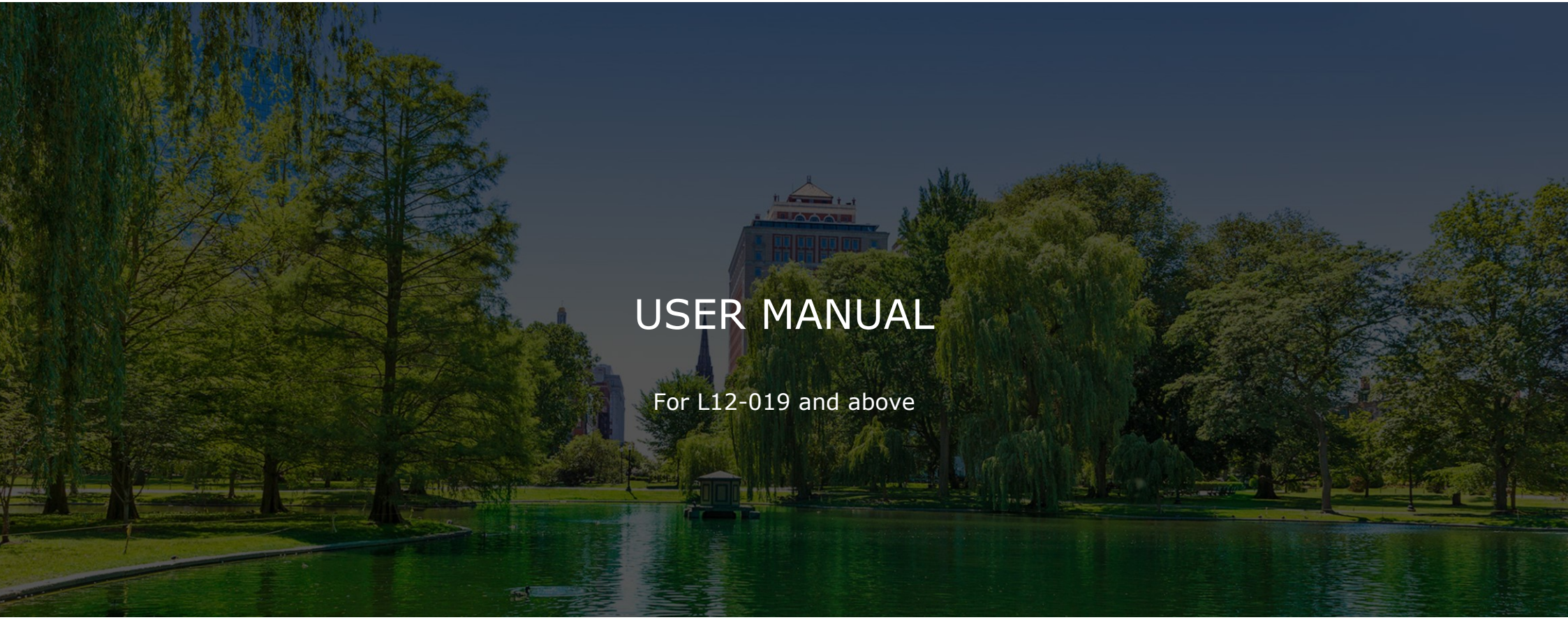
weedingtech

Foamstream L12

EPA Est. No 94946 – GBR – 1



USER MANUAL

For L12-019 and above

ENGLISH (EU/USA) – 16/03/2020 – ISSUE 5

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1 Safety Information

To ensure safety while operating the L12, please carefully read the following information.

1.1 Operator Attention

WARNING

- Read and understand this user manual before operating the L12.
- The L12 should only be used by trained operators.
- Proper PPE is to be worn at all times while operating the L12 (see section 3).
- Major repair work should only be carried out by professionally trained service engineers.

1.2 Carbon Monoxide Hazards

WARNING

- Boiler and engine exhaust contains poisonous carbon monoxide gas.
- Never run the L12 indoors, even if a door or window is open. **ONLY USE IN A WELL VENTILATED AREA.**
- Do not use the L12 in potentially explosive atmospheres.

1.3 Electric Shock Hazards

WARNING

- Do not operate the L12's electrical components with wet hands.
- Always ensure electric cables are in good condition.

1.4 Fire and Burn Hazards

WARNING

- Petrol/gasoline
- and diesel are explosive and flammable. Always ensure no sparks or fire sources are present while refueling.
- Do not refill petrol/gasoline or diesel while machine is in use.
- Clean up any overflowing fuel prior to turning on the L12.
- Never smoke while operating the L12.
- Do not touch the working components in the L12 while in use or immediately following use. Allow sufficient time to cool before servicing.
- Do not disconnect and change the lances too quickly as water may squirt out of the fitting.

1.5 Engine Fuel Warning

WARNING

- **NEVER PUT PETROL/GASOLINE IN THE DIESEL TANK**

2 Introduction

Thank you for purchasing the Foamstream L12!

IT IS IMPORTANT THAT ALL OPERATORS READ AND UNDERSTAND THESE INSTRUCTIONS BEFORE USING THE MACHINE

Having read these instructions, the operator will:

- Understand how the L12 works
- Identify key components in the L12
- Know how to carry out pre-start and start-up procedures
- Observe safe operating practices
- Be able to effectively operate the L12
- Be able to shut down and clean the L12
- Be able to perform basic maintenance and troubleshooting tasks

PLEASE KEEP THESE INSTRUCTIONS IN A SAFE PLACE FOR FUTURE REFERENCE

3 Important information

The following PPE (Personal Protective Equipment) are recommended when operating the L12:

- Eye protection is required when handling Foamstream® concentrate
- Gloves are required as the lance assembly will get hot
- Safety Footwear suitable for working in the areas concerned is recommended
- No specific protective clothing is required, although use of overalls and a HI-Viz vest is suggested as best practice.

IT IS THE RESPONSIBILITY OF THE OPERATOR TO WEAR APPROPRIATE PPE

Never operate the machine without checking that there are adequate supplies of clean petrol/gasoline, clean diesel, clean water, and clean Foamstream® concentrate in the appropriate tanks.

The L12 produces **VERY HOT** water. This can cause serious burns and injury if used incorrectly.

Never point the lance at people or animals as this machine can operate at high temperatures and high pressures.

All personnel operating a L12 machine must be deemed competent to do so and must be adequately trained. A copy of the training record is available on demand.

Always check the L12 for any damage before use. Damaged cables, hoses or connections must be reported immediately, and the machine taken out of use until repairs have been completed.

Use only genuine Weedingtech spare parts and Foamstream® consumables. This will ensure the best performance of your machine and maintain the warranty of the unit.

The L12 must never be modified, safety interlocks bypassed, or settings adjusted (unless specified in these guidance notes) without Weedingtech's written consent.

Ensure that the L12 is placed in an area where there is adequate ventilation when in use.

Ensure that the consumable liquid (foam concentrate) is not subject to temperatures below 5 degrees centigrade at any time.

Ensure that both the L12 and its water tank are securely attached to the transport vehicle. It is the responsibility of the vehicle driver to ensure that any load is secure and that any payload restrictions are observed. You can refer to section 14 for more information on transport.

NEVER OPERATE THE L12 WITHOUT FOAMSTREAM® CONCENTRATE

4 Product description

The L12 weed control unit consists of:

- Foamstream® L12
- Water tank
- Hose reel (20 metres/65.6 ft)
- Weeding lance

The L12 houses a diesel-powered boiler, a petrol/gasoline-powered engine, itself connected via belt drive to a piston pump and an alternator, a 32 litres/8.45 gal. diesel tank, and a slot for a Foamstream® concentrate can.

Water is pumped into the boiler, and when it reaches 95 degrees centigrade, the indicator light goes green, indicating that it is hot enough for weeding. The water flows from the boiler (12 l/m @ 12 bar – 3.1 gpm @ 174 PSI) and a venturi mixer opens to allow Foamstream® concentrate to be injected at a ratio of approximately 99.5 parts water to 0.5 parts concentrate. Air is added to the water and Foamstream® mix as it exits the lance to create the foam.

Figure 1 - L12

The L12 has been designed to require no manual input or adjustment (See section 0 for operating details).

A safety valve and over-temperature sensor ensure that internal pressure and temperature will not exceed 120 bar/1740 PSI or 120 degrees centigrade/248 F in the event of a system fault.

Filters are fitted to the diesel, water and foam systems to ensure supplies are kept clean and free from debris. These needs to be checked daily (see section 6). The engine has an integrated petrol/gasoline filter.
The L12 has an open frame that allows for easy access for maintenance and visual checks. The electrical system is

protected in the control box behind the front panel. The transmission system links the engine to the main water pump and the alternator. The alternator charges the battery and provides power to the boiler.

The L12 requires a water tank, providing an unrestricted water supply. Between any water tank and the L12, there are two hydraulic connections (water supply, water return) and one electrical connection (water sensor).

An automatic hose reel is located inside the unit to allow the 20 metres hose to be stowed safely when the L12 is not in use. The hose comes off the top of the reel and is connected to the lance via a quick-release connection.

L12 Specifications	
HEIGHT (mm / ft)	1070 / 3.51 (no light) 1230 / 4.03 (with light)
WIDTH (mm / ft)	1040 / 3.42
DEPTH (mm / ft)	980 / 3.22 or 1950 / 6.40 (with tank)
WEIGHT (kg / lbs)	360 / 794 - EMPTY 425 / 937 - FULL
WATER	780 LITRES / 206 GAL.
DIESEL	32 LITRES / 8.45 GAL.
PETROL/GASOLINE	6.1 LITRES / 1.6 GAL.
FOAMSTREAM	WHOLE CAN 25 KG / 55 LBS
ENGINE OIL	1.1 L. / 0.29 GAL SAE **MINERAL** 10W40
PUMP OIL	0.3 L. / 0.08 GAL. SAE 10W40
FLOW RATE	12 LPM / 3.1 GPM
OPERATING PRESSURE (BAR / PSI)	12 / 174 WEEDING LANCE 100 / 1450 PRESSURE LANCE
FOAM OPERATING TEMPERATURE	95 – 110 °C 203 – 230 °F (WEEDING/HOT MODE)
UNLOADER VALVE	100 BAR / 1450 PSI
SAFETY VALVE	120 BAR / 1740 PSI
OVER TEMP. CUT-OUT	120 °C / 248 °F
ENGINE (PETROL/GAS.)	8.7 kW @ 3600 RPM; RUN @ 2000 RPM (~5.3 kW)
BOILER (DIESEL)	88 kW; 12V DC
PUMP	12 LPM (3.1 GPM), 170 BAR (2465 PSI) @ 1450 RPM; 4kW
ALTERNATOR	14V, 33A @ 1750 RPM; RUN @ 2380 RPM
PETROL/GAS. CONS	1 LPH / 0.27 GPH
DIESEL CONSUMPTION	7 LPH / 1.85 GPH
FOAMSTREAM V4 CONS.	2.4 LPH / 0.64 GPH
FOAMSTREAM + CONS.	4 LPH / 1.06 GPH
AMBIENT OPERATING TEMPERATURE RANGE	AIR 5– 40 °C / 41 – 104 °F WATER 5 – 60 °C / 41 – 140 °F

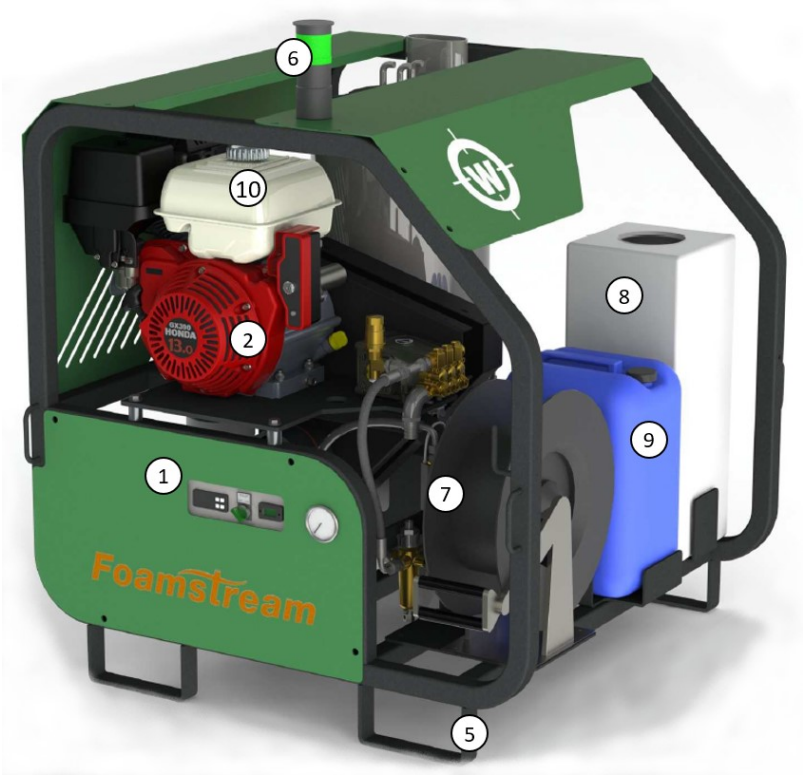


Figure 2 – Perspective view of the L12

No.	Part	Description
1	Control Panel	Includes: - Pressure gauge (main water line, after venturi) - Tachometer (engine hours when off, RPM when on) - Digital thermostat, Novus N321 connected to PT100 sensor - 2 position main switch: Cold and Hot (boiler on)
2	Engine	Honda GX390 with speed fixed
3	Water tank	780 litres/206 gal. as standard. Not represented
4	Lance	Not represented
5	Feet/forklift slots	Forklift can also be used from sides
6	Indicator light	Green light – illuminates when foam is hot enough to weed
7	Hose reel	Automatic hose-reel with 3/8” hose
8	Diesel tank	Diesel tank with low-level sensor
9	Foamstream can	Can is placed in slot, and hose outlet is fitted onto cap
10	Petrol/Gasoline tank	

5 FOAMSTREAM®

5.1 How FOAMSTREAM® kills weeds

Foamstream® uses heat to kill weeds. Water is heated to near boiling point and then mixed with the Foamstream® concentrate to produce foam before being applied. The foam blanket ensures that the heat is held on the plant so that the weeds experience hot, killing temperatures for a few seconds. Figure 6 below explains and compares the process to hot water and steam.

5.2 Indicators

The lances can apply large volumes of water and foam and can be used to kill larger weeds. Foam cover, and hence heat retention on weeds, is easier to achieve on prostrate plants that are near the ground. Tall plants should be trodden down either by foot or by using the lance outlet, to aid foam cover and heat retention.

Figure 3 - Foamstream during treatment

Immediately after treatment, weeds will go dark green and limp. This indicates that the machine is operating properly. The weeds will die; this becomes more obvious within the next one to seven days (depending on species and weather). If weeds fail to go limp, temperatures may be too low or treatment speed too high.

Figure 4 - Weed immediately after treatment with Foamstream

Figure 5 - Weed 24 hours after treatment with Foamstream

If weeds go brown immediately after treatment, this could indicate that treatment speed is too slow and excessive heat is being applied.

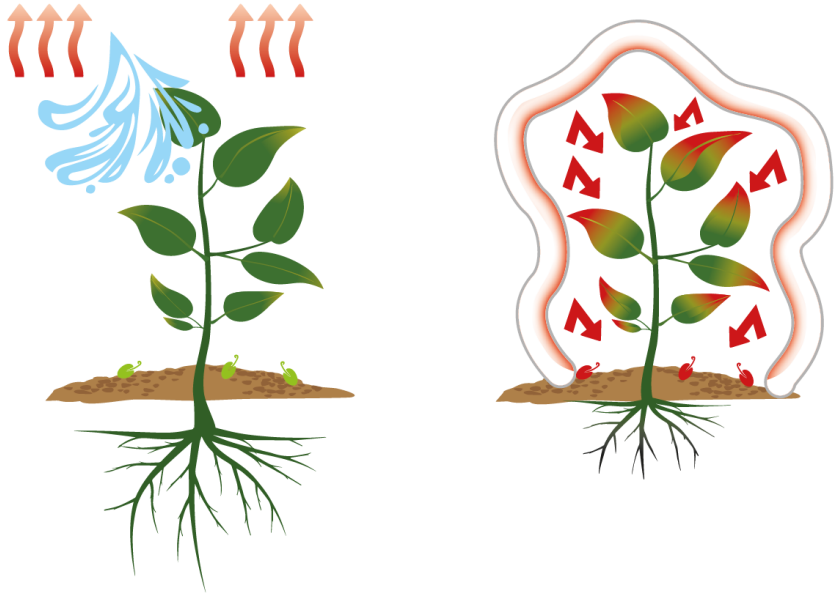


Figure 6 - Foamstream's triple action

Steam / Hot Water	Foamstream
Kills the leaves	Kills weeds
No effects on seeds	Sterilises seeds
Very weak effect on roots	Damages the root

In general, annual weeds are easier to kill than biennial or perennial ones. Weed species that originate from desert or semi-arid regions are more heat tolerant and will need a slightly prolonged treatment period compared to other species.

Biennial or perennial weeds usually have parts protected against heat (especially regenerative parts under the soil, the Rhizome). Foamstream is a contact application, it will kill foliage, but many perennial and biennial plants will regenerate. The number of repeat treatments required to completely kill weeds depends on the species and their size.

5.3 Caution – poisonous weeds

Some poisonous weeds, such as common ragweed (*Senecio jacobaea)* may still be attractive to animals after treatment with Foamstream. When treating any area where animals are likely to graze after treatment with Foamstream, check for the presence of such potentially toxic weeds and remove them or keep out of reach of animals that are at risk.

5.4 The effect of the system on plants

The L12 has been designed to operate in an urban environment and control weed growth on both hard surfaces and cultivated land. These weeds may be in, at, or around kerbs and channels, footpath edges, driveways, boundaries, obstacles etc.

Within these environments there are various plant species that need to be controlled. These species may vary in type and growth patterns depending on the specific geographic location.

The system, through its unique operation, delivers a plant kill based on thermal activity penetrating and breaking down the cell structure of the plant.

With varying plants in the target area, it is important for the operator have some knowledge of the weed types, sizes and

ages that they are treating, as this impacts on the speed of operation to deliver an effective kill.

For maximum efficacy, it is important that all weeds in the target area are in contact with the hot foam. Either flatten tall weeds i.e. by treading or use of the lance or ensure that the stems are 'ring barked' (completely surrounded by a blanket of foam). The density of the plants and foliage is a very important aspect for the operator to be aware of, as this also impacts on the speed of operation. It should be noted:

- As the height and/or density of the target plants increases, the speed of operation will be slower.
- In a situation where regular treatment of the area is part of a maintenance programme the weeds will generally be easier to treat as regrowth should be reduced.
- Regular treatment also allows increased speed of operation, as the volume of target plants to kill will be minimised on each maintenance cycle.

6 Pre-start checks

THESE CHECKS MUST BE COMPLETED BEFORE EACH START OF THE L12. ANY FAULTS MUST BE RECTIFIED BEFORE THE L12 IS SWITCHED ON.

- ✓ The L12 is in good condition and securely attached to the transport vehicle
- ✓ The L12 water tank is securely attached to the transport vehicle
- ✓ Water tank is full of clean water
- ✓ Water filter is clean and free from debris
- ✓ Air intakes (boiler and engine) are clear of debris
- ✓ The lance, hose reel and hose are securely connected and free from damage
- ✓ Lance wear strips are not excessively worn
- ✓ The water inlet, return hose and water level sensor are connected
- ✓ Pipe/hose routes are clear of sharp edges and hot surfaces
- ✓ There are no signs of leaks from any pipe or connection
- ✓ Petrol/gasoline tank is full of clean petrol/gasoline fuel
- ✓ Diesel tank is full of clean diesel fuel
- ✓ Diesel filter is clean and free from debris
- ✓ The Foamstream® concentrate has not been subject to temperatures below 5°C/41°F and frozen or separated
- ✓ Foamstream® concentrate can is in place and connected
- ✓ Foamstream® filter is clean and free from debris
- ✓ Engine engine oil level is correct
- ✓ Pump oil level is correct
- ✓ Engine and boiler exhaust are secure and clear of debris and obstruction
- ✓ Water feed valve is connected and in the ON (inline) position
- ✓ Air has been bled from water system

DO NOT PUT PETROL/GASOLINE INTO THE DIESEL TANK

7 Start procedure

- Complete pre-start checks (see section 6)
  - Fluids filled-up
  - Main water valve open
  - Filters clean
- Connect the chosen lance (keep the trigger pressed)
  - Weeding lance (for weeding) OR
  - Power lance (for cleaning)
- Start the engine by:
  - Turning the key (1 on Figure 7)
  - Or if cold, use the choke and turn the key (2 on Figure 7)

If the engine won't start, refer to the troubleshooting guide of the manual

The pump will now be on. It may require up to a minute to purge the lines of air before full flow is present. When the trigger is pressed, cold foam will come out.

- Turn the boiler switch to "ON" position (3 on Figure 7). The switch will illuminate green, and the boiler will heat up whenever the trigger is pressed.

The boiler is only active when the trigger is pulled

When the boiler switch is on the 'ON' position, the trigger needs to be pulled for the boiler to heat-up.

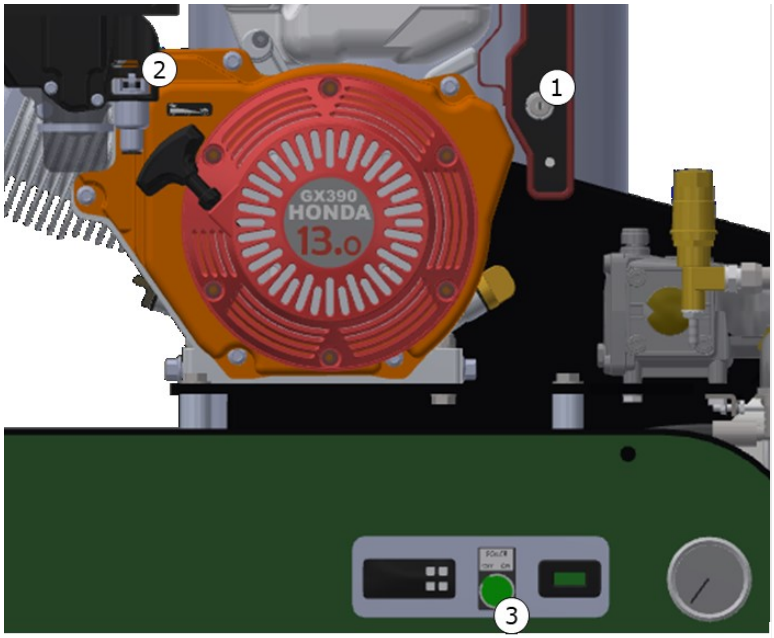


Figure 7 - Details of the switches of the front panel

- Keep the trigger pressed until tower light illuminates green (this shouldn't take longer than 90 seconds). This indicates that the temperature has reached 85C/185F and that the machine is ready to kill weeds.

For cleaning (using power lance):
It is possible to operate in both boiler "OFF" or boiler "ON" modes, i.e. with cold or hot water.
The temperature in boiler "ON" mode is not critical so the state of the green light need not be considered.

8 Using the L12

Once operational, the L12 is designed to be simple to use.

8.1 GREEN TOWER LIGHT (and use of trigger)

In normal weeding operation, the green tower light will be illuminated when the water is of sufficient temperature. Whenever the user presses the trigger after a release, the green light must be checked to ensure it is on. This may take a few seconds depending on the length of release.

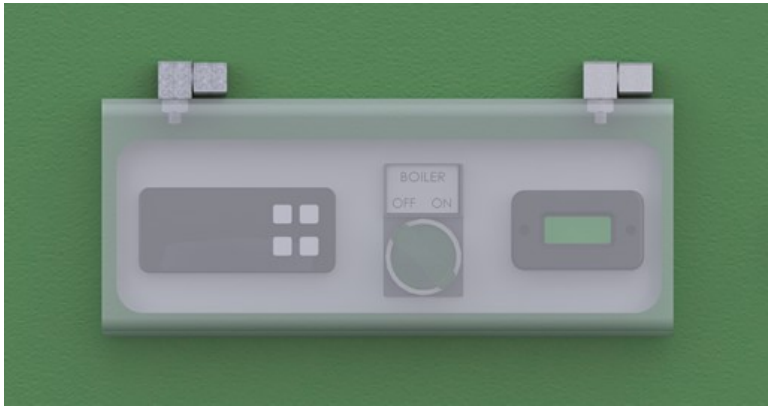


Figure 12 – Details of the front panel

8.2 BOILER SWITCH

When the boiler is on, the switch on the front panel illuminates green.

The user can switch to using cold water (for cleaning with the power lance), by turning this switch off at any point. To cool the boiler and water emitted from the lance, keep the trigger pressed and wait for up to 1 minute.

8.3 THERMOSTAT

The thermostat indicates the water temperature at the outlet of the boiler, it can be switched from Celsius to Fahrenheit.

8.4 TACHOMETER

The tachometer shows the RPM of the engine when the engine is on, and the total hours of the engine when it is off.

8.5 PRESSURE GAUGE

The pressure gauge shows the pressure of the water in the system after the foam venturi. This is the pressure in the boiler, hose and lance.

8.6 CHANGING LANCE

It is possible to change the lance whether the machine is on or off. To change the lance, release the lance trigger and pull back the quick release. The lance will come off if pulled. When attaching the new one, pull back the quick release, push lance into handle, and release. Make sure it is attached. Trigger is now ready to use with new lance.

Make sure not to lock the trigger before pulling the quick release on the front of the trigger head, as pictured below.

HIGH RISK OF BURN

VERY HOT WATER CAN BE RELEASED IF THE TRIGGER IS PRESSED WHEN NO LANCE IS ATTACHED

8.7 AUTOMATIC PROTECTION

The L12 automatically responds to protect itself under certain conditions. These include:

- Low diesel – the L12 will shut down completely
- Low water – the L12 will shut down completely
- Low petrol/gasoline – the L12 will shut down completely
- Low engine oil – the L12 will shut down completely

In the above conditions, whereby the machine has run low on input fluids, the user simply has to re-fill the required fluids and then can restart the machine as usual.

The below conditions indicate that there may be a problem with the machine. Refer to the troubleshooting guide.

- High boiler outlet temperature (over 120C/248F) – the L12 will shut down the boiler.
- High system water pressure (over 120 bar/1740 PSI) – the safety valve will open.

THE L12 SHOULD BE SWITCHED OFF AND CHECKED BY A COMPETENT SERVICE ENGINEER IF IT DOES NOT OPERATE AS EXPECTED.

9 Foamstream® application (killing weeds)

To effectively control vegetation with the herbicide-free Foamstream® system, you must co-ordinate all the different elements that give a successful result. If one element is not functioning properly, the desired result will not be achieved.

For effective results the Foamstream® system requires the:

- Correct volume
- Correct temperature
- Correct method
- Correct quantity of foam agent

This section looks at the speed and method of application.

10.1 Hose reel

The L12 unit is fitted with an automatic hose reel which contains 20 m / 65 ft of hose as standard. The hose comes off the bottom of the reel and is connected to the lance with a quick-release trigger gun.

Only remove as much hose as is required.

Once finished, rewind the hose onto the reel neatly.

10.2 Speed

Operators will average approximately 2 - 4 kilometres per hour / 1.2 – 2.5 mph, when proficient at applying the Foamstream® with the L12. Foamstream® and the L12 are unaffected by weather, thus ensuring overall productivity each week is consistent.

DO NOT HURRY!

If the operator moves too quickly over the vegetation, the required volume of hot water and foam may not have penetrated or been applied correctly. Total vegetation control will not have been achieved.

10.3 Use of the lance

To kill weeds effectively, the lance head must be no more than 25 mm / 0.08 ft above the ground at all times. If possible, keep the lance head in contact with the ground. While every element of the treatment is important, the most critical aspect is to ensure the lance head is not lifted from the targeted area.

Control of vegetation for up to 90 days will only be achieved if the temperature measured at the lance head does not fall below 96°C. If the lance head is more than 30mm above the ground, a less than acceptable result may be achieved due to the rapid temperature loss.

It is recommended the operator keeps the trigger pressed, if possible. This maintains constant flow of hot water and foam and ensures that they are leaving the lance at the correct temperature.

Whenever the trigger is pressed after a release, there may be a short period (in seconds) when the temperature needs time to warm up. Keep the trigger pressed, and when the tower light goes green the water has warmed up to weeding temperature.

When moving the lance head from one treatment zone to another, release trigger and ensure the hot foam is not applied to sensitive plant areas.

If there is a reduction in foam produced from the lance head, you will not achieve the desired kill. You can check this by lifting the lance and observing the water flow.

10.4 Treatment of thick weeds

The Foamstream system works by penetration of heat into plant cells. In cases of dense growth and dense swards of grass (especially species such as kikuyu), progress will be slower as a greater volume of liquid (thermal energy) is required to ensure a result.

10.5 Confirmation of treatment

With practice, operators will become familiar with determining whether weeds have been treated correctly.

Broad leaf weeds will go floppy and wilt (similar to boiled cabbage). In most cases these will go darker in colour.

Grasses: usually, grasses immediately lighten in colour and flatten to the ground. This can be difficult to observe when using hot foam.

Moss will go bright green.

In all cases, a distinctive smell (similar to cooking spinach) also assists to confirm a result.

VISUAL CONFIRMATION THAT THE TREATMENT HAS BEEN SUCCESSFUL IS ESSENTIAL.

10.6 Correct posture

When using the equipment for several hours per day it is important that operators adopt the correct posture and technique.

Remember: it is the heat that controls the vegetation.

When treating straight stretches of roads or parks, use just the trigger hand to guide the lance. This keeps your back upright and not twisted and you are not encouraged to push down with the other hand. Optional wheels are available.

Only use the other hand when changing direction or raising the lance.

When walking, swap trigger hands every so often to rest the muscles.

Videos are available on www.weedingtech.com for proper treatment speeds.

11 Shut-down procedure

Upon completion of work, or when taking a long break (more than 10 minutes), the unit must be shut down correctly:

- Switch boiler OFF
  - The switch will no longer illuminate green.
- (Optional - recommended) Keep lance trigger pressed ON to cool boiler
  - As the boiler cools, the main green light will go off.
  - Wait until temperature on thermostat drops below 60C/140F.
  - Water will be flowing from lance.
- Turn the engine OFF
  - The whole machine turns off.
- Close the valve to the main water tank

You can also shut the machine down by turning the engine off directly, without waiting for the boiler to cool down.

12 Basic fault finding

The table below lists basic faults which can be diagnosed and rectified by a competent L12 operator. Please refer to the training documentation provided during training.

BEFORE BEGINNING ANY WORK ENSURE THE WEEDINGTECH L12 HAS BEEN **SWITCHED OFF**.

WARNING: WATER IN THE L12 MAY BE HOT.

THE L12 SHOULD BE SWITCHED OFF AND CHECKED BY A COMPETENT SERVICE ENGINEER IF THE OPERATOR IS UNABLE TO DIAGNOSE AND RECTIFY A FAULT USING THE TABLE BELOW, OR IF A FAULT PERSISTS.

	SYMPTOM		CAUSE	REMEDY
1	Engine not turning	1.1	Low battery voltage	Check battery voltage (should be 14v). If low, then recharge it.
				If necessary, use the pull-start.
				Battery not charging, see 6
		1.2	Loose / damaged wiring	Check battery connections and wiring.
2	Engine turning but not firing	2.1	Cold engine	Use the choke
		2.2	No petrol/gasoline	Re-fill tank
		2.3	Low oil	Add oil (if low, engine is prevented from starting)
		2.4	No diesel	Re-fill diesel tank (if low, engine is prevented from starting)
		2.5	Water level sensor detecting no water	Re-fill water tank (if low, engine is prevented from starting)
				Ensure level sensor connected
		2.6	No spark	Remove, clean or replace spark plug

	SYMPTOM		CAUSE	REMEDY
3	Boiler switched off with engine on, but no (or low) flow from lance	3.1	Trigger off	Press trigger
		3.2	Main water valve shut	Open valve
		3.3	No water in tank	Re-fill tank
		3.4	Leak	Ensure all fittings are tight
		3.5	Air in water inlet	Wait for minute while air is bled from system.
		3.6	Blocked water filter	Clean filter
		3.7	Unloader valve set loose	Tighten unloader valve until when using pressure lance, there is 100bar/1450 PSI in line and trickle (5%) of return.
		3.8	Belt is loose on pump	Open belt housing and check tension on belts. Tighten if necessary.
		3.9	Valves in pump damaged	Open pump head and reset valves or replace them.
		3.10	Accelerator arm on engine has been moved, reducing RPM & flow	Adjust arm and test. Options are: Engine RPM using tachometer (2000), flow rate (12 lpm, 3.1 gpm), or alternator voltage (14V). Tighten screw.
		3.11	Safety valve set loose, discharging flow	Tighten safety valve until when using pressure lance, there is 100bar/1450 PSI in line and then tighten a further full turn.

	SYMPTOM		CAUSE	REMEDY
4	Boiler switched on with engine on, but boiler does not start	4.1	No flow, see 3	See 3
		4.2	Faulty flow switch	Check by removing and checking not blocked. Then turn upside down and check resistance. Replace if necessary.
		4.3	Faulty pressure switch	Replace pressure switch.
		4.4	No back pressure from lance	Check lance is fitted and with correct and not worn-out nozzles.
				Check that the pressure is at least 5 bar.
				Check that there are no leaks
		4.5	Loose contacts on boiler diesel pump	Ensure tightly connected.
		4.6	Temperature limiter switch (snap switch) has been triggered	Reset or replace and then on restart ensure there is full (12lpm) flow through the boiler. If not, see 3
		4.7	Valve in diesel pump stuck (open or closed)	Open solenoid valve on diesel pump to confirm and replace the coil for the valves
		4.8	Boiler electrodes misaligned	Open top of boiler to expose electrodes and ensure no more than 5mm from each other and positioned over the nozzle tip. Replace if necessary.

	SYMPTOM		CAUSE	REMEDY
5	Green tower light does not come (or stay) on, indicating that the boiler is not reaching temperature	5.1	Boiler not starting, see 4	See 4
		5.2	Air in diesel lines (reducing fuel flow rate into pump)	Ensure all hoses and clips are tightly fitted.
				If necessary, disconnect and force air out of lines before reconnecting.
		5.3	Low diesel pressure	Set the diesel pressure to 14 bar/203 PSI
		5.4	Coil in boiler is covered in thick layer of soot	Drop a soot-breaker into the boiler to clean the coil. Then, measure the emissions to help ensure air and diesel set correctly.
		5.5	Blocked diesel nozzle	Replace diesel nozzle in boiler
		5.6	Thermostat setting is incorrect, so light does not illuminate	Reset by holding on 'P' button for 1 second until 'SP1' appears. Then adjust up and down. Press 'P' again to get to 'SP2', then again to go leave menu. SP1 should be 107. SP2 should be 85.
		5.7	Accelerator arm on engine has been moved, increasing RPM & flow	Adjust arm and test. Options are: Engine RPM using tachometer (2000), flow rate (12 lpm/3.1 gpm), or alternator voltage (14V). Tighten screw.
		5.8	Valve stuck in diesel pump, see 4.8	See 4.8

	SYMPTOM		CAUSE	REMEDY
6	Battery not charging	6.1	Belt is loose	Open belt housing and check tension on belts. Tighten if necessary.
		6.2	Alternator not charging the battery	Replace alternator
7	Water but no (or poor quality) foam from lance	7.1	No foam	Replace foam can
		7.2	Blocked foam filter	Clean foam filter
		7.3	Blocked foam hose	Remove kinks and debris from hose
		7.4	Blocked venturi	Remove and clean the venturi (including check valve, restrictor and two nozzles)
		7.5	Line pressure is higher than 30 bar	Check the correct (weeding) lance is connected.
				Check there is no blockage between the venturi and the lance (check the main hose for kinks)
		7.6	Using the Foamstream Plus restrictor with Foamstream V4	Change restrictor (0.6mm/0.024 in.)
8	Excessive foam consumption	8.1	Using the Foamstream V4 restrictor with Foamstream Plus	Change restrictor (0.4mm/0.016 in.)
		8.2	Restrictor has come loose	Check O-rings on restrictor and push back in

	SYMPTOM		CAUSE	REMEDY
9	Flow out of lance too hot – steam and/or high thermostat reading	9.1	Thermostat set too high, see 5.6	See 5.6
		9.2	Reduced flow, see 3	See 3
		9.3	Valve stuck in diesel pump, see 4.8	See 4.8
		9.4	Temperature limiter switch (snap switch) failed	Check operation of switch (and perhaps replace), see 4.7
10	High pressure (>16bar weeding lance, >100bar power lance)	10.1	Wrong lance connected	Connect one of the authorised lances
		10.2	Kink in or damage to main hose	If hose is kinked, unkink it. If necessary replace it.
		10.3	Unloader valve set too tight	Loosen unloader valve until when using pressure lance, there is 90-100bar in line and trickle (5%) of return.
		10.4	Malfunctioning pressure gauge	Replace pressure gauge
		10.5	Blocked nozzle in lance	Expose nozzle from lance and clean before re-assembling lance
11	Low pressure (<10bar weeding lance, <90bar power lance)	11.1	Low flow, see 3	See 3
		11.2	Low back pressure from lance, see 4.4	See 4.4

13 Service checks and intervals

The engine hours on the L12 are readable on the tachometer on the front panel (when the engine is off). A high-level maintenance schedule is detailed on the next pages but for more information ask your distributor about planned maintenance.

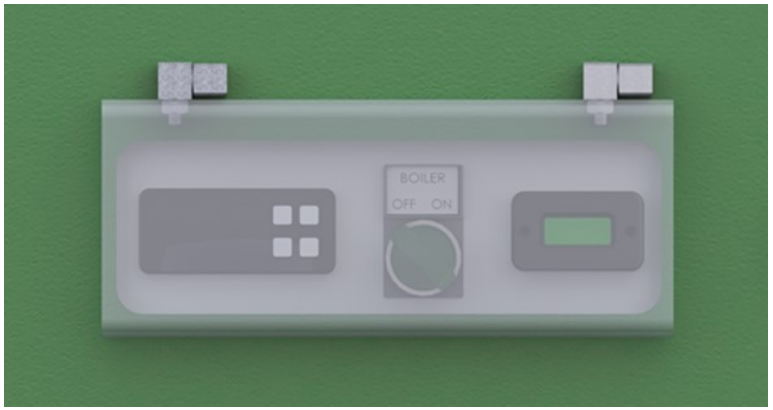


Figure 8 – Close-up of tachometer (right-hand side), showing engine hours

BEFORE BEGINNING ANY WORK ENSURE THE WEEDINGTECH L12 HAS BEEN SWITCHED OFF

Procedure	Area		10 h/ daily	20h/First month	50h/monthly	100h/ 6 monthly	250h/Yearly	500h/2 Yearly	1000h/Yearly	1500h/2 Yearly	5000h/3 Yearly
Honda GX390	Engine oil	Check level	■								
		Change		■		■					
	Air filter	Check	■								
		Clean			■						
	Fuel line	Check								■	
										■	
	Sediment cup	Check				■					
		Clean				■					
	Charge voltage	Check			■						
	Alternator/water pump/ belt stretch	Check				■					
		Replace									■
	Spark plug	Check				■					
		Clean – re-adjust				■					
	Valve clearance adjustment	Clean				■					
						■					
	Spark arrestor	Clean				■					
						■					
	Fuel tank and strainer	Clean					■				
							■				

Boiler	Fuel filter	Check	■								
		Replace						■			
	Fuel nozzle	Check				■					
	Electrode gaps					■					
	Nozzle filter					■					
	Electrical connections						■				
	Descale coil	Clean						■			
	Clean coil (soot)						■				
	Fuel pump filter						■				
	Electrical connections							■			
Water pump	Water filter	Check	■								
	Oil level/condition		■								
	Smooth pump operation		■								
	Pressure hoses and fittings				■						
	Oil/Water leaks		■								
	1St oil change	Replace			■						
	Oil change						■				
	Valve and plungers								■		
	Pump gaskets								■		
Other	Correct pressure	Check	■								
	Frame integrity				■						
	Pressure gauge					■					
	Tanks					■					
	Guns, jets and accessories					■					
	Battery connections					■					
	Hoses and fittings						■				
	Serial no/spec plate	Replace					■				

14 Loading and handling

Before handling or lifting the L12, ensure that it is fully disconnected from the:

- Water tank (inlet hose, return hose, and level sensor cable)
- Lance (and the hose is retracted onto reel)

The L12 is designed to be lifted from below using a forklift or similar machinery. It is also possible to lift it from above using straps or chains passed through the chassis.

CARE SHOULD BE TAKEN WHEN LIFTING THE L12

ONLY USE LIFTING MACHINERY AND STRAPS/CHAINS CAPABLE OF LIFTING MORE THAN 400 KG / 882 LBS

14.1 On-vehicle set up

It is recommended that the L12 has its water tanks placed at its rear.

- The left of the L12 requires access to the water filter and has the engine exhaust, which cannot be obstructed.
- The right requires access for the input fluids.
- The front requires access for controls and hose.

Before driving, the user should make sure that the unit and the water tank are appropriately strapped or bolted to the vehicle.

Figure 9 – Example of strapping of the L12 to a vehicle

15 Schematics

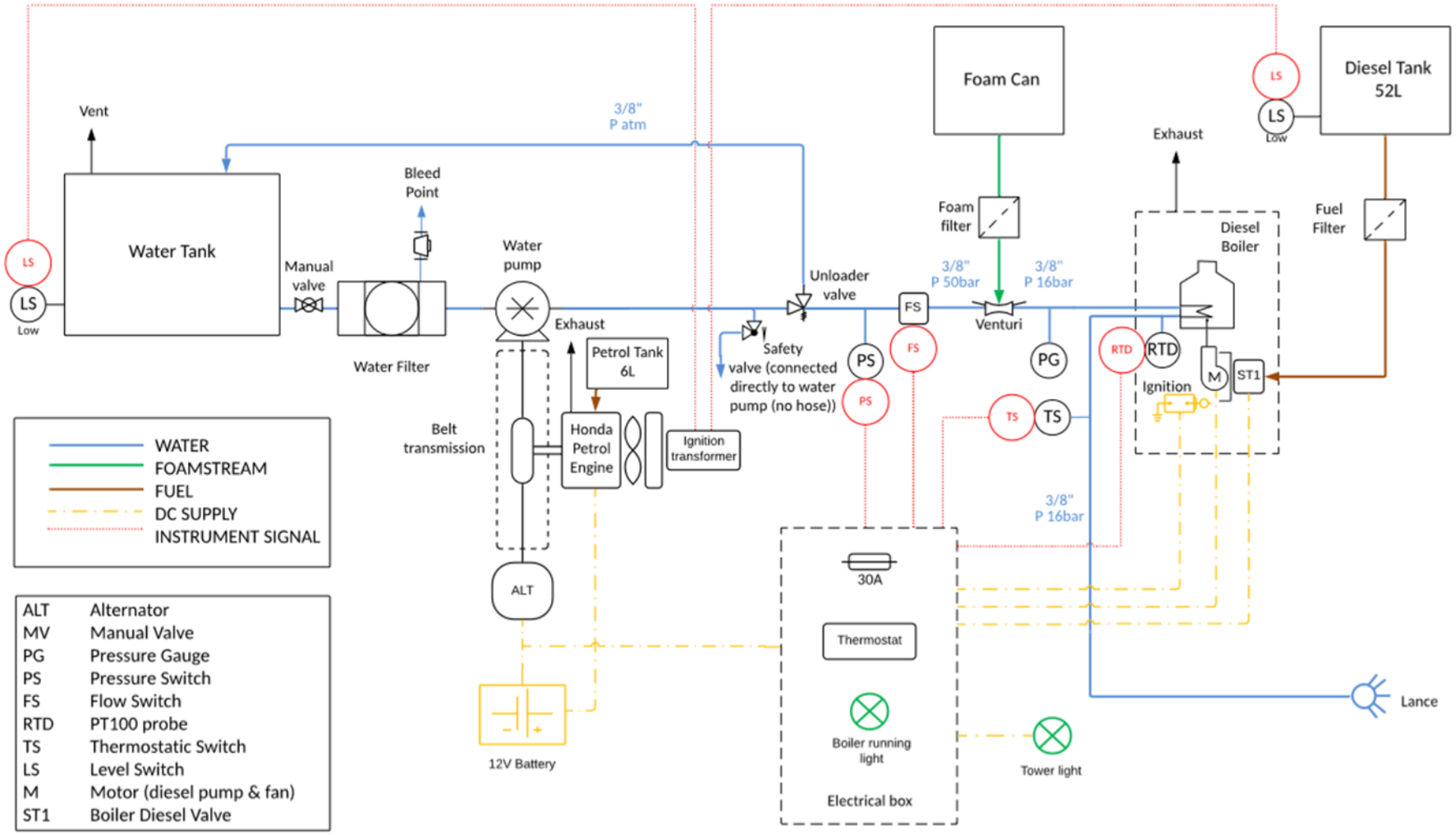
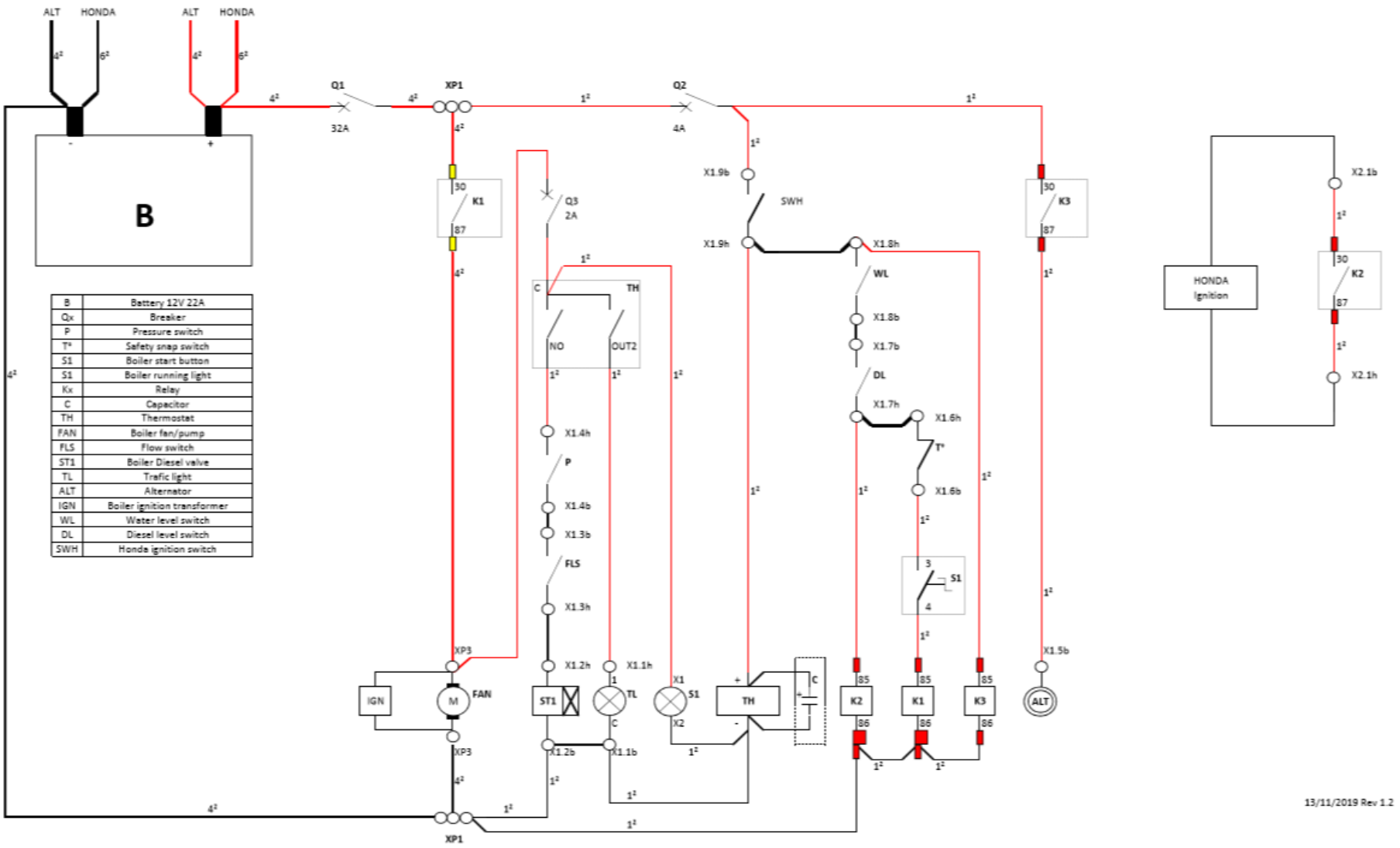
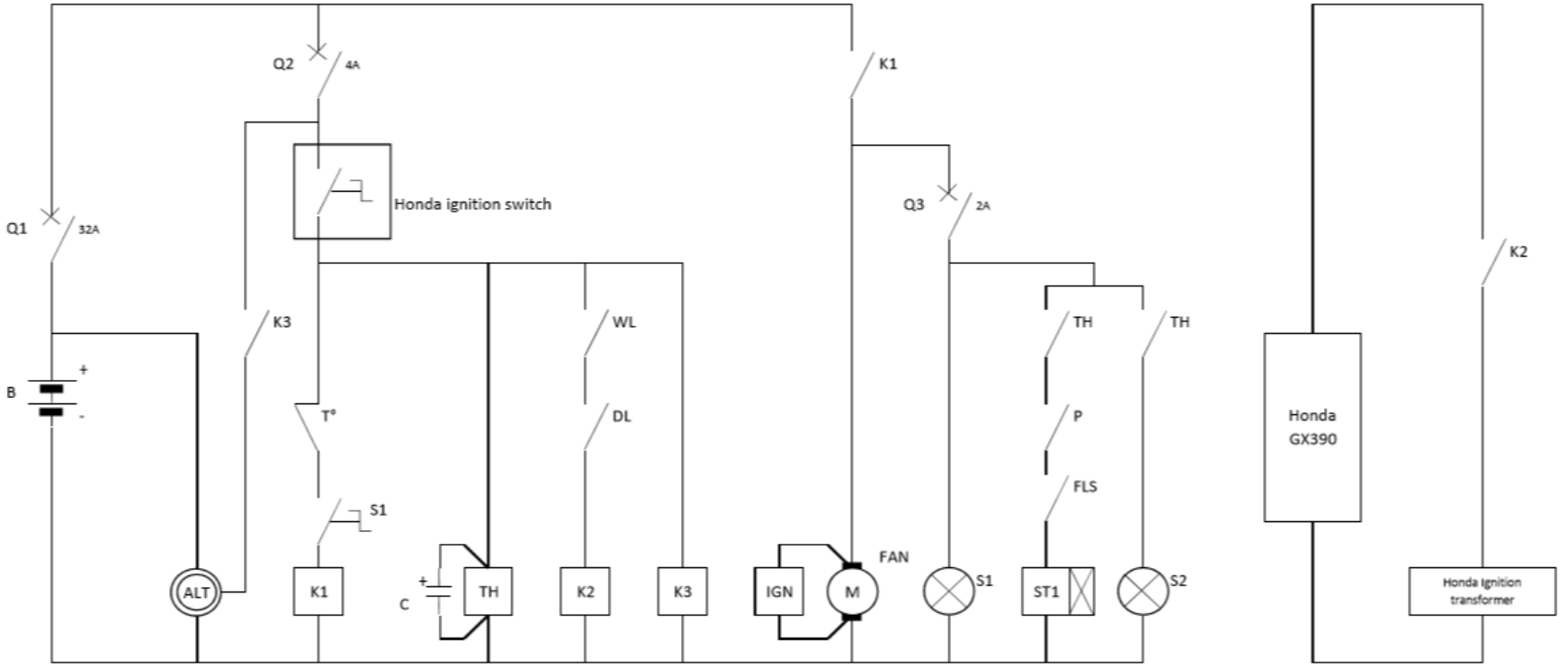


Figure 10 - L12 P&ID



B	Battery 12V 22A
Qx	Breaker
P	Pressure switch
T°	Safety snap switch
S1	Boiler start button
S1	Boiler running light
Kx	Relay
C	Capacitor
TH	Thermostat
FAN	Boiler fan/pump
FLS	Flow switch
ST1	Boiler Diesel valve
TL	Trafic light
ALT	Alternator
IGN	Boiler ignition transformer
WL	Water level switch
DL	Diesel level switch
SWH	Honda ignition switch

Figure 11 – Wiring diagram rev 1.2



B	Battery 12V 22A
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Kx	Relay
TH	Thermostat
C	Capacitor
FAN	Boiler fan/pump

WL	Water level switch
DL	Diesel level switch
FLS	Flow switch
ST1	Boiler Diesel valve
S2	Trafic light
IGN	Boiler ignition transformer
ALT	Alternator

12/11/2019 Rev 1.2

Figure 12 – Electric diagram rev 1.2

16 Warranty

(a) The following is an inexhaustive summary of relevant aspects of the standard terms and conditions of Weeding Technologies Ltd ("WTL") and is subject to those terms and conditions and to any special terms and conditions agreed between the parties. Where this summary and WTL's standard terms and conditions conflict, those terms and conditions take precedence (and any special terms and conditions take precedence both over WTL's standard terms and conditions and over this document). You are advised to read the full terms and conditions including so as to take note of further exclusions of liability.

(b) In no case (without express written agreement, and save as required by law) does WTL accept any liability towards any person other than the person ("you") who originally made the purchase from WTL or in respect of any alleged defect not notified by you to WTL within 12 months from delivery.

You are notified that the standard warranty period given by the manufacturer is 12 months from delivery.

(c) You must inspect all goods thoroughly with 7 days of delivery. Subject to the rules set out in section 3 below, any claim must be notified to WTL within 7 days of delivery or (subject to clause (b) above) in the case of any defect which is not reasonably apparent on inspection then within seven days of the defect coming to your attention (or of the date when the defect reasonably should have been apparent to you, if earlier).

(d) Subject to section 3 below, WTL will have no liability if you do not comply with the above.

(e) WTL's options, in cases where it is liable, include repairing or replacing defective goods and allowing you credit for them. If WTL exercises such an option it has no further liability. In any event, the liability of WTL is limited to parts, freight and a limited amount of labour as set out in WTL's standard terms and conditions. Labour in excess of such limits will be at your cost in any event.

(f) You must, if so requested in writing by WTL, at your risk promptly return any goods the subject of any claim and any packing materials securely packed and carriage paid to WTL for examination. (If the claim is substantiated, WTL will normally reimburse these costs)

(g) If any repairs, modifications, or adjustments are carried out upon goods other than by WTL or personnel that hold a valid training certificate or are an authorised sub-contractor then WTL will have no liability in respect of those goods.

(h) WTL does not accept any liability to you for any loss or damage of any nature except as expressly stated in the standard terms and conditions (or in such terms and conditions as may be specially agreed between you and WTL). This means among other things that WTL has no liability for consequential losses, property damage, penalties, liquidated, exemplary or aggravated damages, downtime, loss of goodwill, capital costs or any pure economic loss.

(i) Subject to section 3 below, WTL does not accept any liability for defects resulting from wear and tear, accident, improper use or use except in accordance with the

instructions or advice of WTL or authorised dealer or neglect or from any instructions or materials provided by you. Please note that this means WTL cannot accept liability in the event of use of unauthorised foam concentrate or alteration in factory foam additive dosage settings. Please note that it is not to be inferred or implied from the fact that WTL may supply you with any technical means of altering the settings for the use of the goods that you have any contractual or other legal protection in the event that you do so - any alterations to the settings for the use of the Units if not made in accordance with WTL's or the manufacturer's express written instructions are made at your own risk.

17 Product certification

L12 is CE certified, Declaration of conformity is available upon request.

Engine emissions are EURO and USA EPA CARB certified

Sound Pressure Level: 75 dB(A)

Guaranteed Sound Power Level: 87dB(A)

Measurement Uncertainty K: ±0.4 dB(A)

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