



## Lubrication Quick Guide

version 1





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# **Section 1 - Introduction**

### **1.1 Intended Use**

The purpose of this quick guide is to assist users in the lubrication of an E-Multi Auxiliary Injection Unit. This quick guide is designed to cover most system configurations. This quick guide should be used in conjunction with the E-Multi user manual and the E-Multi controller user manual. If you need additional information specific to your system, or information in another language, please contact your representative or a Mold-Masters office.

#### **1.2 Release Details**

Table 1-1 Release Details				
Document Number Release Date Version				
QGEMLENG01	November 2023	01		



# **Section 2 - Lubrication**



#### WARNING

Make sure that you have fully read "Section 3 - Safety" of the E-Multi user manual before doing maintenance procedures on the E-Multi injection unit.

# CAUTION

#### CAUTION

Regular inspection and lubrication will help to maintain the health of the E-Multi and minimize unscheduled downtime. Failure to follow the recommended lubrication procedures will result in premature machine failure, thereby voiding the machine warranty.

### **2.1 Preventive Maintenance Schedule**

Table 2-1 Preventive Maintenance Schedule				
Preventive Maintenance	Frequency			
Verify injection pressure oil circuit	Check preload pressure on controller at start of every shift. Preload pressure is shown in the top right hand corner of the screen when the machine is in manual or when waiting for a start trigger in auto.			
Oil bath level	Check every 3 months; add oil if necessary			
Lubricate linear guides	Check every 3 months; add grease if necessary			
Lubricate injection ball screws	Inspect every 10 days. Lubricate every 250,000 cycles or every 3 months, whichever comes first			
Lubricate carriage ball screw nut (E-Multi Radial and Servo Carriage options only)	Lubricate every month for sprue-break applications Lubricate every 3 months for continuous forward applications			



Table 2-2 Injection Unit Lubrication						
Location	Туре	Manufacturer	Manufacturer's P/N			
Injection Ball Screw Nuts	Spindle bearing grease	Klüber Lubrication	ISOFLEX NBU 15* No exceptions allowed			
Carriage Ball Screw Nut	Spindle bearing grease	Klüber Lubrication	ISOFLEX NBU 15 Preferred			
Linear Guides Carriage Spring Pack	Spindle bearing grease	Klüber Lubrication	ISOFLEX NBU 15 Preferred			
	Barium based thickening agent	Klüber Lubrication	Staburags NBU 8EP			
	Lithium based thickening agent	Klüber Lubrication	Klüberplex BEM41-141			
	Aluminum based thickening agent	Lubcon	Thermoplex ALN 1001			
Oil Bath Level	75W-90 EP	Mobil	Mobil Delvac 75W-90			
(for internal Ball Screw Thrust Bearings))	Synthetic extreme pressure gear oil GL-5	Pennzoil	Pennzoil Synthetic 75W- 90 (GL-5)			
Hign-Pressure Oil Circuit		Shell	Spirax S6 AXME 75W-90			
		BP	Energear SHX-M 75W-90			
General Assembly	Soap based lithium	Klüber Lubrication	ISOFLEX NBU 15			
	grease	Shell	Gadus S2			
		Loctite	30530			
	Barium based thickening agent	Klüber Lubrication	Staburags NBU 8EP			
	Lithium based thickening agent	Klüber Lubrication	Klüberplex BEM41-141			
	Aluminum based thickening agent	Lubcon	Thermoplex ALN 1001			
High-Temperature Bolts Thermocouples Barrel-to-Housing Feed Block Retaining Bolts Screw Drive Gearbox Output Shaft Screw Spline or Threads Screw Bushing and / or Collet Ring Check Threads and Seating Face	Anti-seize compound, silver grade	Loctite	767			
Actuator Rod End	Thread lock compound,	Loctite	242			
Actuator Link	removable		243			
Ball-screw Back Stops						
Spring Pack Set Screw						
Vibrator Wounting Screws						
Screws						



Table 2-2 Injection Unit Lubrication					
Location	Туре	Manufacturer	Manufacturer's P/N		
Pipe Plugs	Pipe thread sealant	Loctite	567		
Needle Valve to Solenoid Teflon tape Valve		Any	-		

\*Can be purchased from Mold-Masters

Table 2-3 Lubrication Volumes of Injection Ball Screws							
E-Multi Model	Number of Ports per Injection Ball Screw Nut	Required Volume of Kluber Isoflex NBU 15 Added Manually Every 250,000 cycles or Every 3 Months, Whichever Comes First					
	-	cc per port cc per nut cc Total for 2 Nuts					
EM1	1	4.2	4.2	8.4			
EM2	3	2.5 7.5 15					
EM3	1	25 25		50			
EM4	4	10	40	80			
EM5	3	20	60	120			

Table 2-4 Lubrication Volumes of Carriage Ball Screws				
E-Multi Model	Number of Ports per Carriage Ball Screw Nut	Required Volume of Kluber Isoflex NBU 15 Added Manually Every 3 Months*		
	-	cc per port		
ER1, EM1-SC	1	4		
ER2, EM2-SC	1	4		
ER3, EM3-SC	1	27		
ER4, EM4-SC, EM4-TPM	1	50		
EM5, EM5-TPM	1	70		

\*Lubricate every month for sprue break applications.



#### **2.2 Preload Oil Pressures**

The E-Multi controller uses a pressure transducer in the injection pressure oil circuit to monitor injection pressure during the injection cycle. The pressure in the circuit should be within the specifications shown in Table 2-5.

Table 2-5 Preload Oil Pressures (1.34 Software)							
	Screw Diameter	Preload Oil Pressure on Gauge				Preload Pressure Transducer Voltage	
odel	mm	bar	bar psi		V		
Ĕ		Max	Min	Max	Min	Max	Min
	12						
	14						
	16	4.6	4.0	66	57	2.35	2.31
<b>A</b> 30	18						
EM 15	22						
	18			38	30	2.20	2.16
	20	2.6	2.0				
<b>2</b> 80	22	2.6	2.0				
EM 50	25						
	22		1.4	29	21	2.16	2.11
00	25						
8 8 9	28	2.0					
100 EM	32						
ю _	32	2.0	1.4	29	21	2.12	2.08
EM 250	38	2.0					
	32		2.5 1.9	00 07		2.14	2.11
	35						
	40				07		
50	45	2.5		30	27		
4 8 5	50						
350 350	55						
	50		1.4 0.8	20 11	11	2.08	2.05
	55	4.4					
60	65	1.4					
EM 140	75						





#### 2.2.1 Check the Preload Oil Pressure

#### WARNING

Do not open the high pressure port plugs. High pressure port plugs have plastic plug caps installed to prevent accidental opening.

When doing maintenance, avoid adding air into the oil circuit. Adding air will cause errors in the oil pressure measurement and will result in damage to the E-Multi.

- 1. Always check with E-Multi injection unit preload pressure at operating temperature and idle pressure.
- 2. On the controller, tap the Operation Mode Select button and choose Set Up mode. Check the [F1] LED. If it is not blinking, press the [F1] button to put the controller into setup mode.
- Check the screw position. If the position is greater than half the stroke, move the screw to the half stroke position, and then move the screw back approximately 25 mm (1.0 in.) further. This will decompress the screw and make sure the pressure value is showing idle pressure.
- 4. Navigate to the screw settings page. Verify that the actual voltage is within the limits.

#### 2.2.2 Assemble the Injection Pressure Oil Fill Kit



#### NOTE

The oil fill kit may have been supplied with the E-Multi injection unit and is also available from Mold-Masters. The fill kits are supplied without oil. The oil circuit requires 75W-90 synthetic gear oil.

Components of the high-pressure oil-fill kit:

- Oil gun
- Tee with fittings
- Pressure gauge
- Flexible hose, 2 m (6.6 ft) with quick connects
- 1. Thread the gauge into the tee and tighten.
- 2. Fill the gun with 500 ml (16.90 oz) of the 75W-90 synthetic oil.
- 3. Connect the tee to the quick disconnect port on the injection housing.
- 4. Connect the flexible hose to the oil gun and tee.
- 5. Pump the gun to purge air from the hose. Pump until clear, bubble-free oil comes out of the end of the hose.



#### WARNING

Never run the E-Multi injection unit with the fill kit attached. Serious injury to the operator and / or damage to the machine may result.

- 1. Connect the oil gun to the oil manifold on the E-Multi injection unit using the flexible hose quick connect.
- 2. It is necessary to see the controller, specifically the preload pressure reading. If required, a helper can watch the controller and say what the pressure is.
- 3. Holding the oil gun with the hose pointing down, pump the gun until the pressure is 2x the upper limit.
- 4. Place a clean, absorbent cloth below the manifold bleed screw.
- 5. Open the bleed screw slightly. It is possible air will come out and the pressure will drop significantly. If this happens, open the bleed screw about 1/4 turn and examine the oil that comes out.



#### NOTE

The oil should be clear, without bubbles and not foamy.

- 6. Close the bleed screw and pump the pressure up to 2x the upper limit for the oil kit pressure gauge.
- 7. Continue bleeding and pumping until no air, bubbles or foam come from the bleed screw.
- 8. Pump the pressure up one more time.
- 9. Disconnect the oil fill kit.
- 10. Open the bleed screw slightly and bleed the oil until the preload pressure on the controller reaches the upper limit.
- 11. If possible, cycle the injection unit in Auto mode for 10-20 cycles and check the preload pressure again.
- 12. Bleed or fill as required to get the pressure to remain stable and within the preload oil pressure specifications when cycling in Auto mode.



**2.3.1 Oil Bath Location** 

#### 2.3.1.1 EM1, ER1, and EM1-SC



2. High-pressure oil plug

#### 2.3.1.2 EM2, ER2, and EM2-SC



#### 2.3.1.3 EM3, ER3, and EM3-SC

The locations of the oil fill ports on the EM3, ER3, and EM3-SC are similar to that of the EM1. See section "2.3.1.1 EM1, ER1, and EM1-SC" on page 2-7 for the location of the oil fill port.

#### 2.3.1.4 EM4, ER4, EM4-SC, and EM4-TPM

The locations of the oil fill ports on the EM4, ER4, EM4-SC, and EM4-TPM are similar to that of the EM1. See section "2.3.1.1 EM1, ER1, and EM1-SC" on page 2-7 for the location of the oil fill port.



#### 2.3.1.5 EM5



#### 2.3.2 Fill the Oil Bath



#### WARNING

Be careful not to confuse the low-pressure oil fill port with the high-pressure oil system plug or the water plug.



#### NOTE

For continued warranty support, use only approved synthetic gear oil as specified in Table 2-2.

- 1. Move the injection unit fully back.
- 2. Remove the low-pressure plug from the fill port. See "2.3.1 Oil Bath Location" on page 2-7 for the location of the oil fill port. The oil level should be up to the lower threads of the fill hole.
- 3. Fill with synthetic gear oil as indicated in "Table 2-2 Injection Unit Lubrication" on page 2-2.



#### 2.4 Injection Ball Screws and Linear Guides

**2.4.1 Locations of the Lubrication Points** 

#### 2.4.1.1 EM1



Figure 2-1 Injection ball-screw lubrication points (2)



Figure 2-2 Linear guide lubrication points (2)



See section "2.4.1.1 EM1" on page 2-9 for the locations of the lubrication points of the injection ball screws of the ER1.



Figure 2-3 Linear guide lubrication points (6 in total)



Figure 2-4 Carriage ball screw lubrication point (1)





Figure 2-5 Linear guide lubrication points of the carriage lower assembly (2)



Figure 2-6 Linear guide lubrication points of the carriage lower assembly (2)

#### 2.4.1.2 EM1-SC

See section "2.4.1.1 EM1" on page 2-9 for the the locations of the lubrication points of the injection ball screws.

See Figure 2-4 on page 2-10 for the location of the carriage ball screw lubrication point.

See Figure 2-3 on page 2-10 for the locations of the lubrication points of the linear guides.

See Figure 2-5 on page 2-11 for the locations of the linear-guide lubrication points of the carriage lower assembly.

See Figure 2-6 on page 2-11 for the locations of the linear-guide lubrication points of the carriage lower assembly.EM2





Figure 2-7 Side view showing location of ball-screw lubrication points



Figure 2-8 Bottom view showing locations of ball-screw lubrication points (6)



Figure 2-9 Side view showing the linear-guide lubrication points (2)



#### 2.4.1.3 ER2



*Figure 2-10 Side view showing locations of linear-guide lubrication points (8 in total)* 

See Figure 2-4 on page 2-10 for the location of the lubrication point of the carriage ball screw.

See Figure 2-5 on page 2-11 and Figure 2-6 on page 2-11 for the locations of the linear-guide lubrication points of the carriage lower assembly.



#### 2.4.1.4 EM2-SC

See Figure 2-3 on page 2-10 for the locations of the lubrication points of the linear guides of the EM2-SC.



Figure 2-11 Side view showing the location of the lubrication point of the carriage ball screw nut (pre-mid-2023 systems)



Figure 2-12 Bottom view showing the location of the lubrication point of the carriage ball screw nut (pre-mid-2023 systems)





Figure 2-13 Side view showing the location of the lubrication point of the carriage ball screw nut (mid-2023 or later systems)



#### 2.4.1.5 EM3



Figure 2-14 Side view showing location of ball-screw lubrication points



Figure 2-15 Bottom view showing locations of ball-screw lubrication points (2)



Figure 2-16 Side view showing linear-guide lubrication points (3)



#### 2.4.1.6 ER3



*Figure 2-17 Side view (true vertical) showing lubrication point of carriage ball screw nut (carriage down 130 mm from fully-up position)* 



*Figure 2-18 Side view (true vertical) showing lubrication point of spring pack (carriage down 50 mm from fully-up position)* 





Figure 2-19 Side view (true vertical) of ER3 showing the lubrication points of the linear guides (3)



*Figure 2-20 Close-up showing the lubrication points (4) of the lower assembly linear guides* 



#### 2.4.1.7 EM4



Figure 2-21 Side view showing location of ball-screw lubrication points



Figure 2-22 Bottom view showing locations of ball-screw lubrication points (8)



Figure 2-23 Side view showing locations of linear-guide lubrication points (3)



#### 2.4.1.8 ER4

See Figure 2-21 on page 2-19 and Figure 2-22 on page 2-19 for the locations of the ball-screw lubrication points.

See Figure 2-18 on page 2-17 for the location of the lubrication point of the carriage ball screw.

See Figure 2-19 on page 2-18 for the locations of the lubrication points of the linear guides.

See Figure 2-20 on page 2-18 for the locations of the lubrication points of the linear guides of the lower assembly of the carriage.



#### 2.4.1.9 EM5



*Figure 2-24 Side view showing locations of ball-screw lubrication points (6 in total; 3 on the other side)* 



*Figure 2-25 Side view of carriage showing localized lubrication points for the servo carriage and linear guides* 





Figure 2-26 Descriptions of the localized lubrication points



*Figure 2-27 Side view of EM5 showing localized lubrication points for servo carriage fixed housing (left) and linear guides (middle and right)* 



# **2.4.2 Lubricate the Injection Ball Screws and Linear Guides**

See section "9.4.1 Locations of Lubrication Points" on page 9-8 for the locations of the lubrication points of your unit.

See "Table 9-3 Lubrication Volumes of Injection Ball Screws" on page 9-8 for the proper amount of lubrication for your unit.

- 1. Make sure that the grease fitting is clean.
- 2. Attach the grease gun to the grease fitting and pump to apply adequate grease for lubrication.

#### 2.4.2.1 Servo Carriage Option

The ball screw nut of the E-Multi servo carriage assembly requires periodic lubrication.

See "Table 2-4 Lubrication Volumes of Carriage Ball Screws" on page 2-3 for the proper amount of lubrication for your unit.

- 1. Move the carriage back to the rear hardstop.
- 2. Remove the support beam cover. Unscrew the four button head screws using a 5 mm hex key.
- 3. Press the E-Stop button on the controller.
- 4. Make sure that the grease fitting is clean.
- 5. Use a grease gun to add the specified volume of grease.
- 6. Reinstall the support beam cover.

# **2.4.3 Lubricate the Radial-Carriage Ball Screws and Linear Guides**



#### WARNING

Do not put fingers into the lubrication access hole. There is a shearing hazard if the carriage moves and serious injury can occur.

The E-Multi Radial carriage assembly requires periodic lubrication of the ball screw nut. See "Table 2-4 Lubrication Volumes of Carriage Ball Screws" on page 2-3 for lubrication specifications.

The E-Multi Radial has linear guides attaching the upper assembly to the lower assembly and also has additional linear guides supporting the E-Multi barrel housing and injections housings. Lubricate these linear guides according to the maintenance schedule found in "Table 2-1 Preventive Maintenance Schedule" on page 2-1.

#### 2.4.3.1 ER1 and ER2

See section "Figure 2-2 Linear guide lubrication points (2)" on page 2-9 and section "2.4.1.3 ER2" on page 2-13 for the lubrication points of the ER1 and ER2 models.

See "Table 2-4 Lubrication Volumes of Carriage Ball Screws" on page 2-3 for the proper volume of lubrication.

1. Move the carriage to line up the grease fitting with the plug hole to allow access to the grease fitting. This position is approximately 75 mm (3 in.)





from the uppermost carriage position.

2. Remove the plug.



- 3. Move the carriage until the fitting is aligned with the hole.
- 4. Press the E-Stop button on the controller.
- 5. Make sure that the grease fitting is clean.
- 6. Use a grease gun to add the specified volume of grease.
- 7. Reinstall the plug.

#### 2.4.3.2 ER3 and ER4



#### WARNING

Do not put fingers into the lubrication access hole. There is a shearing hazard if the carriage moves and serious injury can occur.

See section "2.4.1.6 ER3" on page 2-17 and section "2.4.1.8 ER4" on page 2-20 for the lubrication points of the ER3 and ER4 models.

See "Table 2-4 Lubrication Volumes of Carriage Ball Screws" on page 2-3 for the proper volume of lubrication.

- 1. Move the carriage to the fully up position.
- 2. Remove the access cover.
- 3. Bring the carriage down approximately 50 mm (2 in.) to access the grease fitting for the spring pack assembly.
- 4. Press the E-Stop button on the controller.
- 5. Use a grease gun to add the specified volume of grease.
- 6. Bring the carriage down approximately 130 mm (5 in.) from fully up to access the grease fitting for the ball screw nut.
- 7. Press the E-Stop button on the controller.
- 8. Use a grease gun to add the specified volume of grease.
- 9. Lubricate the four linear guides on the lower assembly.
- 10. Lubricate the three linear guides on the upper assembly sled.



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