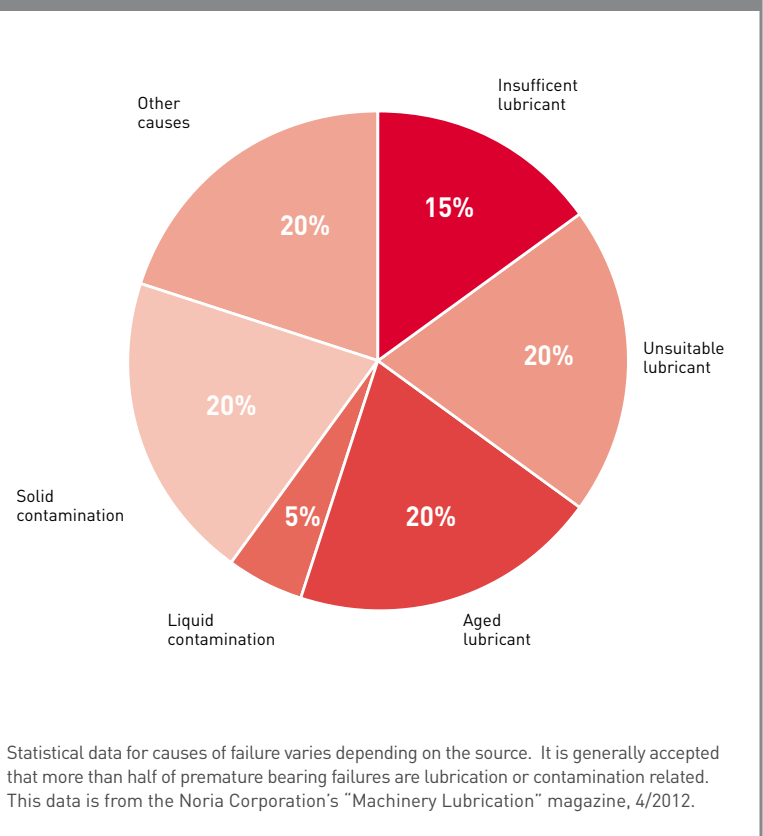
Introduction

To maintain their competitiveness, manufacturing and mining operations must maximise production output while minimising long term operating costs. A key component to achieving this is the implementation of preventative maintenance strategies which extend equipment service life and minimise the downtime required for maintenance, repair and overhaul. Success in this area reduces the total cost of ownership of production assets and ultimately improves business performance.

Cost and downtime due to premature wear is significant. For grease lubricated bearings, well considered lubrication strategies have a dramatic affect on extending bearing service life and therefore reducing costs and improving equipment reliability. The chart opposite provides estimates of the causes of premature bearing failures. Poor lubrication practices and contamination are the major causes.

In recognition of this, industry leading businesses invest in automatic lubrication systems for the purpose of bearing re-lubrication and contaminant exclusion because they deliver superior reliability results compared to manual lubrication.

Causes of rolling element bearing failures



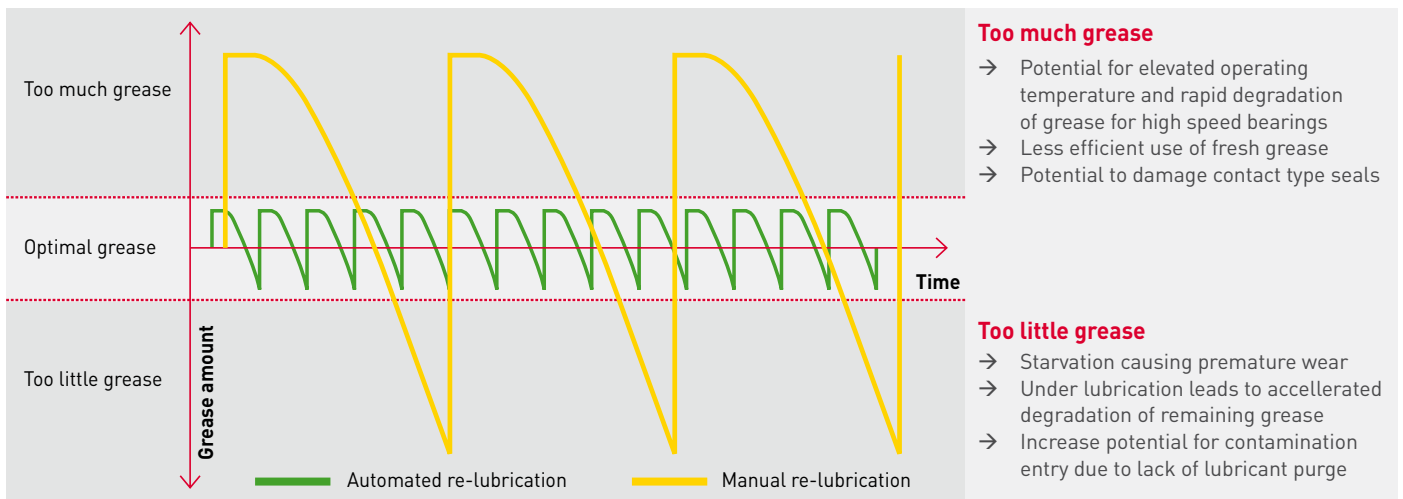
Benefits of short re-lubrication intervals

Bearing re-lubrication addresses the need to maintain sufficient fresh grease around the working components of bearings as they rotate. Insufficient or infrequent re-lubrication leads to the deterioration of lubrication conditions, lubricant starvation and to premature wear. Meanwhile, for high speed bearings, the rapid supply of excessive amounts of grease can cause over-lubrication which leads to degradation of grease condition and therefore also threatens the service life of bearings.

The longest bearing service life is achieved when grease is added in small amounts at short time intervals. When implemented correctly, this regime of grease delivery maintains a steady-state of lubrication protection where over-lubrication and lubricant starvation do not occur.

Factors which act to reduce the service life of the grease include high speeds, elevated operating temperatures, vibration and high loads. When operating conditions such as these prevail, the benefits of delivering small amounts of grease at short time intervals are at their greatest.

The diagram below demonstrates the differences between re-lubrication methods which deliver small amounts of grease at short time intervals and those which deliver large amounts at extended time intervals.



1

Benefits of Automated Lubrication

1.2. Contamination prevention



The contamination of bearings by water and solid particles causes accelerated wear and dramatically reduces bearing service life. Industries which involve the handling of abrasive material suffer the greatest losses as a result of inadequate contamination control procedures and systems. perma automatic lubricators provide a means to achieving a purge of clean grease through bearing seals in order to prevent the entry of water, dirt and dust, and in doing so extend bearing service life.

Preventing contamination in harsh operating environments

When solid or liquid contaminants enter a bearing they cause accelerated wear and the early onset of fatigue. For solid contaminants the rate of wear increases with the size, concentration and hardness of contaminants. Smaller particles lead to abrasive wear whilst larger particles can cause indentation of bearing raceways which later become sites of fatigue related wear. Greasing practices which prevent the ingress of contaminants provide long term financial return by means of longer bearing service life and reduced downtime.

Strategies for preventing contamination vary depending on bearing housing and seal configurations. For bearings with free-purging labyrinth or taconite seals contamination prevention is achieved by delivering a consistent purge of clean grease through the seals. In simple terms, if clean grease is purging out of the seal, contaminants, whether they be solid or liquid, cannot enter the bearing.

Bearings which operate in harsh environments, including high humidity and high levels of liquid or particulate contaminants, demand the strictest attention to regular seal purging. Under such conditions automated purging of seals provides the greatest benefits.

Strategies for the prevention of contamination of bearings

Strategy 1 – Slurry pump seal purging

Automated purging of labyrinth seals provides constant protection against ingress of solids and liquids. For pumps where the wet-end seal is subjected to water spray a higher rate of automated purging is commonly applied to compensate for the elevated rate of grease washout.



Strategy 2 – Conveyor pulley bearing re-lubrication & seal purging

Automated lubrication provides constant protection against the ingress of contaminants. For the example shown bearing re-lubrication and seal purging is provided by a single automatic lubricator.



Strategy 3 – Conveyor pulley bearing seal purging (hybrid solution)

Automated purging of taconite or labyrinth type seals provides constant protection against the ingress of contaminants. Meanwhile, for this solution, bearing re-lubrication is provided manually on a period maintenance cycle. This type of hybrid system can provide a practical balance between automated and manual greasing for large pulley bearings.



1

Benefits of Automated Lubrication

1.3. Safer lubrication



Workplace safety is of ultimate importance. Reliable systems which reduce the interface between people and operating equipment are a key element to reducing the likelihood of workplace accidents.

Automated systems provide a valuable contribution to reducing the likelihood of workplace accidents by significantly reducing the time required to lubricate equipment.

Workplace safety and efficiency improvements

Automated lubrication systems are maintenance tools which make a positive contribution to work place safety and efficiency. This is particularly the case for large operations in hot climates where the physical demands of performing regular manual greasing increase the risk of fatigue and heat exhaustion compared to automated alternatives.

The implementation of automatic lubrication systems does not mean that the frequency of equipment inspections should be reduced. Automated systems save time which can be invested into other tasks such as mechanical inspections, condition monitoring data collection, breather maintenance and oil cleanliness management activities such as a filtration and clarification.

Strategies to improve safety and efficiency:

Strategy 1 – Remote mount lubricators for large electric motors, fans and pumps, which would otherwise be difficult to reach, at safe and easy to reach locations at ground level.

Safety gain – Improve safety via the remote installation of lubricators at safe to access locations to remove the temptation for personnel to step up onto, or climb onto, equipment structures.

Efficiency gain – Save time which would otherwise be required to locate and use safety steps.

Example - Direct mounting of lubricators to the fan bearings shown would require personnel to climb onto the fan structure or use a safety step for lubricator inspection and servicing. The remote mounting solution allows lubricators to be safely handled from ground level.



Strategy 2 – Remote mount lubricators used for conveyor pulley bearings which are located behind cages and avoid unnecessary manual handling of cages.

Safety gain – Improve safety by avoiding the need to lift and handle cages and guards.

Efficiency gain – Save time which would otherwise be required during shuts for permits, isolations, cage removal and cage reinstatement.

Example - The perma FLEX125 lubricators shown are providing consistent grease delivery to the tail pulley bearings of a conveyor.



Strategy 3 – Automatically lubricate equipment which would otherwise require working at heights or confined space permits.

Safety gain – Improve safety by reducing the need to perform work at heights or within confined spaces.

Efficiency gain – Save time which would otherwise be required during shuts for permits, isolations, equipment preparation and other time consuming requirements.

Example - The perma STAR VARIO lubricator shown is lubricating the bearing of a gravity take-up pulley on a conveyor via a 5 meter long remote grease line.





Simple, robust, reliable

By tightening the activating screw the gas generator drops into the electrolyte fluid where it starts an electrochemical reaction that generates gas. The accumulation of gas forces the piston forward in a controlled manner, gradually expelling the lubricant under pressure. The lubricant is continuously injected into the lubrication point. The lubricant cartridge is empty when the piston has reached then end of its allowable travel and becomes visible at the end of the clear cone.

The lubrication period is determined by colour-coded activator screws (type 1, type 3, type 6, or type 12) and the average ambient temperature.

Applications

perma CLASSIC is a single-point lubricator which is suited to a broad range of bearing and chain applications. perma CLASSIC is particularly well suited to low to medium speed bearings in harsh operating environments. For example, the steel body and flexible base make the perma CLASSIC ideal for conveyor pulley bearing lubrication in arduous operating environments such as can be found in the quarry industry.



Product characteristics

Benefits



Colour coded activation system

**Settings:
1, 3, 6 or 12 months**

- Simple and low cost to implement a no-fuss solution.
- Colour coded system to identify time setting which cannot be tampered with or altered once activated.
- Quick start technology which reduces the delay time between activation and the delivery of first grease.



Robust metal body

Impact resistant flexible end cone

- Metal body can withstand knocks and impacts to provide reliable lubrication under the harshest conditions.
- End cone can be flexed approximately 45 degrees and will recover to its original position without damage.
- Additional accessories for lubricator protection is not required.



Pressure build-up to 4 bar allows remote mounting with lines up to 1 meter*

- Provides options for simple remote mounting.
- Can be installed on any angle and is fully dust proof and water proof.

* This is a guide. Limits depend on variables such as line ID, grease type, temperature and the resistance of the lubrication point itself. Extending line lengths delays the delivery of first grease to the lubrication point. Excessive lengths may prevent lubricant delivery altogether.

Technical data

Housing
Metal

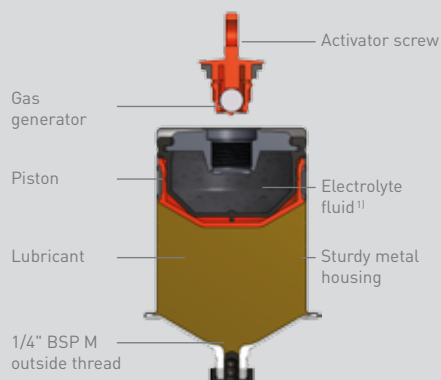
Drive
Gas generating unit

Discharge period at +20 °C with SF01
1, 3, 6 or 12 months

Lubricant volume
120 cm³

Operating temperature
0 °C to +40 °C

Remote installations*
1 meter of 3/8" ID line (grease)



¹¹User friendly citric acid.

Discharge period in months

	1	3	6	12
120 cm ³				
Time period**	1	3	6	12
cc per day	4	1.4	0.7	0.3

** Grease discharge rates are temperature dependent. Rates shown are for an average temperature of 20°C.



For high corrosion, high humidity and high contamination environments

By tightening the activating screw the gas generator drops into the electrolyte fluid where it starts an electrochemical reaction that generates gas. The accumulation of gas forces the piston forward in a controlled manner, gradually expelling the lubricant under pressure. The lubricant is continuously injected into the lubrication point. The progression of the piston can be observed through the transparent body of the lubricator.

The lubrication period is determined by colour-coded activator screws (type 1, type 3, type 6, or type 12) and the average ambient temperature.

Applications

perma FUTURA is a single-point lubricator which is suited to a range of rolling element and plane bearing applications. perma FUTURA is particularly well suited to low to medium speed bearings in wet operating environments. The transparent body of the perma FUTURA allows inspection of the piston position while the integrated support flange provides protection against damage in the event of accidental impacts.



Product characteristics

Benefits



Colour coded activation system

Settings:
1, 3, 6 or 12 months

- Simple and low cost to implement a no-fuss solution.
- Colour coded system to identify time setting which cannot be tampered with or altered once activated.
- Quick start technology which reduces the delay time between activation and the delivery of first grease.



Transparent body

Impact resistant integrated support flange

- Transparent lubricator body is perfectly clear allowing the position of the lubricant piston to be easily inspected.
- Integrated support flange is reinforced with glass and rubber fibres to provide strength while reducing brittleness.
- Additional accessories for lubricator protection are not required.



Pressure build-up to 4 bar allows remote mounting with lines up to 1 meter*

- Provides simple options for remote mounting including beam and cage attachment options.
- Can be installed on any angle and is fully dust proof, corrosion proof and water proof.

* This is a guide. Limits depend on variables such as line ID, grease type, temperature and the resistance of the lubrication point itself. Extending line lengths delays the delivery of first grease to the lubrication point. Excessive lengths may prevent lubricant delivery altogether.

Technical data

Housing
Transparent plastics

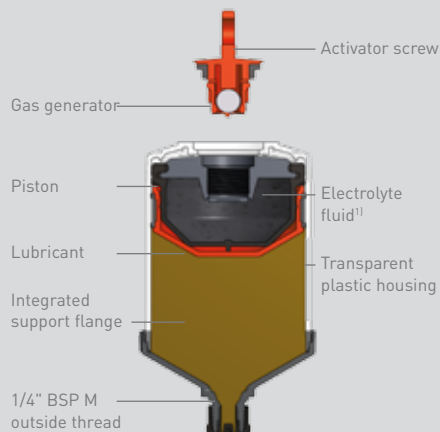
Drive
Gas generating unit

Discharge period at 20 °C with SF01
1, 3, 6 or 12 months

Lubricant volume
120 cm³





Operating temperature
0 °C to +40 °C

Remote installations*
1 meter of 3/8" ID line (grease)



¹⁾User friendly citric acid.

Discharge period in months

				
120 cm ³				
Time period**	1	3	6	12
cc per day	4	1.4	0.7	0.3

** Grease discharge rates are temperature dependent. Rates shown are for an average temperature of 20°C.



Flexible use - even for challenging lubrication points

The automatic lubrication system perma FLEX is available in two convenient sizes (60 cm³ / 125 cm³).

It can be used for inside or outside applications at temperatures ranging from -20 °C to +60 °C. Discharge period setting is flexible and can be adjusted from 1 to 12 months using the dial on top of the lubricator.

perma FLEX comes fully assembled and ready-to-use. Simply turn the dial to the desired discharge period and the system is activated. The electronically controlled chemical reaction will build up the pressure that is necessary to continually supply the lubrication point with fresh lubricant.

Applications

perma FLEX is suited to a broad range of rolling element and plane bearing applications and can also be filled with oil for the purpose of chain lubrication. The dial activation system is simple to use and allows a single product to be used where multiple products might otherwise be required. The dial system also allows the time setting to be adjusted during operation if necessary. If required the lubricator can be turned off during extended periods of downtime. perma FLEX is IP68 rated meaning that it is dust tight and water proof.



Product characteristics

Benefits



Dial activation system

Settings:
1, 2, 3, ...12 months for
60 & 125 cm³ sizes

- Variable time setting options reduces compromise relating to selection of lubricant dispensing rates.
- If required, the time setting can be altered during service and the lubricator can be stopped and started again.



Transparent body

Slimline design

- Transparent lubricator body is perfectly clear allowing the position of the lubricant piston to be easily inspected.
- Slimline design minimises the space required for installation.



Pressure build-up to 5 bar allows remote mounting with lines up to 2 meters*

Intrinsically safe

- Provides simple options for remote mounting including beam and cage attachment options.
- Certified under IECEx for use in Zone I areas. Contact perma for further information.

* This is a guide. Limits depend on variables such as line ID, grease type, temperature and the resistance of the lubrication point itself. Extending line lengths delays the delivery of first grease to the lubrication point. Excessive lengths may prevent lubricant delivery altogether.

Technical data

Housing
Transparent plastics

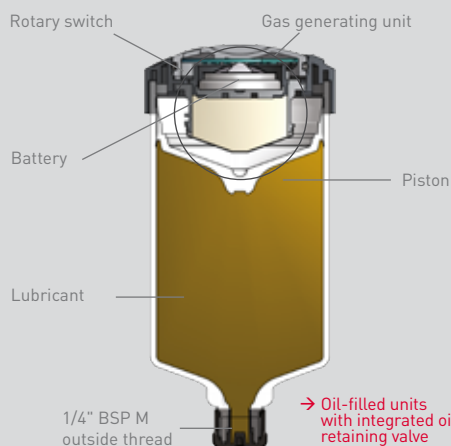
Drive
Gas generating unit

Discharge period at 20 °C with SF01
1, 2, 3, ..., 12 months

Lubricant volume
60 cm³ and 125 cm³

Operating temperature range
-20 °C to +60 °C

Remote installations*
2 meters of 3/8" ID line (grease)



Rotary switch for discharge period setting





For applications with high variations in temperature

perma NOVA can be used for applications that are within a temperature range of $-20\text{ }^{\circ}\text{C}$ up to $+60\text{ }^{\circ}\text{C}$. A discharge period of 1 to 12 months can be easily programmed by pushing the selection button on the NOVA control unit. A temperature sensor regularly measures the ambient temperature and the control unit calculates the required gas generation based on this data. This ensures a continuous and controlled discharge. perma NOVA consists of a reusable control unit, a lubricant canister filled with 130 cm^3 of lubricant and a protection cover.

Applications

perma NOVA is especially well suited to the lubrication of bearings on equipment where there is considerable variation in ambient temperature or where intrinsic safety is required, such is often the case in the oil and gas industries. The re-usable Control unit contains a temperature sensor which allows the behaviour of the lubricator to automatically adjust to the operating conditions. The perma NOVA is IP65 rated meaning that it is dust tight and protected against water jets.



Product characteristics

Benefits



LCD display with push button
Settings:
1, 2, 3, ...12 months for
65 & 125 cm³ sizes
 with automatic temperature compensation

- Variable time setting options reduces compromise relating to selection of lubricant dispensing rates.
- Control unit constantly monitors temperature. Temperature measurements are used to alter gas generation rates in order to provide accurate lubricant dispensing across a broad range of temperatures.



Transparent body
Slimline design

- Transparent lubricator body is perfectly clear allowing the position of the lubricant piston to be easily inspected.
- Slimline design minimises the space required for installation.



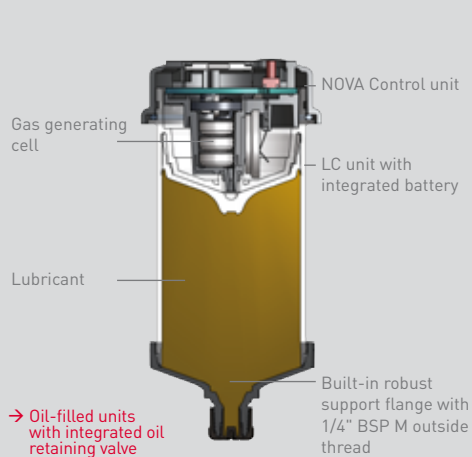
Pressure build-up to 6 bar allows remote mounting with lines up to 2 meters*
Intrinsically safe

- Provides simple options for remote mounting including beam and cage attachment options.
- Certified under IECEx and ANZEx for use in Zone I areas. Contact perma for further information.

* This is a guide. Limits depend on variables such as line ID, grease type, temperature and the resistance of the lubrication point itself. Extending line lengths delays the delivery of first grease to the lubrication point. Excessive lengths may prevent lubricant delivery altogether.

Technical data

Housing
Transparent plastic
 Drive - reusable
Gas generating unit
 Discharge period
1, 2, 3... through to 12 months
 Lubricant volume
130 cm³
 Operating temperature
-20 °C to +60 °C
 Protection class
IP 65
 Remote installations*
2 meters of 3/8" ID line (grease)



Products

2.5. perma STAR VARIO



Electro-mechanical, variable time settings, temperature independent

perma STAR VARIO consists of a reusable electro-mechanical drive unit and a single-use lubricant cartridge. Because the lubricator is mechanically driven the dispensing rate is independent of ambient temperature and back pressure*. Inspection of the perma STAR VARIO is made easy via the combination of the transparent lubricant cartridge, a flashing LED alert system and an LCD display screen which communicates the status of the lubricator to maintenance personnel.

The label of the lubricant cartridge includes allocated spaces for recording the date of installation and the date of next service. The label also confirms the % of grease remaining. These features support responsible lubricator management.

*Total resistance to grease flow must be less than the pressure delivery capability of the lubricator. Note that for the previous model of the perma STAR VARIO the guideline for maximum grease line length was 3 meters.

Applications

perma STAR VARIO is a single-point, automatic lubricator which is suited to a broad range of bearing and chain applications. perma STAR VARIO is ideal for applications which demand precise grease delivery or for operating environments which include significant temperature fluctuations. The remote installation kits for perma STAR VARIO provide practical solutions for lubricators to be installed at safe and easy to reach locations.



Product characteristics

Benefits



LCD display with push button shows discharge period, LC size and operating status

Setting:
1, 2, 3, ... 12 months & LC three sizes

- Simple to navigate menu with LCD display makes the system easy to set.
- Broad range of setting options reduces compromise when selecting lubricant dispensing rates and provides greater flexibility for service planning.
- System can be turned off for extended equipment shut downs.



Electromechanical, reusable drive unit

All around visible LED lights signal function and errors

- Precise lubricant dispensing which is independent of temperature and back pressure*.
- Simple to inspect via the combination of the flashing LED system, LCD display and transparent lubricant cartridge.



Pressure build-up to 6 bar allows remote mounting with lines up to 5 meters*

Purge function

- Extensive options for remote mounting lubricators at safe to access locations.
- Remote mounting reduces the dependence on time during maintenance shutdowns for lubricator servicing and reduces the requirement to perform time consuming equipment isolations.

Technical data

Drive - reusable
Electromechanical

Power supply
STAR VARIO Battery pack 4.5 V

Discharge period
1, 2, 3, ... 12 months

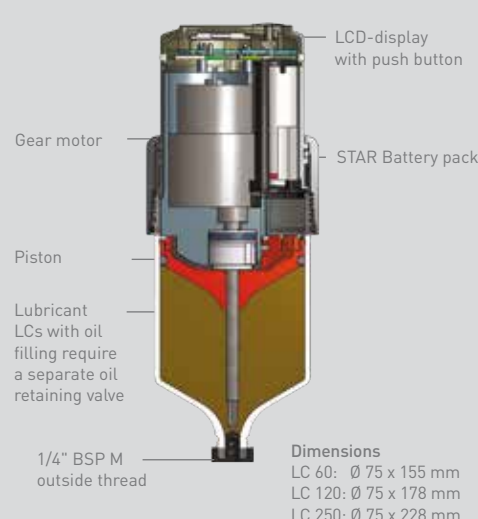
Lubricant volume
60 cm³, 120 cm³ or 250 cm³

Operating temperature
-10 °C to +60 °C

Protection class
IP 65

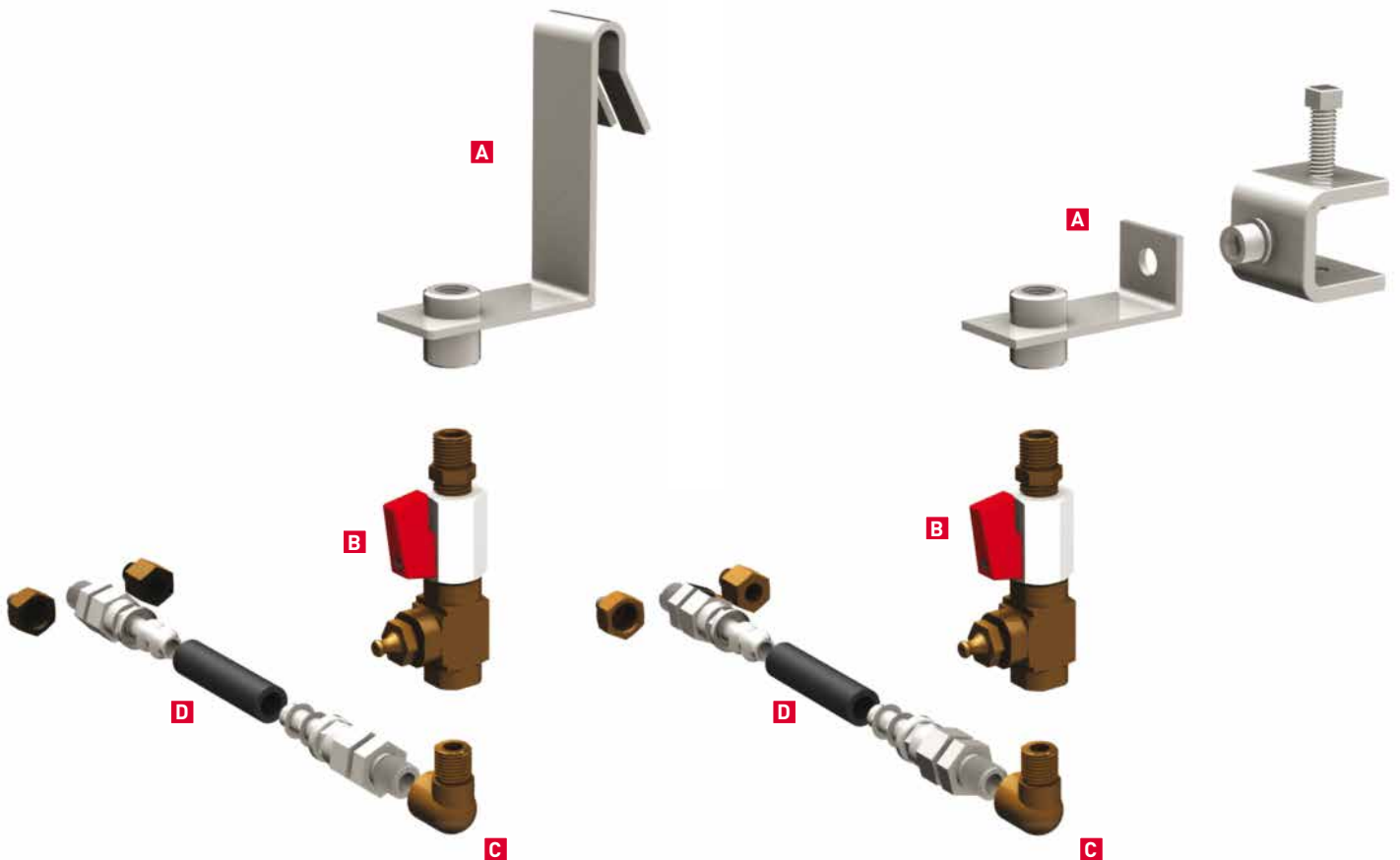
Standard & special lubricants
Oil / Grease up to NLGI2

Remote installations*
5 meters of 3/8" ID line (grease)



3

Remote Installation Kits for Gas Type Lubricators



A. Stainless steel bracket

Compact stainless steel brackets are available which can be easily attached to square cage mesh using a hook attachment design or to beam sections using beam clamps.

B. Manual purge point

Used for convenient additions of supplementary grease, line purging and grease blockage clearing.

C. Elbows

Elbow fittings are full bore with 1/4" BSP threads.

D. Heavy duty hose

Quality Duffield brand manufactured in Germany. Supplied with 3/8" internal diameter and easy to use push-lock type swivel hose ends.

Quality installations are essential to the implementation of lubrication programs which will stand the test of time. Care taken to "get it right" during implementation will ensure long-term lubricator reliability and sets the foundation for a robust maintenance solution.

Introduction

Direct mounting of gas type lubricators is preferred as this presents maximum grease pressure to the lubrication point. However, where safe access requirements dictate that lubricators be remote mounted the 1 and 2-point kits detailed below provide simple and robust installation options.

What is included in installation kits for gas type lubricators?

The list below summarises the components included in remote installation kits for gas type lubricators. Meanwhile, the images opposite provide diagrammatic examples of the components – the examples shown are for K1CHS50 and K130S50.

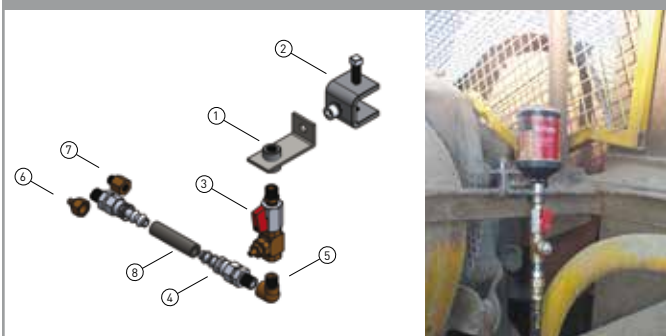
- Stainless steel bracket & attachment option
- Manual purge points (one per point)
- Grease line (1 meter per point)
- Push lock, swivel hose ends 1/4" BSP male (2 per point)
- Elbows 90°C full bore 1/4" BSP (one per point)
- Adaptors 1/4" BSP female to 1/4" BSP male (one per point)
- Reducers 1/4" BSP female to 1/8" BSP male (one per point)
- Spiral wrap (0.5 meter per kit)

Kit options

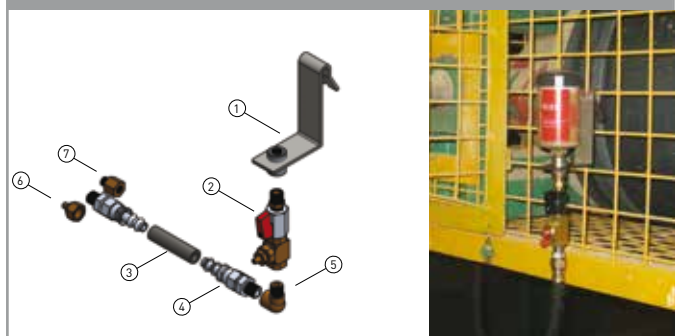
Kit Part #	Description
K130S50	Kit SS 1 point BC30 0.5m hose with fittings
K130S100	Kit SS 1 point BC30 1.0m hose with fittings
K230G	Kit SS 2 point BC30 1.0m hose per point with fittings

Kit Part #	Description
K1CHS50	Kit SS 1 point cage 0.5m hose with fittings
K1CHS100	Kit SS 1 point cage 1.0m hose with fittings
K2CHG	Kit SS 2 point cage 1.0m hose per point with fittings

Example installation kit contents – K130S100



Example installation kit contents – K1CHS100



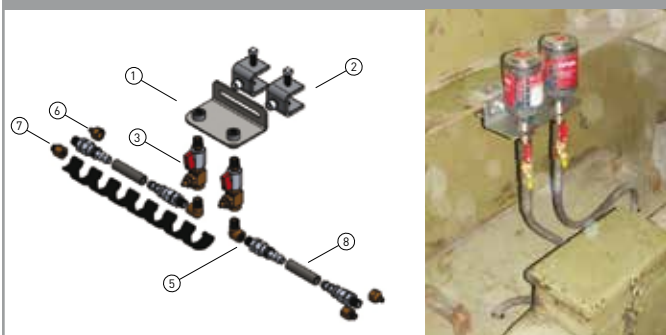
Bill of Materials

1	1 x 1 point bracket	5	1 x 90 degree elbow
2	1 x 30mm S/S beam clamp	6	1 x 1/4" BSPF-1/8" BSPM reducer
3	1 x Manual purge kit	7	1 x 1/4" BSPF-1/8" BSPM ext.
4	2 x Female swivel hose ends	8	1.0m of 3/8" ID grease line

Bill of Materials

1	1 x 1 point cage bracket	5	1 x 90 degree elbow
2	1 x Manual purge kit	6	1 x 1/4" BSPF-1/8" BSPM reducer
3	1.0m of 3/8" ID grease line	7	1 x 1/4" BSPF-1/8" BSPM ext.
4	2 x Female swivel hose ends		

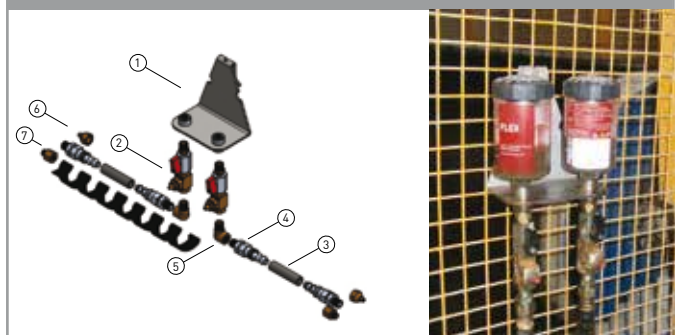
Example installation kit contents – K230G



Bill of Materials

1	1 x 2 point bracket	5	2 x 90 degree elbows
2	2 x 30mm S/S beam clamps	6	2 x 1/4" BSPF-1/8" BSPM reducers
3	2 x Manual purge kits	7	2 x 1/4" BSPF-1/8" BSPM ext.
4	4 x Female swivel hose ends	8	2m of 3/8" ID grease line

Example installation kit contents – K2CHG



Bill of Materials

1	1 x 2 point cage bracket	5	2 x 90 degree elbows
2	2 x Manual purge kits	6	2 x 1/4" BSPF-1/8" BSPM reducers
3	2m of 3/8" ID grease line	7	2 x 1/4" BSPF-1/8" BSPM ext.
4	4 x Female swivel hose ends		

4

Remote Installation Kits for perma STAR VARIO

4.1. Introduction

A. Full length protection covers

Covers to protect lubricators from solid and liquid contaminants.

B. Manual purge point

Used for convenient additions of supplementary grease, line purging and grease blockage clearing.

C. Elbows

Elbow fittings are full bore with 1/4" BSP threads.



D. Stainless steel bracket

There are two main categories of brackets – Standard Duty and Heavy Duty. The example shown here is the Heavy Duty C-section design which provides complete protection to lubricators.

E. Stainless steel beam clamps

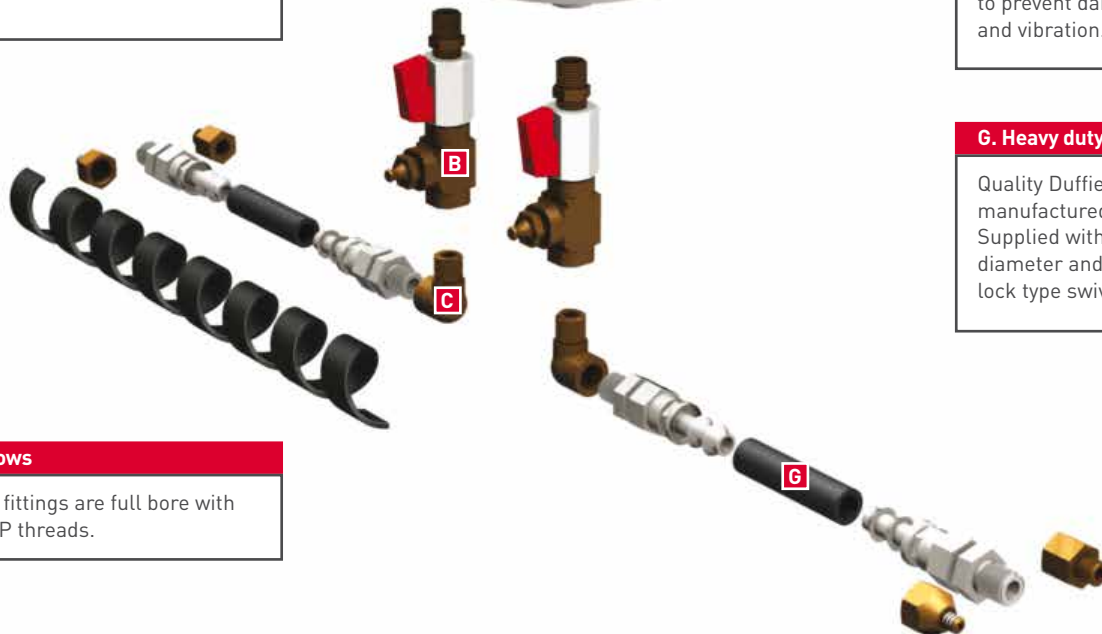
Simple to use beam clamps supplied with case hardened cup head set screws and stainless steel assembly screws.

F. Support flanges

Provide support to lubricators to prevent damage from impacts and vibration.

G. Heavy duty hose

Quality Duffield brand manufactured in Germany. Supplied with 3/8" internal diameter and easy to use push-lock type swivel hose ends.



Quality installations are essential to the implementation of lubrication programs which will stand the test of time. Care taken to "get it right" during implementation will ensure long-term lubricator reliability and sets the foundation for a robust maintenance solution.

Introduction

A comprehensive range of remote installation kits is available for the perma STAR VARIO. Available in 1, 2, 3 and 4 point configurations, the kits are designed to be simple to implement and to provide long term durability.

The brackets included in the kits are fabricated from stainless steel and are secured to beam sections, cage mesh or round rails using simple attachment methods. Installations can be completed quickly, without the need for power tools or hot work.

What is included in installation kits for perma STAR VARIO?

The list below summarise the components included in perma STAR VARIO remote installation kits. Meanwhile, the image opposite provides an diagrammatic example of the components – the example shown has the part number K265C.

- Stainless steel bracket
- Attachment option (beam clamps, cage hooks or U-bolts)
- Manual purge points (one per point)
- Lubricator support flanges (one per point)
- Full length PVC covers (one per point)
- Grease line (2 meters per point)
- Push lock, swivel hose ends with adaptor to 1/4" BSP male (2 per point)
- Spiral wrap (0.5 meter per kit)
- Adaptors 1/4" BSP female to 1/4" BSP male (one per point)
- Reducers 1/4" BSP female to 1/8" BSP male (one per point)
- Elbows 90°C full bore 1/4" BSP (one per point)

Bracket types – Standard Duty & Heavy Duty

There are two main categories of brackets: Standard Duty and Heavy Duty. Both categories include stainless steel construction, 1/4" BSP female sockets and laser cut profiles to minimise contamination build-up. Heavy Duty brackets also feature a C-section design which provides a robust holding system for the lubricator covers.

The C-section design is especially suited to installations which are to be subjected to water wash down, as would be anticipated for applications such as slurry pumps in coal preparation plants. This design also provides greater mounting flexibility due to the 4-slot design of the bracket mounting face.

The images of 2-point brackets shown demonstrate the differences between Standard Duty and Heavy Duty designs.

Standard Duty	Heavy Duty
	
Suited to operating environments with high levels of dry contaminants such as ore, dirt and dust.	Suited to operating environments with high levels of wet and dry contaminants and where regular wash down is likely.

Custom designs

Brackets and installation kits can be customised to meet the specific needs of different equipment configurations, lubrication strategies and mounting requirements. Customised solutions include manifold brackets, customised brackets to suit specific equipment or mounting needs, inclusion of pre-assembled & pre-filled grease lines and the inclusion of specific fittings.

Manifold design example

For applications where higher grease rates are required or when the rationalisation of lubricator time settings is important.

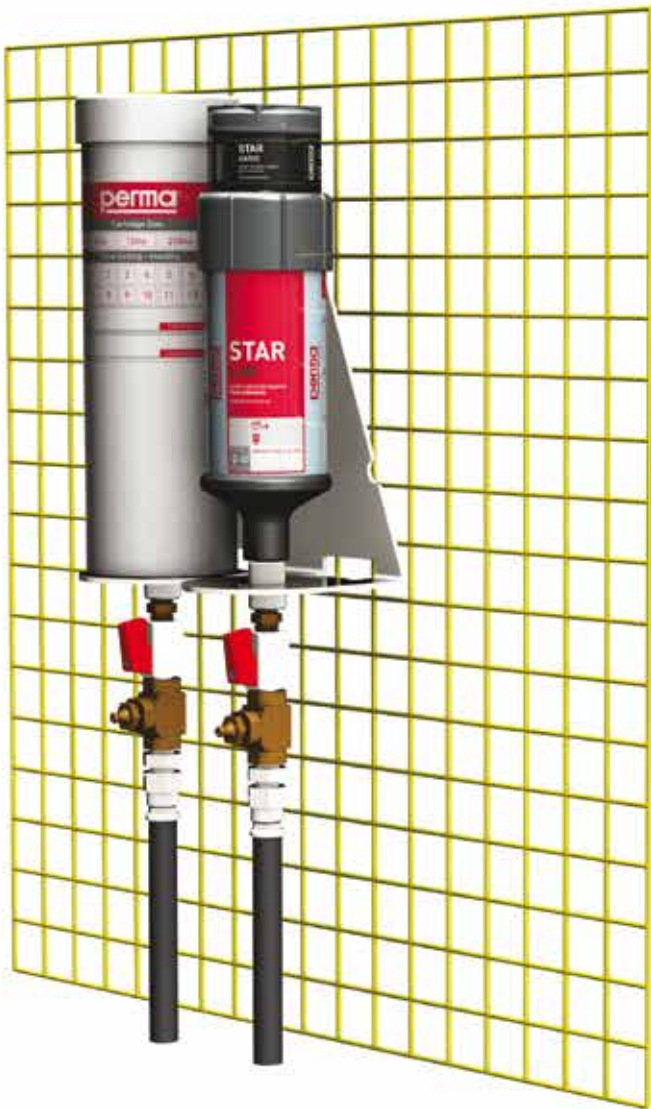
Example: K230J



4

perma STAR VARIO Installation Kits

4.2. Standard Duty kits



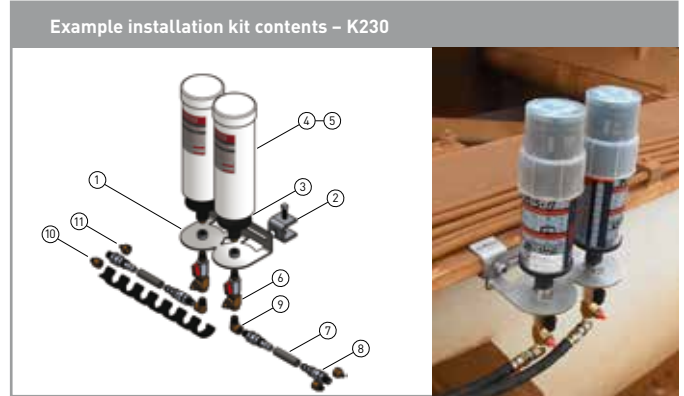
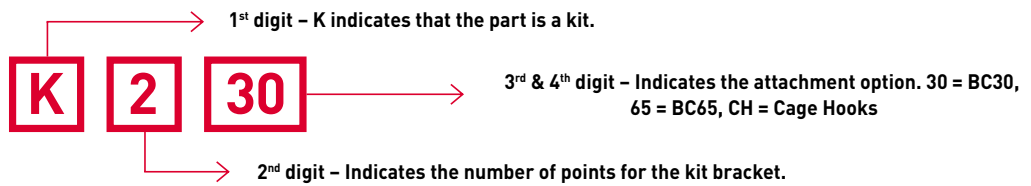
Standard Duty installation kits are highly versatile and can be adapted for attachment to beam sections or square mesh safety cages. The brackets included in Standard Duty kits are fabricated in Australia from stainless steel.

Standard Duty kits include lubricator covers and manual purge kits for each lubrication point along with a range of commonly required fittings, push-lock swivel hose ends and high quality Duffield brand hose with 3/8" internal diameter.

Standard Duty beam mount

The range of Standard Duty kits with beam clamps includes options for 1, 2, 3 or 4 points. Beam clamp options include 30mm and 65mm sizes, as indicated by the 3rd and 4th digits of the product part number – **30** for 30mm clamps and **65** for 65mm clamps.

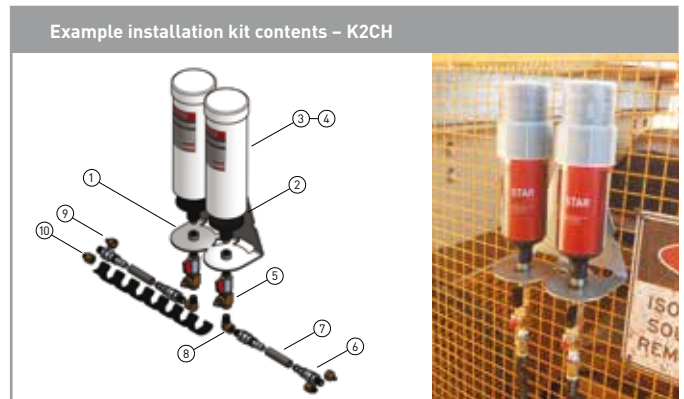
Kit part number
example – K230



Bill of Materials			
1	1 x 2 point standard duty bracket	7	4m of 3/8" ID grease line
2	2 x 30mm S/S beam clamps	8	4 x Female swivel hose ends
3	2 x Lubricator support flanges	9	2 x 90 degree elbows
4	2 x PVC lubricator covers	10	2 x 1/4" BSPF-1/8" BSPM reducers
5	2 x Clear wet caps	11	2 x 1/4" BSPF -1/4" BSPM ext.
6	2 x Manual purge kits		

Standard Duty cage mount

The range of Standard Duty installation kits with cage hooks are suited to square cage down to a mesh size of 25 x 25mm. Installation kits are available for 1, 2, 3 or 4 points as summarised below. **CH** as the 3rd and 4th digits of the product part number indicates the inclusion of cage hook.

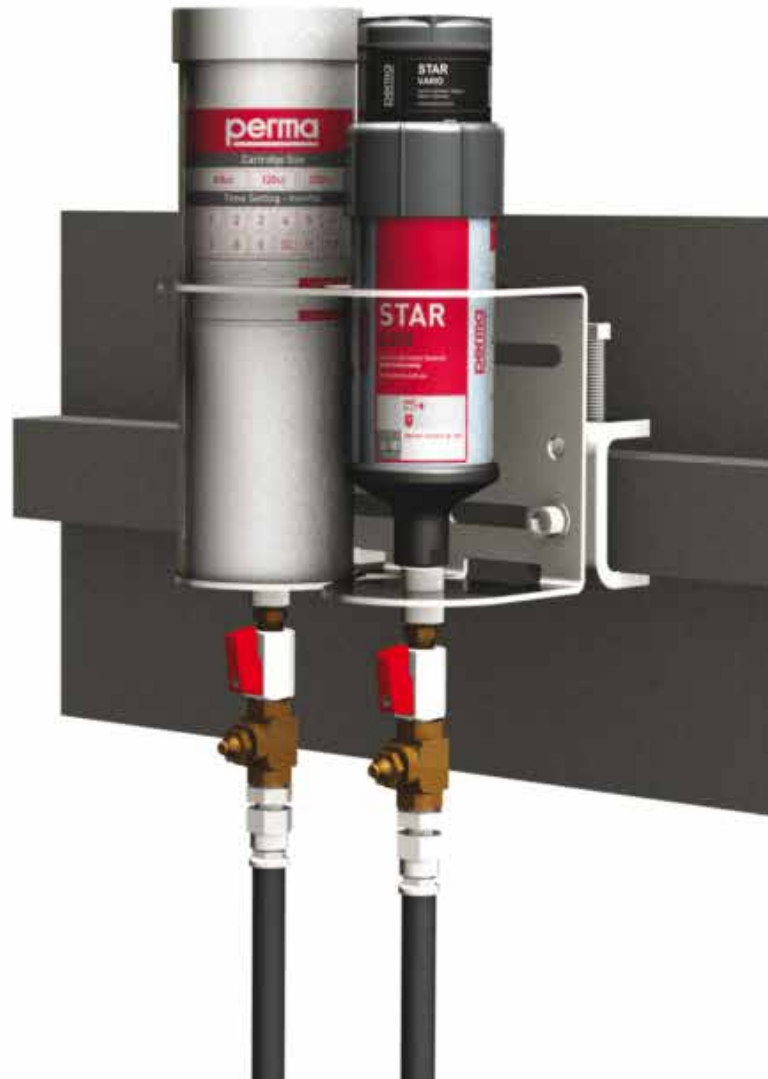


Bill of Materials			
1	1 x 2 point standard duty bracket	7	4 x Female swivel hose ends
2	2 x Lubricator support flanges	8	2 x 90 degree elbows
3	2 x PVC lubricator covers	9	2 x 1/4" BSPF-1/8" BSPM reducers
4	2 x Clear wet caps	10	2 x 1/4" BSPF -1/4" BSPM ext.
5	2 x Manual purge kits		
6	4m of 3/8" ID grease line		

4

perma STAR VARIO Installation Kits

4.3. Heavy duty kits



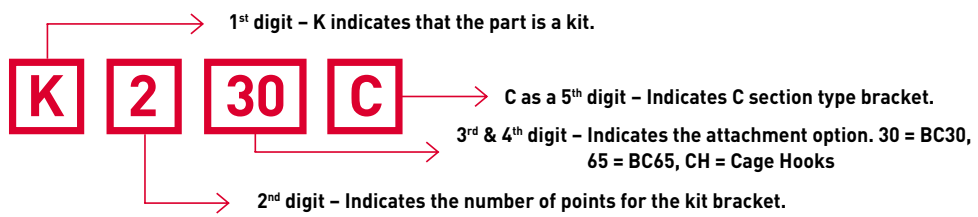
Heavy Duty installation kits have been specifically designed for use in operational areas which are subject to regular wash down and water impact, such as the conditions found in coal handling preparation plants. The installation kits are highly versatile and can be adapted for attachment to beam sections and square mesh safety cages. The bracket systems included in Heavy Duty installation kits are fabricated in Australia from stainless steel.

Heavy Duty installation kits include lubricator covers and manual purge kits for each lubrication point along with a range of commonly required fittings, push-lock swivel hose ends and high quality Duffield brand hose with 3/8" internal diameter.

Heavy Duty beam mount

The range of Heavy Duty kits with beam clamps includes options for 1, 2, 3 or 4 points. Beam clamp options include 30mm and 65mm sizes, as indicated by the 3rd and 4th digits of the product part number – **30** for 30mm clamps and **65** for 65mm clamps. The inclusion of **C** at the end of the part number indicates the use of C-section brackets.

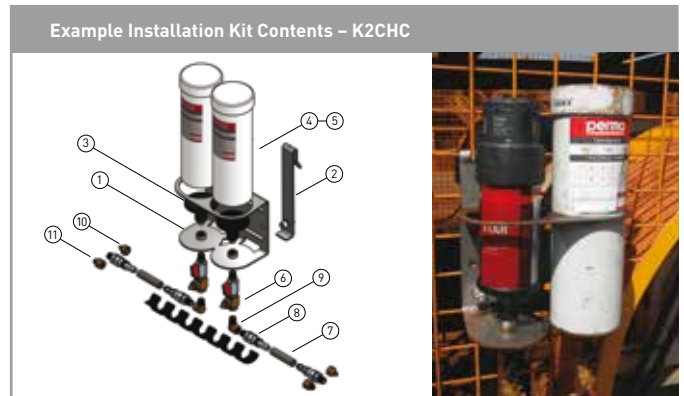
Kit part number example – K230C



Bill of Materials			
1	1 x 2 point heavy duty bracket	7	4m of 3/8" ID grease line
2	2 x 30mm S/S beam clamps	8	4 x Female swivel hose ends
3	2 x Lubricator support flanges	9	2 x 90 degree elbows
4	2 x PVC lubricator covers	10	2 x 1/4" BSPF-1/8" BSPM reducers
5	2 x Clear wet caps	11	2 x 1/4" BSPF -1/4" BSPM ext.
6	2 x Manual purge kits		

Heavy Duty cage mount

The range of Heavy Duty installation kits with cage hooks are suited to square cage down to a mesh size of 25 x 25mm. Installation kits are available for 1, 2, 3 or 4 points. **CH** as the 3rd and 4th digits of the product part number indicates the inclusion of cage hook. The inclusion of **C** at the end of the part number indicates the use of C-section brackets.



Bill of Materials			
1	1 x 2 point heavy duty bracket	7	4m of 3/8" ID grease line
2	1 x cage hook arm set	8	4 x Female swivel hose ends
3	2 x Lubricator support flanges	9	2 x 90 degree elbows
4	2 x PVC lubricator covers	10	2 x 1/4" BSPF-1/8" BSPM reducers
5	2 x Clear wet caps	11	2 x 1/4" BSPF -1/4" BSPM ext.
6	2 x Manual purge kits		



Year by year, improvements to safe work practices and increased production demands lead to an increasing requirement to remote mount automatic lubricators. Correct remote mounting practices require that simple, yet important guidelines be followed:

- A** - Locate lubricators where they can be safely and easily accessed while equipment is operating
- B** - Select stainless steel brackets which can be easily removed if required for maintenance access
- C** - Include manual purge points to provide an efficient means of occasional manual purging
- D** - Use only full bore elbow fittings
- E** - Use 3/8" internal diameter grease line and run lines under or around cages

Remote installation decision making

For many lubrication points it is advantageous to remote mount lubricators at locations which are safe to access while machinery is operating. The questions in the table below can be used to help guide remote mounting decisions. An answer of "yes" to any of the questions indicates that remote mounting is likely to be required.

Question	Answer
1. Is it necessary to remove protective guards or safety cages to access the lubrication point?	Yes – remote mount No – direct mount
2. Is it difficult or unsafe to access the lubrication point while equipment is running?	Yes – remote mount No – direct mount
3. Is the lubrication point subject to severe vibration or high temperatures which may damage the lubricator?	Yes – remote mount No – direct mount
4. Is it necessary to get permits to access lubrication points such as those in confined spaces or located at heights?	Yes – remote mount No – direct mount
5. Is the lubrication point exposed to excessive amounts of water, process materials or impact from solid material?	Yes – remote mount No – direct mount

Remote mounting for gas type lubricators



* This is a guide. Limits depend on variables such as line ID, grease type, temperature and the resistance of the lubrication point itself. Extending line lengths delays the delivery of first grease to the lubrication point. Excessive lengths may prevent lubricant delivery altogether.

- Select grease line with **3/8" internal diameter**
- Restrict the maximum grease line to a length of **1 meter** for CLASSIC & FUTURA and **2 meters** for FLEX & NOVA*
- Select full bore hose end fittings and elbows
- Select stainless steel bracket and locate at a safe point of access
- Route grease lines under or around cage mesh, not through
- Prime grease lines and fittings
- Test the grease delivery path to the lubrication point after priming to ensure that back pressure is not excessive

Remote mounting for perma STAR VARIO



** This is a guide. Limits depend on variables such as line ID, grease type, temperature and the resistance of the lubrication point itself. Contact your perma supplier for further information.

- Select grease line with **3/8" internal diameter**
- Restrict the maximum grease line to a length of **5 meters****
- Select full bore hose end fittings and elbows
- Select stainless steel bracket and locate at a safe point of access
- Route grease lines under or around cage mesh, not through
- Prime grease lines and fittings
- Test the grease delivery path to the lubrication point after priming to ensure that back pressure is not excessive

6

Common Equipment & Applications

6.1. Slurry pumps



Slurry pumps used in operations such as coal preparation plants and other wet-plant operations must endure harsh conditions. Efforts to prevent the entry of water and solid contaminants to pump barrels will extend bearing service lives.

The use of automatic lubrication systems to provide a regular purge of fresh grease through the labyrinth seals of pump barrels is a common and proven method of preventing contaminant entry. As the harshness of the operating conditions increases, so too does the importance of the automatic purging.

Pumps which are subjected to regular wash down or which have water impingement to the wet-end labyrinth demand higher labyrinth purge rates.

In addition to seal purging, automatic systems can also be implemented for bearing re-lubrication in order to provide precise and controlled grease delivery, thereby avoiding grease starvation and over lubrication.

Lubrication assessment criteria

For slurry pump lubrication the following factors are generally assessed in order to develop the lubrication solution:

- Pump manufacturer's recommendations
- Seal types
- Bearing types, grease entry points and grease migration directions
- Characteristics of proposed lubricant
- Typical bearing operating temperatures
- Duty cycle
- Historical lubrication practices
- Desired service schedule
- Operating conditions
- Wash down procedures
- Requirements for safe access

Installation examples



Application Horizontal slurry pump labyrinth seals
Lubricator perma FUTURA
Installation kit Direct mount



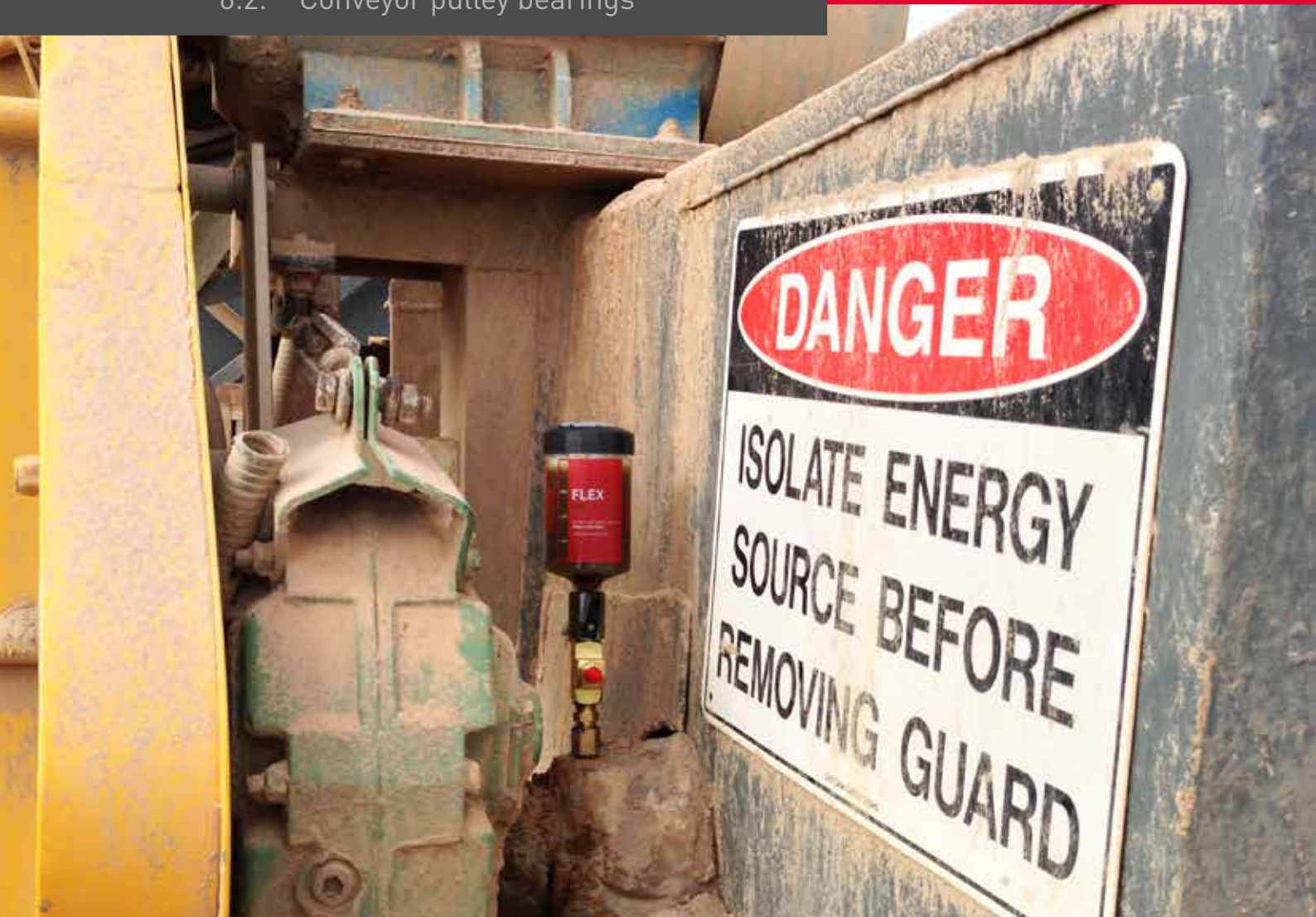
Application Horizontal slurry pump labyrinth seals
Lubricator perma FLEX125
Installation kit Direct mount



Application Slurry pump labyrinth seals & bearings
Lubricator perma STAR VARIO L250
Installation kit K230C



Application Horizontal slurry pump labyrinth seals and gland seal
Lubricator perma STAR VARIO L250
Installation kit K365C



Pulley bearing configurations can vary considerably and as such lubrication programs must be designed to take the specific requirements of different bearing and seal combinations into account. Overall, for typical spherical roller bearings with labyrinth or taconite seals, the lubrication strategy must address two requirements:

- 1) The re-lubrication of the bearing rolling elements to prevent lubricant starvation and;
- 2) The regular purging of seals to prevent the entry of contaminants.

During the implementation of perma STAR VARIO lubrication solutions it is important to address the following items:

- Ensure that the bearing housing is correctly pre-packed with grease. For bearings with free purging seals, purging until fresh grease is observed around the full circumference of the seal ensures against contaminant entry.
- Ensure that the optimal grease entry point on the housing is chosen for bearing re-lubrication in order to achieve a grease flow path which will provide efficient grease exchange.
- Ensure that seals have been fully purged while the bearing is in operation so that the full circumference of the seal is filled with fresh grease. After installation it is the function of the automatic lubricator to continually maintain fresh grease purge.

Lubrication assessment criteria

For conveyor pulley bearing lubrication the following factors are generally assessed in order to develop the lubrication solution:

- Bearing types & speeds
- Seal types
- Location of grease entry points on bearing housings
- Characteristics of proposed lubricant
- Operating conditions
- Historical lubrication practices
- Requirements for safe access
- Desired service schedule

Installation examples



Application Conveyor pulley bearing
Lubricator perma FLEX125
Installation kit Direct mount



Application Conveyor pulley bearing
Lubricator perma FLEX
Installation kit K2CHG



Application Conveyor pulley bearing and seal
Lubricator perma STAR VARIO L250
Installation kit K230



Application Conveyor pulley bearing and seal
Lubricator perma STAR VARIO L250
Installation kit K3CHC

Common Equipment & Applications

6.3. Electric motors



Electric motor bearing re-lubrication is a critical aspect of maintenance. As with other high speed bearing applications, it is important for re-lubrication practices to take the risks associated with over-lubrication into account while providing sufficient re-lubrication to deliver long bearing service life.

The combination of the following practices can provide a lubrication program which avoids over-lubrication and lubricant starvation:

- Add small amounts of grease at short time intervals using an automatic lubricator which provides accurate dispensing rates, independent of temperature.
- Re-lubricate when the motor is in operation.
- Always ensure that spent grease can escape the bearing housing via well maintained grease escape holes or collection traps.
- Do not use powered grease guns.

Lubrication assessment criteria

For electric motor lubrication the following factors are generally assessed in order to develop the lubrication solution:

- Motor manufacturer's recommendations
- Motor speed
- Grease trap / escape port design, access and condition
- Bearing types
- Characteristics of proposed lubricant
- Historical lubrication practices
- Duty cycle
- Motor orientation (vertical or horizontal)

Installation examples



Application Electric motor
Lubricator perma FLEX125
Installation kit Direct mount



Application Electric motor
Lubricator perma NOVA130
Installation kit Direct mount



Application Electric motor
Lubricator perma STAR VARIO L250
Installation kit K230C



Application Electric motor
Lubricator perma STAR VARIO M120
Installation kit Direct mount



Fan support bearings require particular attention when devising a lubrication strategy. Because a broad range of bearing types can be employed it is important to understand the bearing and seal types before proceeding. This information is critical in order to understand the optimal grease delivery points, grease flow paths, the requirements for efficient grease exchange and the point(s) of grease exit from bearing housings.

During the implementation of perma STAR VARIO it is important to address the following items:

- Ensure that the bearing housing is correctly packed with grease in order to ensure efficient grease exchange. This is especially important for bearing types which must be re-lubricated from the side, rather than via a central re-lubrication groove.
- Where contact seals which are not free purging are in use, such as double lip seals, ensure that a suitable point for grease relief is introduced to the housing in order to avoid over-lubrication.
- Consider the use of high performance greases which can withstand the high rate of mechanical work which is applied by high speed rolling element bearings such as spherical roller bearings.

Lubrication assessment criteria

For fan lubrication the following factors are generally assessed in order to develop the lubrication solution:

- Bearing types & speeds
- Seal types
- Grease entry points and grease migration directions
- Typical bearing operating temperatures
- Characteristics of proposed lubricant
- Historical lubrication practices
- Operating conditions
- Requirements for safe access
- Desired service schedule

Installation examples



Application Fan support bearings
Lubricator perma FLEX125
Installation kit Direct mount



Application Fan support bearings
Lubricator perma STAR VARIO M120
Installation kit Direct mount



Application Fan support bearings
Lubricator perma STAR VARIO L250
Installation kit K230



Application Fan support bearings
Lubricator perma STAR VARIO L250
Installation kit K330

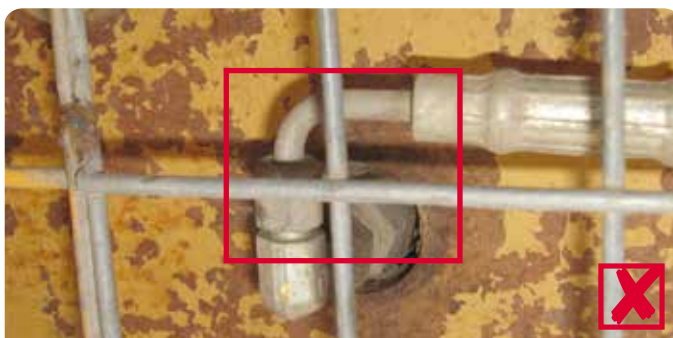


Minimising the pressure loss between single point lubricators and lubrication points is an important factor for achieving long term, reliable lubricant delivery. The range of accessories available from perma have been carefully selected to ensure that pressure losses are minimised and that installations will stand the test of time in harsh operating environments.

Adaptors, elbows, extensions, grease lines & general

perma STAR VARIO lubricators have a 1/4 " BSP male thread at the grease outlet. Where reducers, elbows or extension are required to facilitate installation it is important to adhere to the following guidelines:

- When using reducing adaptors down to fine threads such as 6mm metric or 1/4 " UNF select stainless steel to avoid breakage.
- Minimise the number of elbow fittings.
- Always select full bore elbows.



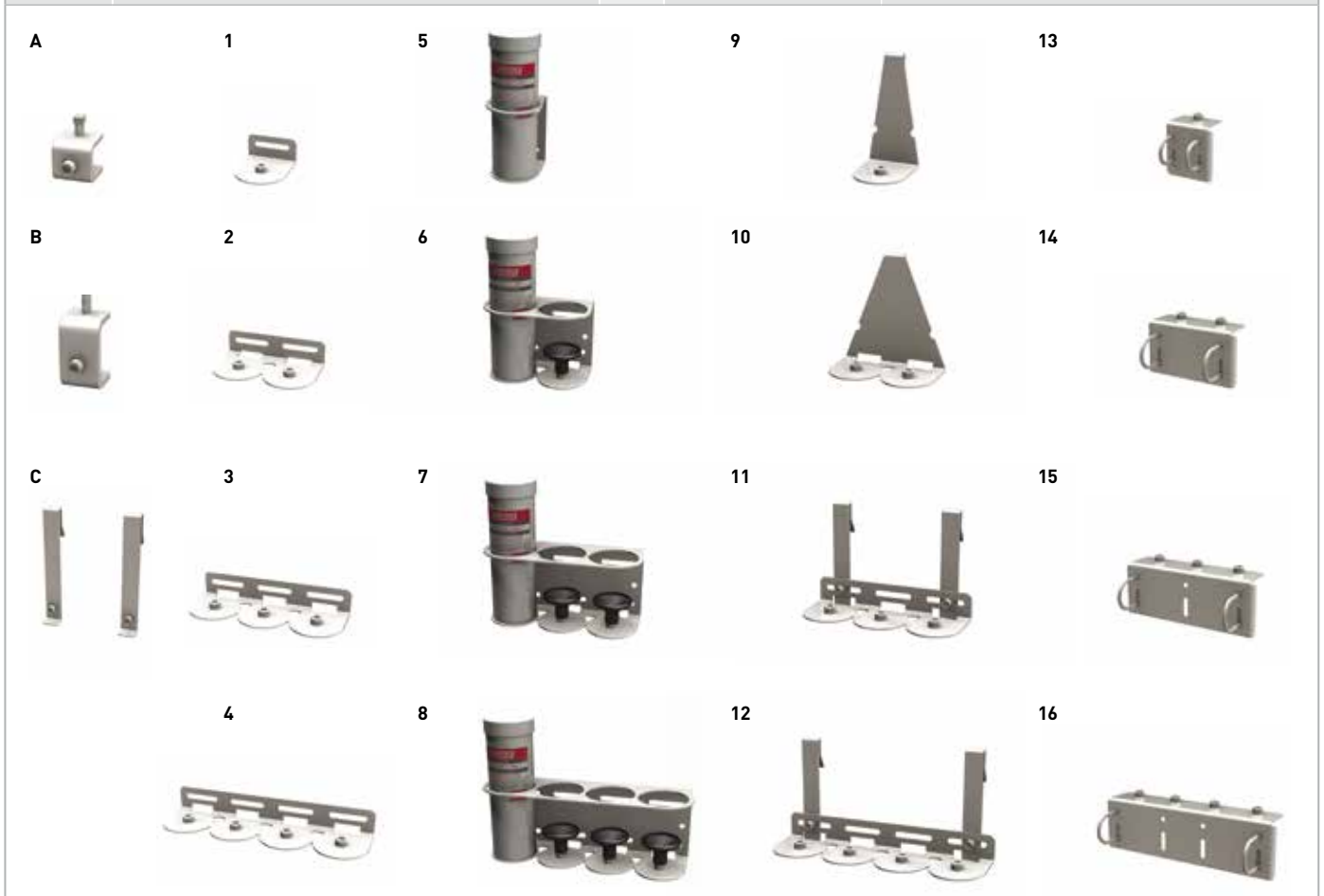
Part #	Description	Pic.	Part #	Description	Pic.
2461/8	1/4 " BSPF – 1/8 " BSPM Brass Straight Adaptor	1	92	90 Degree Brass Elbow 1/4	2
2461/8SAESS	1/8 " BSPF – 1/4 " SAEM Stainless Steel Straight Adaptor	-	1211/8	1/4 " BSPF – 1/8 " BSPM 45 Degree Brass Elbow	-
2461/4	1/4 " BSPF – 1/4 " BSPM Brass Straight Adaptor	-	1211/4	1/4 " BSPF – 1/4 " BSPM 45 Degree Brass Elbow	3
2461/4SAESS	1/4 " BSPF – 1/4 " SAEM Stainless Steel Straight Adaptor	4	52740	40mm long 1/4 " BSP Brass Extension Tube	5
2463/8	1/4 " BSPF – 3/8" BSPM Brass Straight Adaptor	-	52785	85mm long 1/4 " BSP Brass Extension Tube	-
2461/2	1/4 " BSPF – 1/2 " BSPM Brass Straight Adaptor	-	527125	125mm long 1/4 " BSP Brass Extension Tube	-
2466SS	1/4 " BSPF – 6mm M Stainless Steel Straight Adaptor	-	708V	Manual greasing kit 1/4 " BSP	6
2468	1/4 " BSPF – 8mm M Brass Straight Adaptor	-	709V	Manual greasing kit 1/4 " BSP with 5psi check valve	-
24610	1/4 " BSPF – 10mm Brass M Straight Adaptor	-	A620P	Support flange 1/4 " BSP	7
88HDJ	Hose end swivel 3/8" hose to 1/4" BSP M	8	PVC120	Full length cover heavy duty PCV for M120 Star	-
90HD	Hose baryon fibre reinforced internal diameter 3/8"	-	PVC250	Full length cover heavy duty PVC for L250 Star	-
WC120	Full length cover translucent for M120 Star	-	CWL	Crane Wheel Lubricator applicator	9
WC250	Full length cover translucent for L250 Star	-	OGL	Open Gear Lubricator applicator	10



Stainless steel brackets & attachment options

The range of stainless steel brackets and attachment options included in remote installation kits can be purchased as separate components. Brackets are available bare or complete with A620P support flanges. The A620P reinforces perma STAR VARIO lubricators to protect against accidental breakage. The table below includes bare brackets and brackets with A620P's. Note that Heavy Duty C-Section brackets always include A620P's and full length PVC covers. With the exception of Heavy Duty brackets, only bare brackets are pictured below.

Part # (bare)	Description	Pic.	Part # (with A620P)	Compatible attachment options
BC30	Beam clamp 30mm	A	-	This is an attachment option
BC65	Beam clamp 65mm	B	-	This is an attachment option
CH-ARMS	Cage hanger twin arm set	C	-	This is an attachment option
MB01	Standard duty 1 point bracket	1	MB01A620P	Select from BC30 or BC65
MB02	Standard duty 2 points bracket	2	MB02A620P	Select from BC30 or BC65
MB03	Standard duty 3 points bracket	3	MB03A620P	Select from BC30 or BC65
MB04	Standard duty 4 points bracket	4	MB04A620P	Select from BC30 or BC65
-	Heavy duty C-section 1 point bracket	5	MB01C	Select from BC30 or BC65 or CH-ARMS
-	Heavy duty C-section 2 points bracket	6	MB02C	Select from BC30 or BC65 or CH-ARMS
-	Heavy duty C-section 3 points bracket	7	MB03C	Select from BC30 or BC65 or CH-ARMS
-	Heavy duty C-section 4 points bracket	8	MB04C	Select from BC30 or BC65 or CH-ARMS
CH01	Cage hanger 1 point bracket	9	CH01A620P	Cage hooks supplied with bracket
CH02	Cage hanger 2 points bracket	10	CH02A620P	Cage hooks supplied with bracket
CH03	Cage hanger 3 points bracket	11	CH03A620P	Cage hooks supplied with bracket
CH04	Cage hanger 4 points bracket	12	CH04A620P	Cage hooks supplied with bracket
MB01R	Rail mount 1 point bracket	13	MB01RA620P	U-bolts supplied with bracket
MB02R	Rail mount 2 points bracket	14	MB02RA620P	U-bolts supplied with bracket
MB03R	Rail mount 3 points bracket	15	MB03RA620P	U-bolts supplied with bracket
MB04R	Rail mount 4 points bracket	16	MB04RA620P	U-bolts supplied with bracket



Pre-assemble & pre-filled lubricator grease lines

Pre-assembled, pre-filled grease lines are supplied ready to use. They save time, ensure against the accidental inclusion of contaminants when making grease lines on site and remove the need for laborious manual filling. The range of grease lines from perma come in pre-set lengths.

- 3/8" internal diameter with single, synthetic fibre braid.
- Full bore female swivel, push-lock fittings at each end of hose for convenient fitting with adaptors to 1/4" BSP male
- Minimum burst pressure = 84 bar
- Complies with FRAS AS2660
- Minimum bend radius 76mm



Line Length	0.5m	0.75m	1.0m	1.5m	2.0m	2.5m	3.0m
Generic Part #	PSFXXX90HD0.5	PSFXXX90HD.75	PSFXXX90HD1.0	PSFXXX90HD1.5	PSFXXX90HD2.0	PSFXXX90HD2.5	PSFXXX90HD3.0

The table above provides generic part numbers for different length hose assemblies. The first 6 digits of each part number identifies the grease type. Specific part numbers for preferred grease types are created by replacing the first six digits of the generic part number with the relevant perma lubricant code.


For example, a pre-assembled grease line with a length of 1.5 meters which is filled with BP Energrease LC 2 grease:

- Generic part number for 1.5 meter line is PSFXXX90HD1.5
- 6 digit reference code for BP Energrease LC 2 grease is PSF826
- Hence, part number for required line is PSF82690HD1.5

Chain lubrication accessories

Part #	Description	Pic.	Part #	Description	Pic.
A400	Brush 20cm round 1/4 " BSP for oil	1	8615	Tube assembly complete flexible reinforced nylon 15cm	-
A410*	Brush 3 x 4cm rectangular 1/4 " BSP for oil	2	8630	Tube assembly complete flexible reinforced nylon 30cm	-
A411*	Brush 3 x 6cm rectangular 1/4 " BSP for oil	3	8645	Tube assembly complete flexible reinforced nylon 45cm	-
A412*	Brush 3 x 10cm rectangular 1/4 " BSP for oil	4	8660	Tube assembly complete flexible reinforced nylon 60cm	-
A810	Throttle one-way valve 1/4 " BSP for oil	5	8690	Tube assembly complete flexible reinforced nylon 90cm	-
A100	Metal bracket standard duty	6	86150	Tube assembly flexible reinforced nylon 150cm	-
A105	Plastic bracket with two position quick clip	7	90	Reinforced nylon hose 3/8" internal diameter (per meter)	-
MBA105	A105 (see above) with SS 30mm beam clamp	8	87	Male barbed brass fitting for type 90 nylon hose	-
A150	T-piece bracket with 1/4 " BSP insert	9	88	Female barbed brass fitting for type 90 nylon hose	-





The frequent addition of small volumes of lubricant provides the longest bearing service life and therefore reduces maintenance costs. Lubricant selection is also an important factor for achieving extended bearing service life.

To fulfill this requirement perma lubricators are filled standard with a range of high quality German manufactured lubricants.

HTL perma Australia also has the capability to custom fill greases and oils. This ensures that users of perma lubricators are not forced to make compromises when it comes to choice of lubricant.

Custom fill lubricants

HTL perma Australia is equipped with lubricator filling machines from Germany and has the capability to custom fill lubricators with any suitable grease or oil. Custom filling can generally be completed within three business days.

The demand for custom filled lubricants is increasing. Typical reasons for choosing custom filled lubricants are:

- Where lubricant rationalisation programs have been implemented and it is preferred that the lubricants in automatic lubricators conform to the rationalisation decisions.
- Where certain applications demand specialty lubricants.
- Where the mixing of different lubricants presents a real risk of incompatibility problems.
- Where specific lubricants are required in order to satisfy warranty requirements.
- Where specific lubricant brands must be used in order to adhere to contractual obligations.

Standard fill lubricants

perma Code Description	NLGI-class	Thickener	Base oil	Operating temperature range (°C)	Viscosity at +40 °C	Roller bearings	Sliding bearings / guides	Linear guides	Open gears / gear racks	Spindles	Shaft seals (1)	Chains
												
Grease												
SF01 Multipurpose grease	2	Li / Ca	Mineral oil	-30 to +130	220	✓	✓	✓	-	✓	✓	-
SF02 Extreme pressure grease	2	Li + MoS2	Mineral oil	-30 to +120	105	-	✓	-	✓	-	-	-
SF10 Food grade grease	1	Al-Com,	PAO	-45 to +120	150	✓	✓	✓	✓	-	-	-
Oil												
S014 High temperature chain oil	Oil	-	PAO + Ester	-20 to +250	320	-	-	-	-	-	-	✓
S032 Multipurpose oil	Oil	-	Mineral oil	-5 to +100	100	-	✓	-	✓	✓	-	✓
S070 Food grade oil	Oil	-	PAO + Ester	-30 to +120	220	-	✓	-	✓	✓	-	✓

Grease pumpability

The pumpability of grease depends on a range of factors, the most influential being the grease type, temperature and the internal dimensions of delivery lines and fittings.

Grease type - The lower the NLGI rating the easier grease is to pump. NLGI 2 greases are easier to pump than NLGI 3 greases and so on. Grease thickener type, base fluid viscosity and manufacturing methods also have an effect on grease pumpability.

Temperature - Grease is much easier to pump in warmer environments than in cold environments. However, the relationship between pumpability and temperature is not linear, so as temperature drops it is difficult to predict the point at which grease will become substantially more difficult to pump.

Grease line dimensions and fittings - The nature of grease flow through lines and fittings is different to that of liquid lubricants such that pressure drops cannot be calculated on the basis of "pipe friction loss" style calculations. In general it is best to minimise grease line length, use generous sized grease line (perma recommends 3/8" ID) and eliminate restrictive elbow fittings.

