



Appendix B

Check List for Live Steam Operators

- 1 Always ensure water bottle, wet towel and fire extinguisher are close at hand during light-up and operation.
- 2 If using asbestos wicks:
 - a) soak in meths before touching.
 - b) avoid letting them burn dry.
 - c) ensure flame height 1/2" - 3/4" (12mm - 18mm)
- 3 Store meths in a metal container. Replace cap before lighting.
- 4 Use distilled or rain water in boiler and emulsifying steam oil (not motor oil) in displacement lubricators.
- 5 To minimise possibility of priming and flare up, do not fill loco to maximum capacity of water and meths. Use measured quantities equal to 75% of boiler and tank capacities; ensure by tests that fuel runs out before water. (See Table 1 for Typical Capacities).
- 6 Check and lift safety valve off seat at the start of each running session.
- 7 Do not fill gas tanks within 10 ft (3 metres) of flame or running tracks.
- 8 Do not light up gas burner within 10 ft (3 metres) of storage tank.
- 9 Extinguish burner before refilling.
- 10 Drain oil, water and meths fuel after use.

Steam Cylinder Lubrication

Gauge 0 live steam commercial models with pot boilers, such as Bassett-Lowke and Bowman engines, operate on saturated (wet) steam typically at about 15 lb/sq in. (1 Bar) and 250°F (121°C). Even when superheating is provided, as is often the case in privately built engines in 0 gauge, these still have low steam pressures and low steam superheat temperatures in comparison with 3.5"/5" gauge models and especially full sized locomotives. It is therefore important for the successful operation and prolonged useful life of 0 gauge live steam locomotives to use the correct type and viscosity of cylinder oil.

With regard to type, the oil should readily emulsify with the wet steam and water in the cylinders. It should also contain a fatty additive to provide a tenacious lubricating film to resist the scouring action of steam and water. Steam cylinder oils have these characteristics, but motor oils do not.

As to viscosity, it is important to remember that, for a given oil, viscosity varies with temperature, i.e. the higher the temperature the 'runnier' it becomes. The important thing is to have the right viscosity at working temperature. That is why oils for full sized steam locomotives which operate with steam temperatures up to 700°F (370°C) are lubricated with oil which at room temperature is like treacle. In contrast, 0 gauge steam locomotives usually operate on saturated steam at about 250°F (121°C) or with a slight superheat and should be lubricated with light steam oil with a much lower room temperature viscosity to achieve the best conditions at their working temperature. Unfortunately the viscosity and related temperature are rarely stated on the bottles sold by engineering suppliers. The average 0 gauge live steamer has little enough power in reserve for train hauling purposes without the operator adding to its drag by using oil that is thicker than necessary. Additionally, the use of thicker oils than those specified by the makers could adversely affect operation of the displacement lubricator. Viscosity selection is a compromise between the drag of thicker oils and the reduced 'sealing' effect of thinner oils.

It is therefore recommended that the cylinders of 0 gauge locomotives are lubricated with a light steam cylinder oil, blended for saturated or low superheat conditions, with emulsifying characteristics such as that supplied by Stuart Models Limited and others. In emergencies light gear oil (SAE 90 or 120), which has similar characteristics, could be used, but not motor oil.

For the technically minded, lubricating oil viscosity is currently quoted by the UK oil industry in centistokes (cSt) both at 40°C and 100°C. The latter is important to us as it is close to the working temperature of most 0 gauge steam cylinders. (Viscosity is determined by placing a given quantity of oil in a vessel having a precision drain hole and measuring the number of seconds taken for the oil to empty out of it). It is recommended that for the best results the cylinder oil should have a viscosity in the range of 20 - 40 cSt at working temperature with the possibility of going down to 10 cSt. The oil industry is able to provide steam cylinder oils to cover a wide range of steam temperatures.

The table below illustrates the effect of temperature on viscosity.

Steam oil examples	A	B	C	D	E	F
Motor oil examples						
Viscosity cSt @ 40°C	400	470	620-740	880	-	-
Viscosity cSt @ 100°C	28.5	31.2	38 min.	47.5	9.3	25

- Example
- A) Light steam cylinder oils blended for saturated
 - B) or low superheat conditions.
 - C)
 - D) Higher viscosity for superheated full sized engines.
 - E) SAE 30 motor engine oil (viscosity too low).
 - F) SAE 90 motor gearbox oil.

Note: The SAE number system was developed for the motor industry and is only a rough indication of viscosity. Whenever possible use centistokes when ordering oils.



Table 1

Water and Fuel Capacities of Commercially Built Models

Note: Figure in brackets is a recommended volume of water or meths to be used when filling to minimise spillage and priming.

	Water	Meths
Bowman - Note 1 4-4-0 Tender Loco Large 0-4-0T Small 0-4-0T	300/(225)cc 225/(170)cc 120/(100)cc	80/(60)cc 64/(48)cc 40/(30)cc
Bassett-Lowke Enterprise 4-4-0 Super Enterprise 4-6-0 LMS Mogul 2-6-0	250/Note 2 225/Note 3 150/Note 4	75/(56)cc 75/(56)cc 30/(22)cc
Mamod Narrow Gauge Model	75cc to upper level	

Note 1 Bowman capacities are to filling level hole.

Note 2 250cc is 75% full. The air bleed screw is set at 290cc.

Note 3 225cc is to level of air bleed screw.

Note 4 150cc is 75% full, as recommended by Bassett-Lowke.

Caution: Always check water/meths consumption before reducing water quantity on Bassett-Lowke locomotives.

Table 2

Some Commercial 0 Gauge Steam Locomotive Thread Standards

Bowman 4-4-0 Tender Locomotive and 0-4-0T Large and Small (4-4-0 only)	Safety Valve Level Plugs Axles Body Bolts Cylinder Bolts Cyl. Pivot Shaft Connecting Rod Meths Tank Filler Meths Tank Stud	5/16"BSB (26tpi) 6 BA 5/32"Whit * 1/8" Whit,/6 BA 5 BA 7 BA 4 BA 1/4"BSB (26tpi) 5/32"Whit *
Bassett-Lowke Mogul 2-6-0, Enterprise and Super Enterprise	Safety Valve Lubricator Whistle	0 BA 2 BA 2 BA
Mamod 0-4-0T (Narrow Gauge)	Safety Valve	1/4"BSF (22 tpi)

* 5/32" Whitworth (32 tpi) is the Meccano standard thread.