



continuous automatic lubricator



TECHNICAL NOTES



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1. GREASEMAX - DESCRIPTION

GreaseMax is a chemically operated automatic lubricator

It is designed to be screwed into the bearing grease nipple seating, or onto an extension line, and to feed lubricant at a **CONSTANT RATE** for a **SET PERIOD** of time.

GreaseMax is designed to operate for a set period of time. There are 4 operating periods; 1, 3, 6, and 12 months. After the service time has elapsed, the unit is replaced with a new unit.

Because it is self regulating it should be used in conjunction with the plant maintenance scheduling. Therefore changeovers of the **GreaseMax** can be planned and carried out at set periods.

GreaseMax operation is simple and trouble free. Quite frequently its capabilities are not at first appreciated because of its simplicity.

GreaseMax can be used anywhere; on most applications, both large and small, even underwater.

Importantly, **GreaseMax** has **no electrical or mechanical components** and has **only one moving part**, which is the piston. For this reason **GreaseMax** is extremely reliable.

2. ADVANTAGES

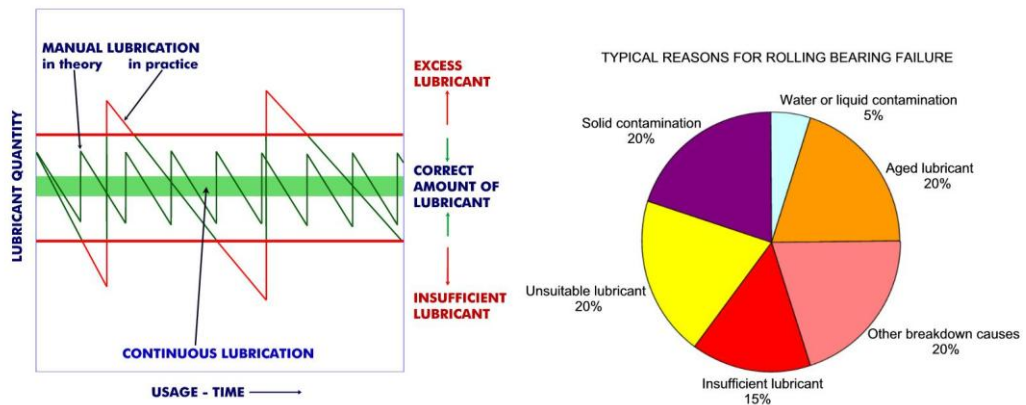
2.1 Cost savings:

- **Direct cost savings over manual greasing.**
- **Direct cost savings by reducing the necessity to stop machinery and production for lubrication.**
- **Indirect cost saving with reduced maintenance** and down time from bearing failures caused by incorrect or missed lubrication.

2.2 Maintenance advantages

- **Lubrication occurs when the plant is in operation**, when it is of the most benefit.
- Constant replenishment of new grease, which **minimises bearing wear**.
- The **bearing is sealed** while **GreaseMax** is in use.
- **Dust and moisture are prevented from entering the bearing.**
- The **lubrication is fully automated** and changeovers can be programmed into the plant maintenance schedule.
- **GreaseMax** ensures that as a warm or hot bearing cools, the slight **vacuum normally created does not draw in foreign material.**
- A continuous supply of fresh lubricant **flushes out any foreign matter, moisture or harmful chemical substances** which may otherwise accumulate in the bearing if it is unused for some time.

- A constant grease supply ensures that **seals are lubricated and more effective in preventing contamination**. This is particularly the case with labyrinth seals.
- GreaseMax change-overs can be programmed with plant maintenance schedules
- **Problems of manual lubrication**
 - **excess lubrication**
 - **insufficient lubrication**
 - **application of incorrect lubricant****are overcome**
- The main problems causing lubrication related failure in ball and roller bearings are overcome. Typically these are:
 - **solid contamination 20%**
 - **unsuitable lubricant 20%**
 - **insufficient lubricant 15%**
 - **water or liquid contamination 5%**
 - **aged lubricant 20%**
 - **other causes 20%**



2.3 Safety & Environment

- **Lubrication is cleaner and environmentally responsible**; there is no excess lubricant affecting either plant cleanliness or the environment.
- **Safety is improved** as operators are not required to lubricate hazardous areas

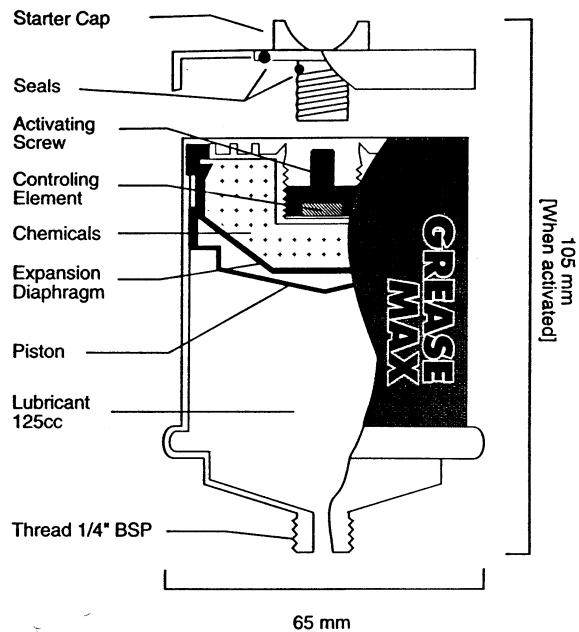
2.4 Design

- **GreaseMax has no electrical or mechanical components** (which can contribute to unreliability).
- **GreaseMax has a steel body** ensuring that it efficiently handles high output pressures and heat with total reliability.
- **GreaseMax has excellent output pressure.**

3. OPERATION OF GREASEMAX

GreaseMax is activated by screwing in the colour coded plastic starter cap. The colour coding of this cap should match the colour coding of the plastic activating screw in the base of **GreaseMax**, (into which this cap is screwed).

When the starter cap is screwed in, a controlling element located internally in **GreaseMax** is forced into a reagent, contained in a neoprene expansion diaphragm. When this occurs a galvanic reaction commences, and gas is produced. The gas expands the diaphragm and as it does so a steel piston (located between the diaphragm and the lubricant) is pushed down and the lubricant is forced out.



GreaseMax requires a minimum of approximately 8 hours for a type 1 unit to approximately 40 hours for a type 12 unit to develop sufficient internal pressure to commence discharging lubricant. This period is normally not a problem for well maintained bearings however if lubrication is required in less than the start up period then activate **GreaseMax** in advance.

GreaseMax has NO INTERNAL PRESSURE prior to activation. Pressure is developed, and the lubricant discharge pressure is virtually in equilibrium with bearing or grease line resistance.

The chemical reaction is so designed as to give a CONSTANT rate of reaction, over the whole life of the unit. **This results in a CONSTANT lubricant output. The GreaseMax discharge rate is not affected by bearing or seal condition, movement, vibration, etc.**

It is often assumed that **GreaseMax** has some sort of pre-loaded internal pressure. This is NOT the case. If it were, **GreaseMax** could not operate as a truly self regulating automatic lubricator as it would then rely on bearing and line resistance to control its operation.

4. INSTALLATION

The starter caps are colour coded. **Ensure that the colour of the starter cap matches the colour of the activator screw in the base of the GreaseMax**, into which the starter cap will be screwed.

1. Screw the starter cap in hand tight. (While the starter cap is being turned down, the seals will be heard to break. Continue to turn the starter cap in until it is **tight**).
2. **Then use a screw driver or similar with a shank size of 8mm - 10mm to tighten the cap FIRMLY (approximately 1/4 of a turn more). This is essential to ensure a gas and liquid tight seal.**

Do not loosen the starter cap or attempt to remove it.

When this has occurred **GreaseMax** is operational. Allow the following minimum starting times: 1 month units - 8 hours, 3 month units - 24 hours, 6 month units - 30 hours, 12 month units - 40 hours, for lubricant discharge to commence. (see "Operation of **GreaseMax**").

Pre grease with a grease gun before the first installation. The short time delay will not adversely affect bearings which have been properly pre greased before the installation of **GreaseMax**. For subsequent installations, pre greasing is not necessary as prior use of **GreaseMax** will have ensured that there is adequate grease in the bearings.

Pre-greasing before the first installation of GreaseMax is also important to ensure that all grease ways are free of old hard grease which can block completely the grease ways.

GreaseMax is designed to operate in most conditions. It will operate satisfactorily in:

- **Areas of severe vibration.** If this includes high shock loading, to prevent long term failure of the plastic mounting points, use mounting brackets and flexible feed lines.
- **Underwater or wet installations.**
- **GreaseMax** is not affected by large daily temperature cycles which can cause condensation problems with some types of equipment.
- **Heat and cold** (see discharge table below for discharge rate variations)
- **GreaseMax** units with grease may be mounted in any position. Movement is OK but brackets may be required to support the unit. For oil filled units see section 4.5.

4.1 GreaseMax discharge rates

GreaseMax is designed to operate at an average temperature of 25°C. The discharge rate and operating period of **GreaseMax** will be different if the average operating temperature varies from 25°C. The following table gives details.

Average temp.	Type 1 White (1 mth)		Type 3 Blue (3 mth)		Type 6 Red (6 mth)		Type 12 Grey (12 mth)	
	Life in months	Grease supply / day grams	Life in months	Grease supply / day grams	Life in months	Grease supply / day grams	Life in months	Grease supply / day grams
65°C	0.15	24.0	0.5	8.0	1	3.6	2	1.8
55°C	0.3	12.0	1	3.6	2	1.8	4	0.9
45°C	0.5	7.3	1.5	2.3	3	1.2	6	0.6
35°C	0.7	5.2	2.5	1.5	4.5	0.8	9	0.4
25°C	1	3.6	3	1.2	6.0	0.6	12	0.3
15°C	1.5	2.3	4.5	0.8	9.0	0.4	18	0.2
5°C	2	1.8	6	0.6	14	0.26	28	0.13
-5°C	4	0.9	12	0.3	24	0.15	48	0.08
-15°C	6	0.6	18	0.2	36	0.1		
-25°C	9	0.4	27	0.13				

Note: The average temperature is the average operational temperature of the GreaseMax unit. This may be different to the average environmental temperature.

4.2 Output pressure of GreaseMax

GreaseMax can develop a maximum discharge pressure of approximately 150 psi. In practice, the operating pressure is much lower than this as the pressure required to move grease into a rotating bearing, with the grease nipple removed, is not great. **GreaseMax holds the output pressure virtually in equilibrium with grease way resistance.**

A grease gun needs high pressure, principally to overcome the resistance of the grease nipple. It also has to get grease into a stationary bearing, which can require a lot of pressure in some instances.

GreaseMax has enough pressure to move grease through 2 metres of extension line. See below for details.

4.3 Affect of bearing and grease way pressure

GreaseMax builds up discharge pressure to the point where fundamentally a balance exists between the resistance of the grease way and the output pressure of the **GreaseMax**. For example, if **GreaseMax** is activated and allowed to discharge without being placed on a bearing, the full operating period will be taken before the unit is empty. If **GreaseMax** is activated and placed on a grease-way requiring pressure **GreaseMax** will build up to this pressure and then discharge according to its normal operating period. **GreaseMax adjusts to grease way resistance, but does not rely on this resistance to control its' operation.**

GreaseMax will maintain the pressure balance. If something occurs to change the grease way resistance then **GreaseMax** will automatically adjust its' discharge pressure to accommodate this change.

4.4 Installation with extension lines

GreaseMax may be used with extension lines for remote positioning. Extension lines are also useful for installations where extreme movement or shock loadings may be applied to the **GreaseMax**. In this case, mount the **GreaseMax** firmly in a bracket (which DIS can supply) and feed the lubricant into the bearing via tubing.

Lubricant	Maximum line length	Min. INSIDE diameter
Grease	2 metres	8mm
Oil	10 metres	3mm

Note: It is possible to install GreaseMax on longer feed lines than the above. For proposed installations outside these limits consult Delta for specialist advice.

All extension lines MUST be pre-filled with lubricant. We recommend only clear extension lines, so that the condition of the lubricant can always be observed.

4.5 Oil units

GreaseMax can be used with a variety of oils for lubrication of bushes, slides, chains, conveyors, -for example to lubricate the undersides of steel slat type conveyors used in applications such as bottle manufacturing and so on.

GreaseMax oil units should be mounted with the outlet upwards or preferably used with a **control valve** (Part Number GF16000) to prevent the oil draining out if the outlet is downwards or if the **GreaseMax** oil unit is feeding an extension line, particularly if the extension line feeds vertically upwards.

Chain lubrication: GreaseMax can efficiently and economically lubricate chains of all types. You will need to use 115 oil which has special tacky additives for use on chains, slides etc. and some fittings: a control valve, a bracket, a brush and possibly a flexible extension line. A full list of **GreaseMax** product codes and fittings is on the Fittings page.

5. CHANGING GREASEMAX

Ideally **GreaseMax** should be used in conjunction with the plant maintenance schedule. This minimises the time taken for lubrication and ensures that an orderly change over of expired units takes place.

GreaseMax are designed to have a small service life overrun to prevent damage to bearings if the changeover date is not accurately kept. For example, a type 3 unit, at normal temperature, will operate for 100 days, which is of course 9 days more than the 91 day average for 3 consecutive months.

We recommend that time is not spent checking for the piston to appear in the cone of the unit after expiry of the scheduled time. It is far more economical to change the units on a fixed schedule, even if a small amount of grease remains. In any event the costs and savings are calculated on set time periods, and the cost in time of attempting to exceed these periods with the resulting requirement for very regular checking is more than the value of the small amount of lubricant remaining.

GreaseMax is designed so that the piston will first become visible as a silver ring in the plastic end cone when there is approximately 10% of lubricant remaining. This is to give a visual forward warning of expiry. **GreaseMax** will continue to operate until all lubricant is expelled. At this point all of the piston is visible.

Caution: When using Moly grease in GreaseMax the piston may not be visible at expiry. (This is due to the opacity of the grease).

6. LUBRICANTS

GreaseMax uses only very high grade lubricants chosen for their performance and suitability for use in **GreaseMax**.

A full range of greases and oils is available to cover all applications. Delta is able to assist customers with special lubrication requirements.

GreaseMax standard lubricants:

Product Code	Description	Base	Temp Range °C	Drop Point °C	Application
001	Multi-purpose grease	Li/Ca	-30 – 120	160	Universal
002	High temp grease	Polyurea	-30 – 150 170 inter.	215	High temp applications
003	Multi-purpose grease + Moly	Li/Ca	-40 – 120	165	Bushes, slides & where water load & vibration is a problem
115	Heavy oil	Mineral oil	Visc @ 40°C	ISO 320	Heavy tacky oil for slides, chains, bushes etc.

Full lubricant specification sheets are available on request

7. IDENTIFICATION OF GREASEMAX

An identification code for the grease type and production batch is impressed into the **GreaseMax** label. The activating cap is colour coded according to the operating period.

1. **Lubricant type:** **GreaseMax** has a 3 digit numeric code, which corresponds with the lubricant code (see table above).
2. **The other 2 letter group** is a production code (month and year as mmyy).
3. **Operating Period:** The **GreaseMax** activator screw (in the base of the unit) and the starter cap are colour coded according to the operating period:

Colour	Type	Discharge Period @ 25 ^o C
White	1	1 month
Blue	3	3 months
Red	6	6 months
Grey	12	12 months

8. WHICH GREASEMAX SHOULD BE USED?

There are no hard and fast rules for selecting the type of **GreaseMax** to be used on any given application. Every bearing is different, the variety of operating conditions is unlimited and other factors need to be taken into account such as wear, seal condition, moisture presence, heat, etc. However the following can be taken as a guide:

Shaft Size	GreaseMax type
100mm-160mm	1 mth
60mm-100mm	3 mth
30mm-60mm	6 mth
up to 30mm	12 mth

- For shaft sizes greater than 160mm, use one or more **GreaseMax** coupled together.
- **If moisture, severe dirt or dust, wear, heavy vibration or other factors are present, consideration should be given to using a quicker acting GreaseMax.**

Additionally, the following "rule of thumb" may prove helpful: In terms of strokes per day from a small hand grease gun, output approx. 0.6cc per stroke, the **GreaseMax** discharge is roughly equivalent to:

GreaseMax type	Strokes per day
Type 1	4-6
Type 3	2-3
Type 6	1
Type 12	0.5

9. SHELF LIFE

GreaseMax and the lubricants used in it have a shelf life of 2 years. The units should be installed within this period to ensure optimum performance. A date of manufacture appears on the side of **GreaseMax** as a 4 digit number representing month and year as mmyy.

10. SAFETY

GreaseMax will improve plant personnel safety by reducing the need to visit hazardous plant and equipment to lubricate. When properly installed, it is possible to change **GreaseMax** without stopping moving machinery, saving on down time.

GreaseMax, made in Germany, is a safe product. Both the production and the **GreaseMax** unit have safety certification from the German and world wide **TüV** safety organisation. The following **TüV** certification symbols are licenced for use on **GreaseMax**:



GreaseMax has been tested as required by all the relevant statutory German Safety Authorities and approved for both manufacturing and mining, including underground coal mining, without restriction. Further details are available on request

GreaseMax uses a small quantity of potassium hydroxide solution as part of its operation. For this reason it is important that the activating cap is not loosened or removed after the **GreaseMax** is placed in service. The screw cap is designed to prevent liquid under pressure being released from the unit. Note that it is not possible for the liquid to escape unless the unit is deliberately cut open or opened as above. Internally the steel piston has rubber seals so that in the unlikely event that the neoprene diaphragm is damaged the liquid cannot escape into the lubricant .

GreaseMax is designed to partially release the plastic cone from the metal body when discharge pressure exceeds approximately 150 psi. This is to prevent continued pressure build up to dangerous levels.

Should a **GreaseMax** be observed in this state immediate maintenance is required as this situation is generally caused by blockages of the grease ways by old grease.

11. THE ENVIRONMENT & DISPOSAL

Expired **GreaseMax** should be placed in the industrial waste or recycled. Pressure is retained for a period after the service life is completed and this, combined with good housekeeping, means they should not be left lying around. **GreaseMax** does not contain any item which precludes burial in land fill either according to law or according to good environmental practice. They may be recycled but the method should be chosen with care as **GreaseMax** should not be opened because of the residual pressure that remains for a period after expiry and as they contain a small quantity of caustic solution.

12. QUALITY

GreaseMax is manufactured to the highest quality standards. The manufacturer as well as Delta is committed to providing the best product of this type together with the best technical support and training of personnel. As part of this commitment we will not introduce any element into the design of **GreaseMax** which can contribute to unreliability, such as electrical or mechanical components, plastic bodies, or by reducing components or using cheaper material including lubricants, to save on production costs.

13. COMMON QUESTIONS ASKED ABOUT GREASEMAX

1 How do I know **GreaseMax** is working, when the position of the piston can't be seen?

Firstly, remember that **GreaseMax** has only one moving part, (the piston), no mechanical parts, and no electrics. It uses an operating system proven to be absolutely reliable over 25 years. The manufacturer has stringent quality control to ISO9001 standard. It is very unlikely that non performance will be encountered.

The **GreaseMax design is fail safe; the starter cap cannot be screwed in without turning the activator screw down, which in turn can only break the seals and release the controlling element into the chemicals. The only possible result then is the production of gas which must push the piston forward and the lubricant out. The gas is retained in a gas tight neoprene bag and also as part of the fail safe design by the gas tight seals on the piston and the double O-rings on the starter cap.**

However, to be assured, check the following:

- Simply feel the bearing temperature if safe to do so, or use a thermometer.
- A fresh discharge of grease around the seals will be visible when **GreaseMax** is operating.

2 If I have a worn bearing will GreaseMax discharge faster?

No, definitely not. **GreaseMax** is self regulating and is a true automatic lubricator. It will maintain it's correct discharge rate regardless of the bearing type, tolerance or operating conditions.

3 Does the orifice size affect the discharge rate?

No. See page 3, Operation of **GreaseMax**.

4 Is a 12 month GreaseMax larger than a 1 month?

No, they are all the same size. The only difference is the discharge rates. (see the diagram and notes on page 3).

5 The plant is regularly stopped, for example at the week end. Will this create a problem with over greasing?

No. **GreaseMax** discharges at a very slow controlled rate and the amount of grease it can push into a bearing while the bearing is stopped for a few days will not a cause a problem.

GreaseMax is able to maintain a fine balance of pressure and if the plant is stopped for short periods, for instance at the week end, the resistance of the grease way is increased. This will temporarily stop **GreaseMax**. When the plant starts again, the grease will be released into the moving bearing. (Eventually **GreaseMax** would build enough pressure to move grease into the stopped bearing).

6 Will the 120 grams of grease in the GreaseMax be enough?

When greasing is done with a grease gun, excess grease is used. Only a very small amount of grease is actually used by a bearing, the rest is wasted. Because **GreaseMax** introduces grease into the bearing at a slow controlled rate while the bearing is moving only a small output quantity is required.

Providing the correct **GreaseMax** is chosen to begin with, the output will be sufficient. An additional benefit is that the plant will remain much cleaner!

7 For our application, GreaseMax output is not sufficient, even with a 1 month unit.

Several **GreaseMax** can be grouped together into one line to provide a higher feed rate.

8 Can we use one GreaseMax to feed two or more lines?

No, never. The discharge cannot be evenly split, as every bearing has a different grease resistance. Inevitably one bearing will be starved of grease.

- 9 We took the unit off and nothing came out, or: when we took the unit off there was a large grease discharge so we think it may not have been working.**

If GreaseMax is applied to a bearing with little or no grease-way resistance (which is common for many applications) and GreaseMax is unscrewed before it is empty, a lubricant discharge will be apparent but at a slow rate. Remember, GreaseMax operates in equilibrium with resistance.

On the other hand a GreaseMax unit which is operating under higher pressure, will, if unscrewed before it is empty, discharge lubricant as the pressure equalises. If the pressure is high this discharge can be quite large, depending on the pressure and the volume of lubricant remaining in the GreaseMax unit.

This situation may cause confusion, specially if users have removed the product from bearings which are similar but have different grease-way resistances. For those bearings with a high grease-way or bearing resistance the GreaseMax when removed (assuming the unit is not fully discharged) will have a large lubricant discharge; for those with little or maybe no grease-way resistance and therefore low pressure there will be little or minimal discharge. The often large variation between the amount of lubricant discharged from GreaseMax units from similar bearings when they are removed before the units are totally empty sometimes leads users to think that some of the units are defective when in fact the units are operating normally according to the conditions.

- 10 Why shouldn't GreaseMax be removed from the bearing during operation?**

If GreaseMax is operating under a lot of pressure, when removed this pressure will be lost. The unit may have been at say, half life, so the piston will be halfway down the cylinder. The chemical reaction which produces the pressure is very slow **and to re-pressurise up to the required pressure the second time may take a considerable period.** Under-lubrication during this period may result.

(Note: when first installed there is no problem with the time taken to accumulate pressure as the internal volume in the expansion diaphragm is fully taken up with liquid so pressure develops quickly).

- 11 Why doesn't GreaseMax have a transparent body?**

GreaseMax has a steel body for a very good reason. Steel does not deform under the heat and pressure likely to be encountered when using **GreaseMax** in some applications. Plastic does. If this were to occur, **GreaseMax** would suffer failure.

The disadvantage of course is that the progress of the piston can't be seen but the advantages in terms of the performance and reliability of the unit far outweigh the disadvantages.

Note: the rate of piston movement is very slow and visual monitoring of the piston would require careful periodic measurements to be made which would be time consuming and impractical in most operations

12 We think it is better to manually inspect the bearings while greasing

As will be apparent, the time spent on manual greasing can be used more efficiently and the expense applied to a better maintenance outcome. If inspections are required they are better done by qualified personnel as part of a Condition Monitoring program. If the bearings are correctly lubricated and then correctly inspected, (which need only be at relatively extended intervals), bearing life will be considerably improved. Maintenance costs will be greatly reduced and the costs of unscheduled production stoppages in terms of lost production and unscheduled maintenance will be lowered.

13 Why isn't GreaseMax adjustable?

GreaseMax is made to be completely reliable in all conditions. We prefer not to compromise with any design aspect but particularly this one. To make it adjustable would mean added complexity and the addition of electrical components. This would inevitably degrade the reliability factor.

14 How should GreaseMax be disposed of?

In the industrial waste. DO NOT leave the expired units lying around for the curious to tamper with. Remember, **GreaseMax** contains a small amount of potassium hydroxide and a small amount of pressure for some weeks after expiry. The amount of lubricant remaining in an expired **GreaseMax** is very small and does not give rise to environmental concerns for disposal.