FUSIONMASTER®

LF110

OPERATOR'S MANUAL

DIXON INDUSTRIES PTY LTD

ABN 89 008 171 855

17 Frederick Road, Royal Park, South Australia, 5014.Tel: +61 8 8240 1555. Fax: +61 8 8240 5588

Email: sales@dixonind.com.au,

LF110 manual butt welder

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1. Safety considerations

Know the machine

Read these operating instructions carefully. Learn the operation, limitations and potential hazards of using your butt fusion machine.

Avoid Dangerous Environments

The equipment is not explosion proof. Never carry out butt fusion in a gaseous or combustible atmosphere.

Electrical safety

Use only a qualified electrician to carry out electrical maintenance work.

Connect electrical components only to a voltage source that corresponds to that marked on the components.

Do not operate the electrical equipment in damp or wet locations.

Prevent electric shock by correctly grounding electrical components. The green (or green/yellow) conductor in the electric cable is the grounding wire and should never be connected to a live terminal. The use of earth leakage protection with portable electric tools is essential and must be provided by the user.

Periodically test & tag electrical equipment according to worksite or standards requirements.

Heater

The heater operates at over 200°C and contact can cause serious burns. Always wear heat resistant gloves when handling the hot plate.

The heater is supplied with a 10 amp 1.8 metre cord that has an EPR rubber outer sheath which will delay, but will not prevent, the inevitable life threatening situation which could occur if the cord is allowed to contact the hot plate and melt through.

Never use a standard appliance cord with low melting point PVC sheath (e.g. Computer cord).

Standing the hot plate so that the temperature controller handle is not vertically above the hot plate will direct the cord away from the hot surface, and keep the controller relatively cool.

Facer

The facing machine is powerful and the cutting blades are sharp. To prevent injury the facer should only be operated when it is securely located in the pipe cutting position.

The nature of the machine and welding process makes it impractical to guard the operational area. Do not attempt to remove shavings from the cutting area while the facer is running. Remove loose clothing or jewellery to prevent these items being dragged into moving parts.

Maintain Equipment Carefully

The machine has moving parts and/or parts that may deteriorate with age and require maintenance. Regular inspection is recommended. For best results keep all machine components clean and properly maintained. Always disconnect the power when adjusting, servicing or changing accessories. Repair or replace damaged electric cables.

2. Machine Description

The **FUSIONMASTER®** LF110 is designed for "single pressure – low pressure" butt welding of pipe from 110mm down to 32mm.

The butt fusion unit is compact, light and strong with heat treated aluminium alloy clamps mounted on stainless steel guide shafts. All mild steel components are zinc plated for maximum corrosion protection. It is ideal for bench or floor operation, or wherever space to manoeuvre is limited.

The standard machine has two 110mm pipe clamps, each of three segments, for welding pipe to pipe. One of the pipe clamps can be removed and replaced with a narrow fittings clamp for holding elbows, tees or stub flanges. A second fittings clamp is optional and can be added if required for welding fitting to fitting.

2.1. General Specification

Machine dimensions	
Main clamp bore	110mm
Length overall	260mm
Width overall	250mm
Height overall	350mm
Component Weights	
Butt machine	7.2kg
Heater plate	2.1kg
Facer	3.0kg
Heater stand	2.5kg
Loaded accessory case (540x300x320mm)	27.0kg
Reducing liners	
Electrical	
Heater plate	750w, 240v, 1 phase
Facer drill	750w, 240v, 1 phase
Recommended gen-set for field operation.	2kva, 240V, 1 phase
Recommended grease for facer drive	Shell Gadus S2 V220 or equivalent

2.2. Heater Plate

The 750 watt aluminium heater plate has a cast in circular element ensuring uniform heat distribution across the 115mm effective heating diameter.

Plate temperature is regulated by an electronic controller sealed inside the heater handle. LED's indicate when power is connected to the electric element. A dial thermometer indicates internal plate temperature. (Refer section on heater technology.) The heater takes about 10 minutes to heat up to working temperature from ambient.

Replaceable non-stick cloths are fitted to the heater surfaces to eliminate hot plastic adhesion. They are secured by snap rings enabling quick and easy field repair if the surface is damaged.

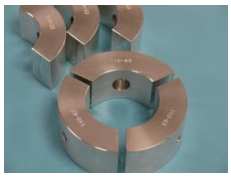
The detachable electric cord has a high melting point outer sheath for protection against short periods of accidental contact with the heater.

When not in use, the heater plate is stored in a protective floor stand that it shares with the facer.

2.3. Facer

The lightweight electric powered facing head is self-aligning and will always produce parallel pipe joint faces. Operating the variable speed motor at low speed will provide adequate torque and speed to process small or large diameter pipes quickly. There is one blade on each cutting face that will cut pipe from 110mm OD, to 22mm inside diameter.

2.4. Reducing Liners for pipe



Reducing Liners can be supplied to suit metric or imperial pipe or fittings.

The reducing liner set for each pipe size consists of 2 plain rings and 1 narrow ring. Each ring is made up of 3 segments.

When welding pipe to pipe, the plain rings are bolted into the two main 110mm clamps for welding

2.5. Reducing Liners for fittings

Narrow reducing liners are attached to the sliding fittings clamp (shown right). The narrow reducers are for clamping elbows, tees or flanges, etc. Remove one of the main 110mm clamps from the machine base and replace it with the sliding fittings clamp.

On the rare occasion it may be necessary to weld a fitting to a fitting it is necessary to purchase a fixed fittings clamp and associated reducers (shown right). This device attaches to the end of the butt machine base.

2.6. Accessory Case

A steel accessory case provides storage for the butt machine, heater, facer, the heater/facer floor stand, and reducing liners.

3. Using the LF110

3.1. Preparation

1. Connect to a 240v, 50Hz power source. Ensure the output of any portable generator used is 240v ±20v.
2. Clean or, if required, replace the non-stick cloths. Clean the heater plate before every weld with clean dry paper or cotton cloth - never use synthetic materials that may melt.
3. Check, and if necessary adjust the heater surface temperature.
4. Install the correct reducing liners for the pipe to be welded.
5. Before facing, clean inside and outside of each pipe end, and carefully clean the cutter blades.
6. Check the facer cutting action (the shaving thickness should be 0.30-0.40mm).
7. Determine the weld force and times required.

TIP

When welding coiled and/or large diameter pipe, clamp the butt machine to a solid support base for rigidity and to assist with pipe straightening and alignment.

3.2. Pipe Alignment

Place the pipes in the clamp jaws with about 20mm of pipe extending past the clamps into the weld zone. Tighten the clamp toggle bolts securely to prevent the pipe from slipping when force is applied. The pipe protruding outside of the machine should be supported such that there is no external bending load on the machine.

Move the pipe ends together until they are almost touching, then check for misalignment (maximum allowable misalignment is 10% of wall thickness). Tolerances on small bore pipes should be sufficient to permit pipe alignment in the LF110 without adjusting the clamps. However, in severe out of round situations, adjust out any misalignment by loosening the clamps and rotating the pipes, and/or using packers as necessary.

3.3. Facing

Move the pipe ends apart and place the facing machine between the pipe faces, close to the fixed pipe. Ensure the facer body is securely hooked on to both guide shafts to ensure the facer sits square to the frame and parallel with the clamps.

Start the facer rotating. Move the pipe ends into contact with the facer and apply just enough force so that a continuous shaving of plastic is simultaneously produced from both sides of the facer.

Caution: To maximise drill and facer drive life, operate the drill at low speed (for maximum torque), and do not apply excessive force to the carriage lever.

On completion of facing, reverse the pipe carriage away from the facer then stop facer rotation. This prevents a step being produced in the faced ends. Remove the facer and place it in the floor stand.

3.4. Check Alignment

Clear away all plastic cuttings without contaminating the pipe ends. ***Do not touch the cut surface or re-clean it***. Move the pipe ends together and re-check pipe alignment (maximum allowable misalignment is 10% of wall thickness).

Always re-face the pipe ends if it becomes necessary to rotate the pipe in the clamps after initial facing.

3.5. Bead Up

Check the heater plate temperature before commencing each joint in case there has been any failure of the power supply or temperature controller.

Place the heater plate between the pipe faces and close to the fixed pipe.

Caution: Ensure the heater handle does NOT stand vertically above the hot plate or dangerous overheating may occur. Do not allow the electric cord to rest on the hot plate.

Move the carriage to bring the pipe faces into contact with the heater plate. Increase lever force as read from the gauge plate to the predetermined “bead-up” force.

Maintain load until an initial bead has formed completely around the pipe circumference on both sides of the heater plate. The time taken to bead up is variable. It is greatly influenced by ambient temperatures, wind, and pipe dimensions.

3.6. Heat Soak

After bead up, reduce the force applied to the heater and maintain just a slight positive load between the pipe and the heater for the heat soak period. Failing to reduce pressure forces hot plastic out of the joint zone and could lead to a weld failure.

On completion of heat soak time, reverse the carriage direction to “crack” the heater plate away from the melted pipe, then move the heater plate out of the weld zone as quickly as possible. (Refer to parameters table for allowable changeover time).

The unique non-stick cloths allow a "peeling off" action as the pipe is cracked away, minimising adhesion of the melted pipe to the heater.

Remove the heater plate and replace it in the floor stand.

Caution: Do not allow the heater plate to slide across the pipe ends and distort the melted surface. Do not contaminate the melted surface in any way.

3.7. Fusion Cycle

Carefully bring the melted pipe faces into contact with each other immediately to minimise heat loss from the weld zone. Build up to the required fusion force smoothly to avoid squeezing out too much hot plastic. As the hot plastic is squeezed from the joint it rolls over to form a “bead”. Always ensure the bead rolls back until it touches the pipe.

Shrinkage will occur as the weld cools so it is important to manually maintain force on the lever until the bead becomes firm. Then tighten the lever wing nut to maintain load on the joint until the weld/cooling time is complete.

3.8. Weld Quality Check

Inspect the uniformity of the bead size and shape all around the pipe. It is advisable to monitor and record times, temperatures and applied force at each phase of every joint for future reference. (See section on trouble-shooting weld failures.)

4. Maintenance - Daily Check List

1. Keep the machine and accessories clean and free of dust and grease. *Do not lubricate any LF110 components except for the facer drive (see later).*
2. Check the temperature of a number of points on the surface of both sides of the heater plate. The reading at any point on either side of the heater plate surface should not be more than ±10°C from the desired welding temperature. (Refer later section on heater plates.)
3. Do electrical safety checks.
4. Replace non-stick cloths if damaged in the weld area.
5. Facing blades should be sharp and have defect free cutting edges to provide continuous shaving thickness of 0.30-0.40mm. Shim worn blades if necessary; sharpen cutter blades if blunt; replace cutter blades if chipped.
6. Ensure the facer drill is securely fixed into the facer body casting, or the drive gears may not mesh properly causing extensive damage.
7. Feel for "sloppy" movement of the cutter plates. This indicates the need to adjust the facer drive internally.
8. If using a portable generator, ensure its output is 240v ± 20v and 50Hz, to protect electronic equipment from permanent damage.

5. Maintenance - periodic

In addition to the daily checks, the following should be carried out before commencing each new project, or after 250 operating hours.

5.1. General

Check the machine frame and slide rails are not damaged or bent.

5.2. Heater Plate

Heater surfaces should be flat, smooth and free of dents or gouges. Dress as necessary.

FUSIONMASTER® heater plates have a vent machined in the edge of the casting to allow entrapped air to escape from under the non-stick cloth. Clean out any build-up of foreign material from the air vent to prevent any adverse temperature effect.

Caution: Ensure heater plate non-stick surfaces are protected from damage during transport.

5.3. Heater Temperature Adjustment

The temperature setting of the LF110 heater is adjusted by turning the screw in the end of the heater handle. Turn clockwise for higher temperature, and anticlockwise for lower temperature. One degree of turn will result in approximately one degree of temperature change. **Always allow several minutes for the plate temperature to stabilise after making any adjustment.**

The controller is factory set to 225°C. It has an operating range of 180°C to 260°C.

5.4. Temperature Calibration

The thermometer in the heater plate indicates the internal plate temperature not the surface temperature, although the difference will not be great.

It is essential to check and record the **surface** temperature of the heater plate before every weld. This is best measured with either a contact pyrometer or a non-contact infrared pyrometer. The outer circumference of the heater should not be measured as this is too far from the weld area.

The pyrometer used to measure surface temperature will itself require calibration to a procedure as recommended by the pyrometer manufacturer.

Caution: Be aware that an insulating air gap can form between the Teflon cloth and the hot plate. Always ensure the cloth is forced into contact with the hot metal surface when using an infrared or non-contact pyrometer or a false reading is likely to occur. Never use an infrared pyrometer on a shiny surface as a false reading will occur.

5.5. Heater Non-Stick Cloth Replacement

The non-stick cloths should be replaced if they are torn, contaminated, or badly discoloured (due to overheating) or lose their non-stick ability. Use the following procedure.

1. Use a screw driver to lever the snap rings out of their securing grooves. This takes very little force. Do not attempt to remove the snap rings if the plate temperature is more than approximately 40°C because they will not release.
2. With the plate flat, place a new cloth into position and reposition the snap ring over the cloth.
3. Push the snap ring into the groove around an arc of the plate. Hold in position with one hand. With the free hand, use a piece of wood or plastic to force the snap ring completely into its groove. (This may take several attempts until some experience is developed.) Never use metallic objects to force the snap rings back into position as this may result in accidental damage to the cloth.

5.6. Temperature Controller Failure

1. When power is connected, one LED glows amber. When the electric element is drawing power the other LED glows red. Either of the LEDs flashing on-off indicates the temperature controller has failed and must be replaced.
2. If neither LED glows when power is connected, first test the power supply and the power cord to ensure those items are not at fault. If not faulty, next test the element pad before replacing the temperature controller.

5.7. Electrical safety testing heater plate

Use an appliance tester capable of performing a *Class 1 250V Run Test* to verify the functionality of **FUSIONMASTER®** model MV70, SV70, LF110, HF225, EHF225 heater plates. These devices cannot be safety tested either as an earthed appliance or as a double insulated appliance because the temperature controller is fitted with surge protection (i.e. metal oxide varistor), and uses solid state switching that only functions when power is applied.

5.8. Element Pad Failure

Caution: This job must be performed by a qualified electrician.

1. Disconnect the power supply.
2. (Refer to heater plate drawing.) Remove the screws securing the temperature controller handle to the heater bracket, and the screws securing the bracket to the heater plate.
3. Remove the thermometer, bracket and gasket from the heater plate to expose the temperature sensor probe. (If the gasket is broken by this action it should be replaced.)
4. Withdraw the sensor probe with long nose pliers, pulling on the metal case, not the fine lead wires.
5. Disconnect the quick connect leads from the element ends, unscrew the earth connection and measure the resistance across the two ends of the element (should be 77 ohms ±10%). If there is a short circuit, the element pad must be replaced. If the element, leads and connectors are OK, the controller will be faulty and must be replaced.
6. Before re-fitting the controller, sparingly coat the sensor probe with some silicon heat sink compound to increase thermal sensitivity, then carefully insert the probe into the probe hole.
7. Reassemble the handle, bracket and thermometer to the heater plate and tighten screws securely.
8. Reconnect the power cord and switch on. Both LEDs should glow immediately. Allow 20 minutes for the heater to reach temperature and to stabilise before making any adjustments or measuring temperature.

5.9. Facer Drive

Refer to Facer drawing.

1. Access the facer drive assembly by removing the securing screw from the facer plate and removing the plate.
2. Inspect the worm and worm wheel assembly for wear. If the worm, or worm wheel, or worm shaft or dog coupling is excessively worn or broken, the complete worm drive assembly must be replaced as a matching assembly.
3. Inspect the worm shaft needle thrust bearing for damage and replace if necessary.
4. Otherwise, clean out and re-grease sparingly with a high pressure grease e.g. Shell Gadus S2 V220 or equivalent.

   Do not use molybdenum disulphide, graphite grease or similar as these may run and cause welding contamination.

5. Replace felt dust seals as required.

5.10. Cutter Blade Sharpening

If chipped or damaged, the blades should be replaced.

If blunt, the high grade tool steel blades may be sharpened with a die grinder. Shim the cutter blades if they are sharp, but shavings are too thin.

6. Notes about Heater Plates and Temperature

6.1. PE Welding Temperatures

Polyethylene pipe is weldable at temperatures ranging from 180°C to 260°C. However butt fusion parameters typically specify 225 ±10°C which is the required surface temperature of the heater plate.

Temperatures greater than 240°C when coupled with long heat soak times may result in diminution of the anti-oxidants in the pipe.

Cold joints will result if the weld temperature is too low, or the heat soak time is too short, or the time between removal of the heater and butting the pipes together is too long.

Caution: Either situation may lead to premature joint failure.

6.2. Heater Plate Temperature

Heater plate temperature displays generally indicate the internal heater temperature. Actual surface temperature may vary from the display, and will also fluctuate, for the following reasons.

1. The rate of heat loss from the heater surface depends on the design of the heater plate and temperature controller. The surface temperature could be significantly different to the thermometer indication. This variation will be greatest on cold, windy days. Always use a shelter when welding in these conditions.
2. As power input cycles on and off the temperature will be highest just after the power cycles off and lowest just as it cycles back on.
3. The temperature is unlikely to be exactly the same at every point on the heater surface due to manufacturing tolerances.
4. As heat is transferred into the pipe during heat soak, the heater temperature initially falls but eventually returns to the set point.

6.3. Measuring Surface Temperature

Note:

It is not physically possible for heater surface temperatures to vary significantly from one point to another. If such a variation is observed, it is most likely to result from using an incorrect temperature measuring technique.

5. Always wait 5 minutes after the heater has first reached set temperature for the temperature to stabilize before recording measurements.
6. Take readings at several points (at 3, 6, 9, 12 o'clock) on both sides of the heater, at the diameter of the pipe being welded.
7. **FUSIONMASTER®** heater plates are fitted with non-stick replaceable cloth. It is essential to use a contact probe or similar, to force the cloth into intimate contact with the plate. (Incorrect readings will result when the cloth system traps an insulating air layer between the cloth and the heater surface.)
8. If a contact probe is used it should be held in position for several seconds before the reading is taken.
9. If an infra-red pyrometer is used incorrect reading are likely to result unless:
   - the emissivity is set at 0.95 for use on the non-stick cloth;
   - the device is held square to the surface being measured;
   - the non-stick cloth is forced into intimate contact with the heater plate (see suggestion below).
10. Never use an infra-red pyrometer to take a reading from a shiny aluminium surface (such as a **FUSIONMASTER®** heater without cloths, or the outer rim of a heater plate) or an error will result.

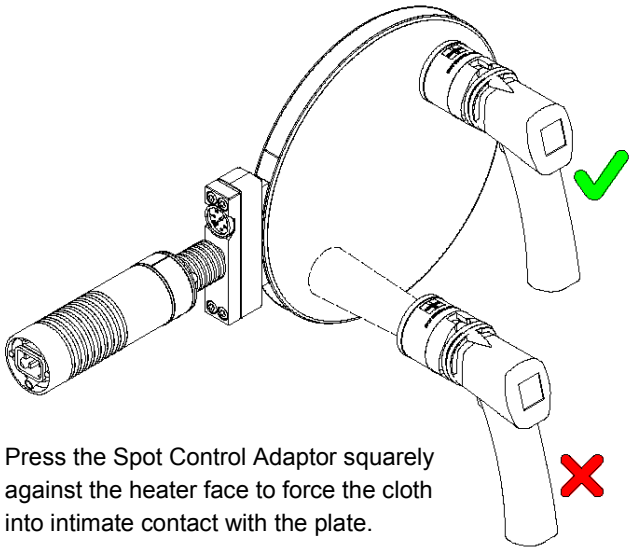
6.4. Suggestion

Use a "spot control adapter" fitted to an Infra-red pyrometer for consistently accurate measurements. When pressed squarely against the heater surface the infra-red beam is correctly focused every time, and intimate contact between the heater plate and non-stick cloth is assured.

HEATER PLATE
TEMPERATURE MEASUREMENT

A common report by operators when checking the temperature of their **FUSIONMASTER®** heater plates is that "the heater is hot on one side but colder on the other" or "there is '50' degrees variation across the face". Given the characteristics of aluminium and the layout of the elements, it is unlikely for such variation to occur. There will of course be small variations in temperature because of the switching characteristics of the controller and proximity to the elements. In the multi -phase heaters (HF450 and larger) with multiple elements, it is also possible for an element to fail, resulting in uneven heat distribution and slow heat up times. This however is not a common occurrence.

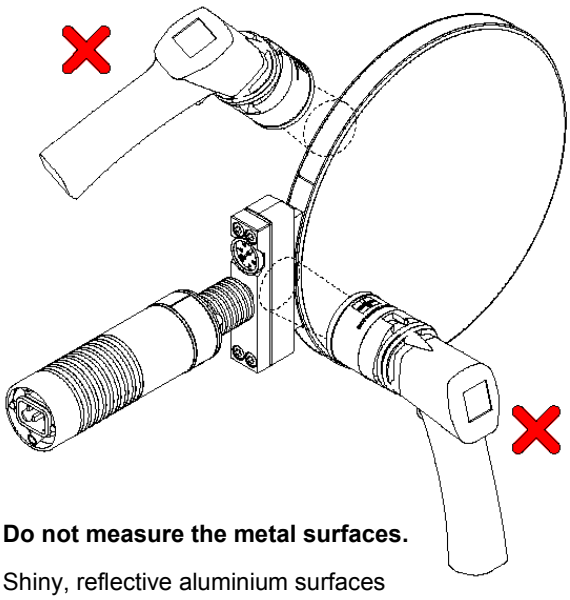
The more likely cause of the observed variation is the technique used to measure the temperature.



Press the Spot Control Adaptor squarely against the heater face to force the cloth into intimate contact with the plate.

Set the emissivity to 0.95

FUSIONMASTER® heater plates are fitted with non-stick replaceable cloth. While this unique feature provides unsurpassed performance, durability and convenience for the user, special care must be taken when determining surface temperature of the plate. Irrespective of the type of instrument used to measure the temperature, it is essential to force the cloth into intimate contact with the plate. *(Incorrect readings will result when an insulating layer of air is trapped between the cloth and the heater surface.)*



Do not measure the metal surfaces.

Shiny, reflective aluminium surfaces have low emissivity and can give inaccurate temperature readings.

Dixon Industries has developed and recommends our **'Spot Control Adaptor'** attached to an Infrared Thermometer to force the cloth into contact with the heater plate to minimize false readings.

DIXON INDUSTRIES PTY LTD
ABN 83 008 171855
17 Frederick Road, Royal Park, South Australia, 5014
Tel. 61 8 8240 1555 Fax 61 8 8240 5588
For more information visit www.fusionmaster.com.au

7. Butt Welding Guidelines

It is recommended that the following guidelines be downloaded from Plastics Industry Pipe Association of Australia Ltd web site (www.pipa.com.au)

- *POP003 Butt Fusion Jointing of PE Pipes and Fittings - Recommended Parameters.*
- *TP003 Specifying Butt Welding of Polyethylene Pipe Systems.*

FUSIONMASTER® welders are designed for the "single pressure – low pressure" fusion method described in POP003.

The welding tables appended to this operating manual are based on POP003-SP-LP.

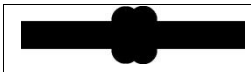
Operators should take care to determine the compatibility of materials for butt welding and only attempt to weld pipes and fittings made of the same polymer, e.g. PE to PE, PP to PP, PVDF to PVDF, etc.

The joint area must always be protected from adverse weather conditions, e.g. strong winds, excessive cold or heat, or rain, which could lead to the pipe wall developing non-uniformly heated zones and consequent failure issues.

The weld zone should be free of bending stress, free of notches or similar damage, and be free of contamination.

8. Weld failure trouble shooting

(Bead shapes are exaggerated for effect.)

	Uniform bead correct welding. NB: the external bead is always more uniform than the internal bead.
	Crack down centre of bead. "Cold weld" signified by clean break through the middle of the weld with a smooth appearance. Could be due to insufficient heat soak time or temperature, or changeover time too long, or excessive soak pressure, or insufficient fusion pressure, or no allowance for drag pressure, or drag pressure too great e.g. due to pulling pipe up a gradient.
	Misalignment - maximum allowable 10% of wall thickness. Care should also be taken to ensure pipes or fittings being joined have the same diameter and wall thickness or the probability of weld failure is significantly increased.
	Insufficient bead roll over. Could be due to insufficient heat soak time or temperature, or changeover time too long, or insufficient fusion pressure, or no allowance for drag pressure,
	Unequal bead size. Look for temperature gradients e.g. pipe surface in the hot sun vs pipe in the shade, or heater plate hot spots. Look for unequal application of pressure. If unequal uniformly around the whole circumference, look for physical difference in materials being joined e.g. melt flow index.

9. Warranty

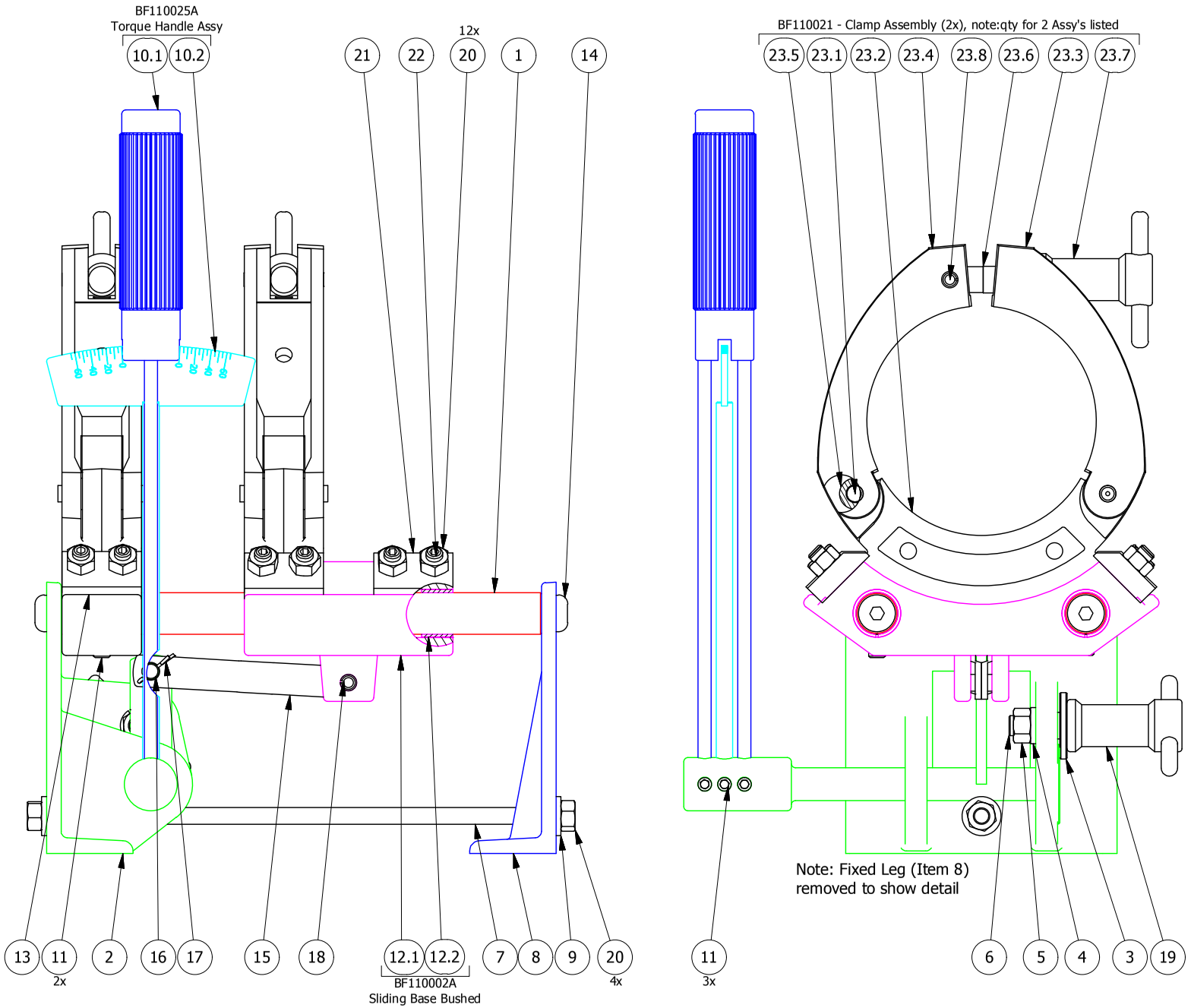
FUSIONMASTER® Butt Fusion Equipment

1. Subject to the terms below, Dixon Industries Pty Ltd ("**The Company**") warrants to repair or replace at its option ex-works Adelaide any product manufactured or repaired by it within 2 years from the date of shipment which are found to be defective due to either faulty workmanship or use of faulty materials, provided that such defective product is returned to the Company's works at the customer's expense, unless otherwise agreed.
2. This warranty is limited solely to products manufactured or repaired by the Company. Products not manufactured by the Company (such as pumps, gauges, motors, switches, etc.) are not covered by this warranty. In relation to a repair, this warranty is limited to the Company's cost of parts and labour to remedy a defective repair.
3. This warranty does not apply to any product that has been damaged by accident, misuse, neglect, use of an electrical power supply that is incompatible with the design specifications of the product or repair or alteration of the product by anyone other than the Company.
4. A warranty claim must be made to the Company in writing within 14 days of the first occurrence of the event or condition on which the claim is based. The claim must include proof of purchase and a detailed statement of the manner in which the product has been used and the event or condition occurred. The Company's decision to admit or refuse any warranty claim shall be binding.
5. Replacement parts provided to the customer before the right to a warranty claim is accepted by the Company will be invoiced at the full cost of the parts, including applicable taxes and freight charges. If a warranty claim is accepted, the cost of any replacement parts covered by the warranty claim which have been so invoiced will be credited to the customer.
6. All costs of returning product to the customer shall be paid by the customer.
7. Other than provided in this warranty, the Company excludes any other responsibility or liability whatever to the maximum extent permitted by law including liability for breach of contract, negligence or incidental, consequential, indirect or special damages including without limitation, interruption to use of the product or any other plant or equipment.

Disclaimer

As the conditions of use of welding equipment are outside the control of Dixon Industries, no warranties are expressed or implied and no liability is assumed in connection with the use of butt welding equipment or the butt welding guidelines or parameters.

The manufacturer reserves the right to vary specifications without notice.



BF110000
LF110 Fusion Base - complete

Item	Part No.	Part Name	QTY
23.8	BF000249	Spring Pin	2
23.7	BF050028	Toggle Nut Assembly	2
23.6	BF050008	Toggle Bolt	2
23.5	BF050011	Washer	8
23.4	BF110032	Clamp Arm Toggle	2
23.3	BF110031	Clamp Arm	2
23.2	BF110022	Clamp Base	2
23.1	BF110015	Hing Pin	4
22	BF000126	Set Screw	12
21	BF110020	Bridge Clamp	6
20	BF000133	Hex Nut	16
19	BF050028	Toggle Nut Assembly	1
18	BF000247	Spring Pin	1
17	BF000167	Split Pin	1
16	BF110017	Clevis Pin	1
15	BF110007	Link Bar	1
14	BF000153	Guide Bar Screw	4
13	BF110001	Fixed Base	1
12.2	BF000073	Glycodur Bush 20mmm	4
12.1	BF110002	Sliding Base	1
11	BF000122	Socket Set Screw	5
10.2	BF110009A	Torque Gauge Weldment	1
10.1	BF110024	Torque Lever Assy	1
9	BF000121	Plain Washers	4
8	BF110005	Fixed Leg	1
7	BF110028	Tie Rod	1
6	BF110012	Stepped Lock Stud	1
5	BF000265	Hex Nut	1
4	BF000268	Spring Washer	1
3	BF110013	Flat Lock Washer	1
2	BF110004A	Lever Leg Assembly	1
1	BF110003	Guide Bar	2

Drawing Name:	LF110 Fusion Base Assembly OPERATORS MANUAL ONLY
Scale:	not to scale
Drawn:	SR
Update:	15/10/2019
CAD File:	U:\Inventor\LF110\BF110000\BF110000_MAN.idw

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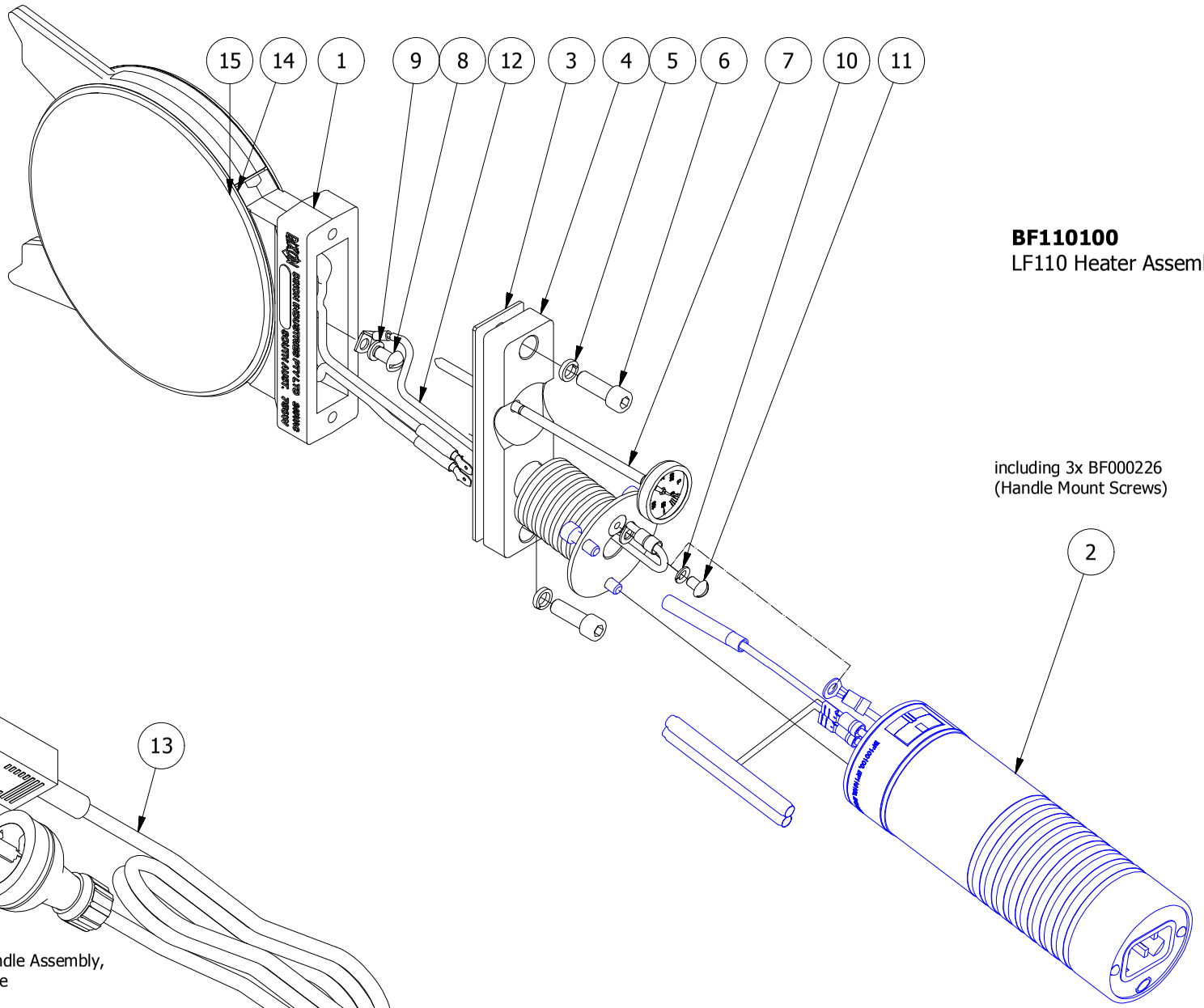

BF110100
LF110 Heater Assembly - complete

including 3x BF000226
(Handle Mount Screws)

to suit Handle Assembly,
not to scale

Item	Part No.	Part Name	QTY
15	BF100112	Snap Ring (pair)	1
14	BF100110	Heater Cloth (pair)	1
13	BF100104	Cord Set	1
12	BF100119	Earth Cable Assembly	1
11	BF000286	Earth Screw (Mtg Brkt)	1
10	BF000095	Spring Washer (Mtg Brkt)	1
9	BF000228	Spring Washer (E-Pad)	1
8	BF000221	Earth Screw (E-Pad)	1
7	BF000183	Thermometer	1
6	BF000232	Bracket Mtg Screw	2
5	BF000233	Spring Washer (spec.)	2
4	BF100105	Mounting Bracket	1
3	BF100108	Gasket Jounting	1
2	BF225102	Electronic Handle Assembly	1
1	BF110101	Element Pad, suit LF110	1

Drawing Name:
LF110 Heater Assembly
OPERATORS MANUAL ONLY

Scale:	not to scale
Drawn:	SR
Update:	18/07/2019
CAD File:	U:\Inventor\LF110\BF110100\BF1101A0_MAN.idw

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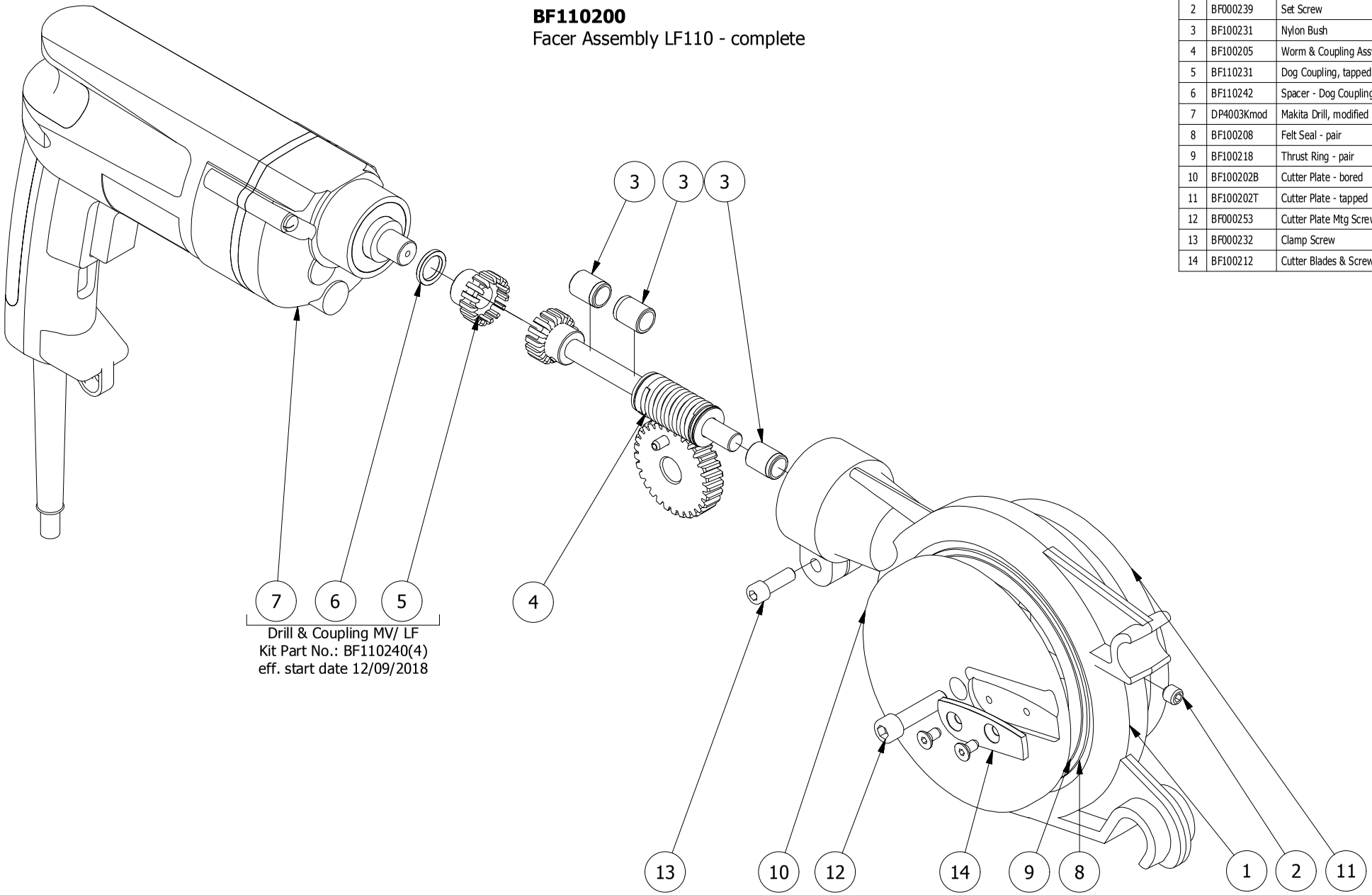
BF110200
Facer Assembly LF110 - complete



Drill & Coupling MV/ LF
Kit Part No.: BF110240(4)
eff. start date 12/09/2018

Item	Part No.	Part Name	QTY
1	BF110201	Facer Body LF110	1
2	BF000239	Set Screw	1
3	BF100231	Nylon Bush	3
4	BF100205	Worm & Coupling Assy	1
5	BF110231	Dog Coupling, tapped	1
6	BF110242	Spacer - Dog Coupling	1
7	DP4003Kmod	Makita Drill, modified	1
8	BF100208	Felt Seal - pair	1
9	BF100218	Thrust Ring - pair	1
10	BF100202B	Cutter Plate - bored	1
11	BF100202T	Cutter Plate - tapped	1
12	BF000253	Cutter Plate Mtg Screw	1
13	BF000232	Clamp Screw	1
14	BF100212	Cutter Blades & Screws (kit)	1

Drawing Name: LF110 Facer Assembly OPERATORS MANUAL ONLY	Scale:	not to scale	
	Drawn:	SR	
	Update:	30/10/2018	
CAD File: U:\Inventor\LF110\BF110200\BF1102a0_MAN.idw			

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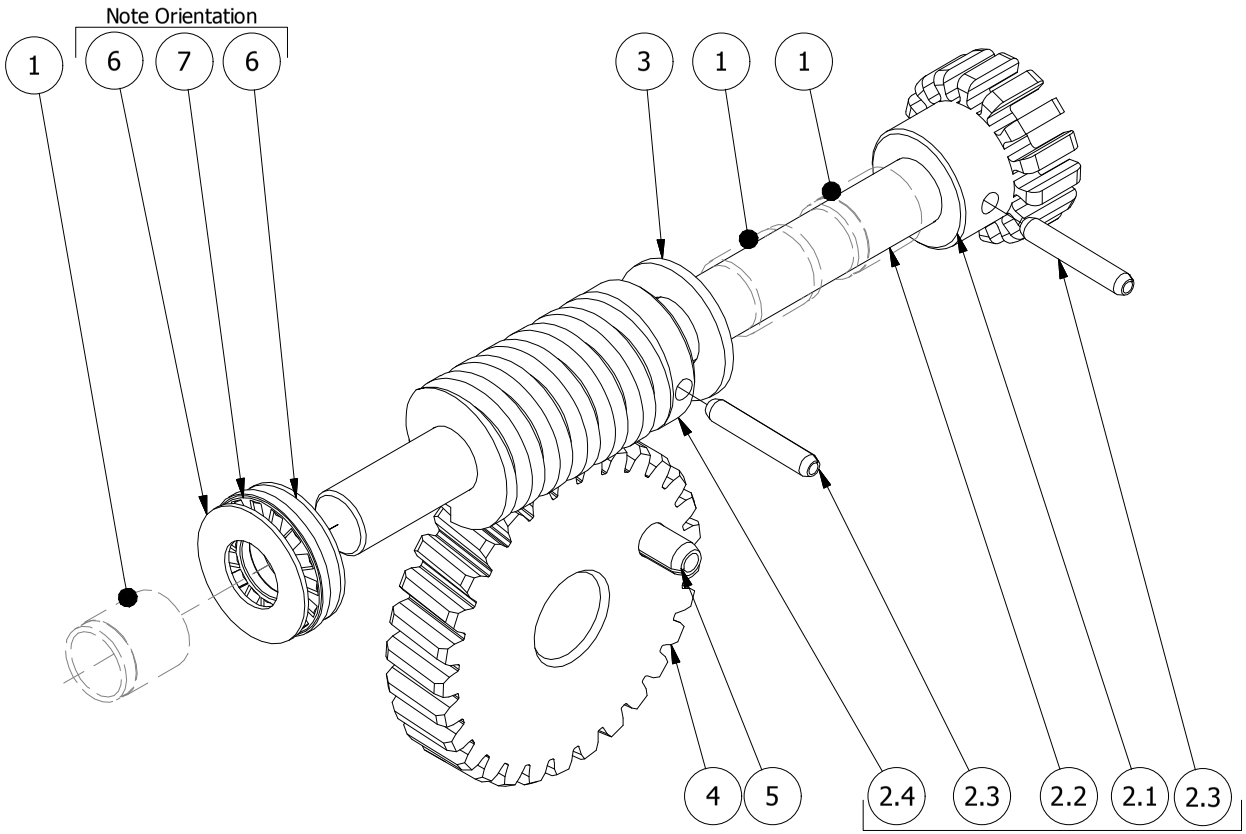

BF100205 - Worm & Coupling Assembly

BF100204
Facer
Worm
Drive
Assembly

Item	Part No.	Part Name	QTY
7	BF000175	Thrust Bearing	1
6	BF000206	Thrust Washer	2
5	BF000222	Spring Pin	1
4	BF100224	Worm Wheel	1
3	BF100238	Spacer	1
2.4	BF100222	Worm	1
2.3	BF000213	Spring Pin	2
2.2	BF100220	Worm Shaft	1
2.1	BF100226	Dog Coupling Fixed	1
1	BF100231	Bush	3

Drawing Name: MV/LR/LF Facer Worm Drive Assembly
OPERATORS MANUAL ONLY

Scale: 1:1
Drawn: SR
Update: 11/10/2019

CAD File: U:\Inventor\MV\BF100200\BF1002a0_MAN.idw

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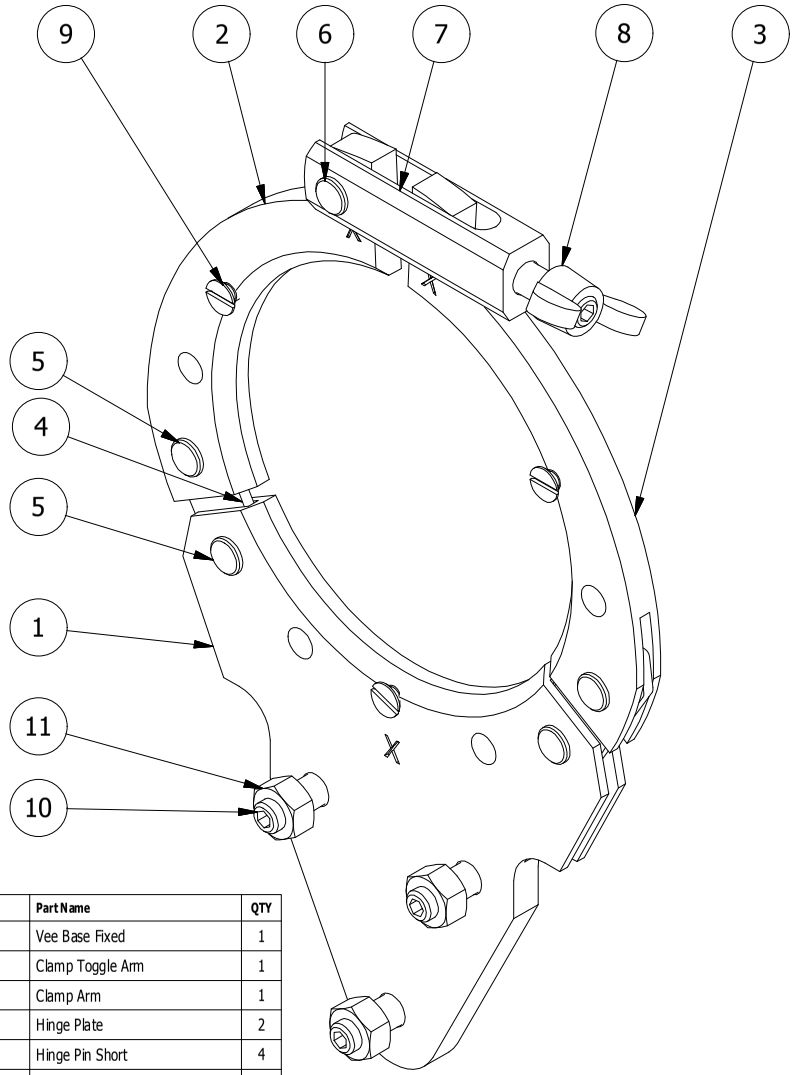
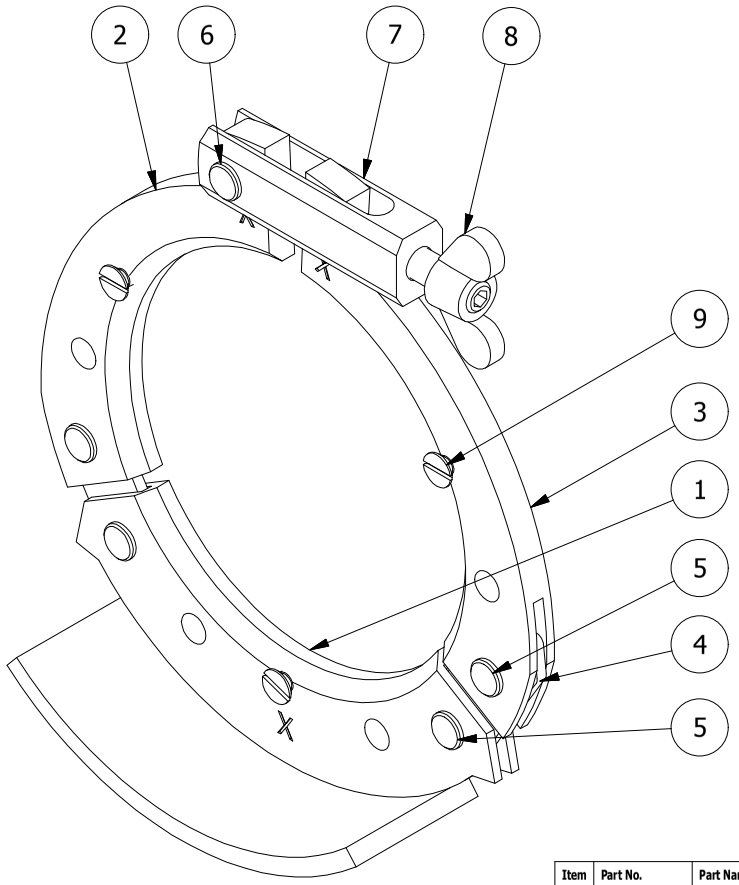
Fittings Clamp, Fixed
Part No. BF110300



Item	Part No.	Part Name	QTY
1	BF110301	Vee Base Fixed	1
2	BF110402	Clamp Toggle Arm	1
3	BF110412	Clamp Arm	1
4	BF110403	Hinge Plate	2
5	BF110407	Hinge Pin Short	4
6	BF110406	Hinge Pin Long	1
7	BF110405	Toggle Hinge	1
8	BF110404	Fittings Clamp Screw Assy	1
9	BF000096	Liner Mtg Screw	3
10	BF000124	Mounting Stud	3
11	BF000133	Mounting Nut	3

Fittings Clamp, Sliding
Part No. BF110400



Item	Part No.	Part Name	QTY
1	BF110409	Clamp Base Weldment	1
2	BF110402	Clamp Toggle Arm	1
3	BF110412	Clamp Arm	1
4	BF110403	Hinge Plate	2
5	BF110407	Hinge Pin Short	4
6	BF110406	Hinge Pin Long	1
7	BF110405	Toggle Hinge	1
8	BF110404	Fittings Clamp Screw Assy	1
9	BF000096	Liner Mtg Screw	3

UNCONTROLLED DOCUMENT

Drawing Name: LF110 Fittings Attachment OPERATORS MANUAL ONLY	Scale:	not to scale	DIXON INDUSTRIES PTY LTD A.B.N. 89 008 171 855
	Drawn:	SR	
	Update:	17/02/2021	
CAD File: U:\Inventor\LF110\BF110400\BF110400_MAN.idw			

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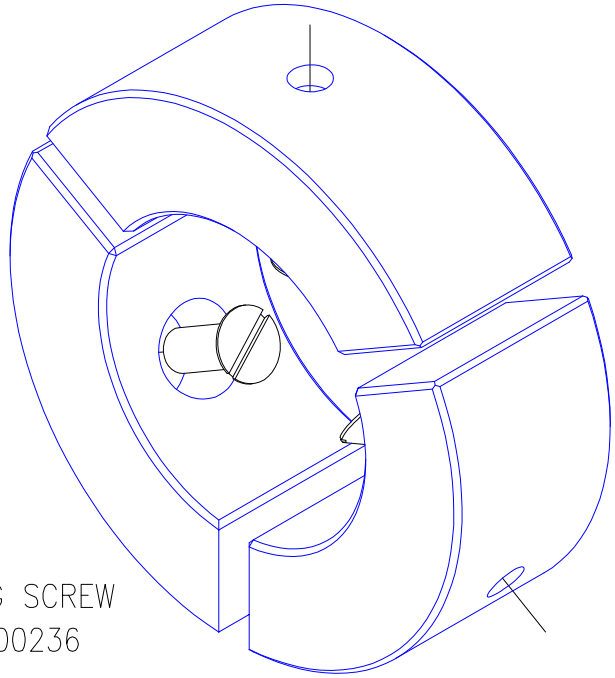
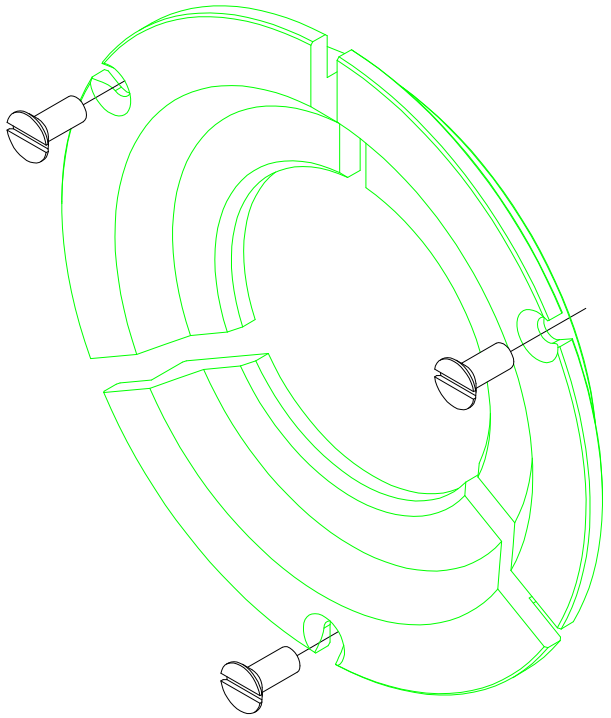


USE MOUNTING SCREW
PART No. BF000236

PART No.	SIZE
BF110925	110-25
BF110932	110-32
BF110935	110-35
BF110940	110-40
BF110943	110-43
BF110948	110-48.2
BF110950	110-50
BF110957	110-57.6
BF110960	110-60.3
BF110963	110-63
BF110975	110-75
BF110990	110-90

110-63 SHOWN
LINERS FIT INTO MACHINE CLAMPS



USE MOUNTING SCREW
PART No. BF000096

PART No.	SIZE
BF110725	110-25
BF110732	110-32
BF110740	110-40
BF110750	110-50
BF110763	110-63
BF110775	110-75
BF110790	110-90

110-63 SHOWN
LINERS FIT INTO FITTINGS ATTACHMENT

UNCONTROLLED DOCUMENT

Drawing Name: LF110 PLAIN & FITTINGS ATTACHMENT LINER OPERATORS MANUAL ONLY	Scale:	Not To Scale	DIXON INDUSTRIES PTY LTD A.B.N. 89 008 171 855
	Drawn:	SR	
	Date:	29/05/09	
CAD File: U:\DWG\Mech Desktop\LF110\BF110900\110 Clamp Liners			

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Parameters based on PIPA Guideline POP003: V7.0 June 2018, Single Pressure - Low Pressure.

FUSIONMASTER® LF110

Nominal pipe od		D	mm	110	110	110	110	110	110	110	110	110	90	90	90	90	90	90	90	90	90
SDR				41	33	26	21	17	13.6	11	9	7.4	41	33	26	21	17	13.6	11	9	7.4
PE80				PN3.2	PN4		PN6.3	PN8	PN10	PN12.5	PN16	PN20	PN3.2	PN4		PN6.3	PN8	PN10	PN12.5	PN16	PN20
PE100				PN4		PN6.3	PN8	PN10	PN12.5	PN16	PN20	PN25	PN4		PN6.3	PN8	PN10	PN12.5	PN16	PN20	PN25
Minimum wall thickness (AS4130:2018)		t	mm	2.7	3.4	4.3	5.3	6.6	8.1	10.0	12.3	15.1	2.2	2.8	3.5	4.3	5.4	6.6	8.2	10.1	12.3
		Parameter																			
Mean heater surface temp		225+/-10	°C	225	225	225	225	225	225	225	225	225	225	225	225	225	225	225	225	225	225
Allowable axial misalignment		0.1t	mm	0.3	0.3	0.4	0.5	0.7	0.8	1.0	1.2	1.5	0.2	0.3	0.4	0.4	0.5	0.7	0.8	1.0	1.2
Bead up pressure	P1	170+/-20	kg	14	18	22	27	33	39	48	57	68	10	12	15	18	22	26	32	39	46
+ measured drag	P3	+drag	kg																		
Total bead up pressure	P3		kg																		
Minimum bead-up size		0.5 + 0.1t	mm	0.8	0.8	0.9	1.0	1.2	1.3	1.5	1.7	2.0	0.7	0.8	0.9	0.9	1.0	1.2	1.3	1.5	1.7
Soak pressure	P2	drag	kg	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag
Soak time	T2	(13.5±1.5)t	second	36	46	58	72	89	109	135	166	204	30	38	47	58	73	89	111	136	166
Maximum Heater Plate removal time	T3	ISO12176-1	second	5	5	5	6	6	8	8	10	10	5	5	5	5	6	6	8	8	10
Pressure up	T4	0.03D + 3	second	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
Welding & cooling pressure	P3	170+/-20	kg	14	18	22	27	33	39	48	57	68	10	12	15	18	22	26	32	39	46
+ measured drag	P3	+drag	kg																		
Total welding & cooling pressure	P3		kg																		
Minimum welding & cooling time in clamps	T5	t + 3	minute	6	6	7	8	10	11	13	15	18	5	6	7	7	8	10	11	13	15
Recommended cooling time out of clamps before rough handling	T6	t + 3	minute	6	6	7	8	10	11	13	15	18	5	6	7	7	8	10	11	13	15

NB the drag pressure must be re-measured and added to the calculated weld pressure for each new joint .

Parameters based on PIPA Guideline POP003: V7.0 June 2018, Single Pressure - Low Pressure.

FUSIONMASTER® LF110

Nominal pipe od		D	mm	75	75	75	75	75	75	75	75	75	63	63	63	63	63	63	63	63	63
SDR				41	33	26	21	17	13.6	11	9	7.4	41	33	26	21	17	13.6	11	9	7.4
PE80				PN3.2	PN4		PN6.3	PN8	PN10	PN12.5	PN16	PN20	PN3.2	PN4		PN6.3	PN8	PN10	PN12.5	PN16	PN20
PE100				PN4		PN6.3	PN8	PN10	PN12.5	PN16	PN20	PN25	PN4		PN6.3	PN8	PN10	PN12.5	PN16	PN20	PN25
Minimum wall thickness (AS4130:2018)		t	mm	1.9	2.3	2.9	3.6	4.5	5.5	6.8	8.4	10.3	1.6	2.0	2.4	3.0	3.8	4.7	5.8	7.1	8.6
		Parameter																			
Mean heater surface temp		225+/-10	°C	225	225	225	225	225	225	225	225	225	225	225	225	225	225	225	225	225	225
Allowable axial misalignment		0.1t	mm	0.2	0.2	0.3	0.4	0.5	0.6	0.7	0.8	1.0	0.2	0.2	0.2	0.3	0.4	0.5	0.6	0.7	0.9
Bead up pressure	P1	170+/-20	kg	7	8	10	13	15	19	22	27	32	5	6	7	9	11	13	16	19	23
+ measured drag	P3	+drag	kg																		
Total bead up pressure	P3		kg																		
Minimum bead-up size		0.5 + 0.1t	mm	0.7	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.5	0.7	0.7	0.7	0.8	0.9	1.0	1.1	1.2	1.4
Soak pressure	P2	drag	kg	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag
Soak time	T2	(13.5±1.5)t	second	26	31	39	49	61	74	92	113	139	22	27	32	41	51	63	78	96	116
Maximum Heater Plate removal time	T3	ISO12176-1	second	5	5	5	5	5	6	6	8	8	5	5	5	5	5	6	6	8	8
Pressure up	T4	0.03D + 3	second	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Welding & cooling pressure	P3	170+/-20	kg	7	8	10	13	15	19	22	27	32	5	6	7	9	11	13	16	19	23
+ measured drag	P3	+drag	kg																		
Total welding & cooling pressure	P3		kg																		
Minimum welding & cooling time in clamps	T5	t + 3	minute	5	5	6	7	8	9	10	11	13	5	5	5	6	7	8	9	10	12
Recommended cooling time out of clamps before rough handling	T6	t + 3	minute	5	5	6	7	8	9	10	11	13	5	5	5	6	7	8	9	10	12

NB the drag pressure must be re-measured and added to the calculated weld pressure for each new joint .

Parameters based on PIPA Guideline POP003: V7.0 June 2018, Single Pressure - Low Pressure.

FUSIONMASTER® LF110

Nominal pipe od		D	mm	50	50	50	50	50	50	50	50	50	40	40	40	40	40	40	40	40	40
SDR				41	33	26	21	17	13.6	11	9	7.4	41	33	26	21	17	13.6	11	9	7.4
PE80				PN3.2	PN4		PN6.3	PN8	PN10	PN12.5	PN16	PN20	PN3.2	PN4		PN6.3	PN8	PN10	PN12.5	PN16	PN20
PE100				PN4		PN6.3	PN8	PN10	PN12.5	PN16	PN20	PN25	PN4		PN6.3	PN8	PN10	PN12.5	PN16	PN20	PN25
Minimum wall thickness (AS4130:2018)		t	mm	1.6	1.6	1.9	2.4	3.0	3.7	4.6	5.6	6.9	1.6	1.6	1.6	1.9	2.4	3.0	3.7	4.5	5.5
		Parameter																			
Mean heater surface temp		225+/-10	°C	225	225	225	225	225	225	225	225	225	225	225	225	225	225	225	225	225	225
Allowable axial misalignment		0.1t	mm	0.2	0.2	0.2	0.2	0.3	0.4	0.5	0.6	0.7	0.2	0.2	0.2	0.2	0.2	0.3	0.4	0.5	0.6
Bead up pressure	P1	170+/-20	kg	4	4	5	6	7	9	10	12	15	3	3	3	4	5	6	7	8	9
+ measured drag	P3	+drag	kg																		
Total bead up pressure	P3		kg																		
Minimum bead-up size		0.5 + 0.1t	mm	0.7	0.7	0.7	0.7	0.8	0.9	1.0	1.1	1.2	0.7	0.7	0.7	0.7	0.7	0.8	0.9	1.0	1.1
Soak pressure	P2	drag	kg	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag
Soak time	T2	(13.5±1.5)t	second	22	22	26	32	41	50	62	76	93	22	22	22	26	32	41	50	61	74
Maximum Heater Plate removal time	T3	ISO12176-1	second	5	5	5	5	5	5	6	6	6	5	5	5	5	5	5	5	5	6
Pressure up	T4	0.03D + 3	second	5	5	5	5	5	5	5	5	5	4	4	4	4	4	4	4	4	4
Welding & cooling pressure	P3	170+/-20	kg	4	4	5	6	7	9	10	12	15	3	3	3	4	5	6	7	8	9
+ measured drag	P3	+drag	kg																		
Total welding & cooling pressure	P3		kg																		
Minimum welding & cooling time in clamps	T5	t + 3	minute	5	5	5	5	6	7	8	9	10	5	5	5	5	5	6	7	8	9
Recommended cooling time out of clamps before rough handling	T6	t + 3	minute	5	5	5	5	6	7	8	9	10	5	5	5	5	5	6	7	8	9

NB the drag pressure must be re-measured and added to the calculated weld pressure for each new joint .

Parameters based on PIPA Guideline POP003: V7.0 June 2018, Single Pressure - Low Pressure.

FUSIONMASTER® LF110

Nominal pipe od		D	mm	32	32	32	32	32	32	32	32	32	25	25	25	25	25	25	25	25	25
SDR				41	33	26	21	17	13.6	11	9	7.4	41	33	26	21	17	13.6	11	9	7.4
PE80				PN3.2	PN4		PN6.3	PN8	PN10	PN12.5	PN16	PN20	PN3.2	PN4		PN6.3	PN8	PN10	PN12.5	PN16	PN20
PE100				PN4		PN6.3	PN8	PN10	PN12.5	PN16	PN20	PN25	PN4		PN6.3	PN8	PN10	PN12.5	PN16	PN20	PN25
Minimum wall thickness (AS4130:2018)		t	mm	1.6	1.6	1.6	1.6	1.9	2.4	2.9	3.6	4.4	1.6	1.6	1.6	1.6	1.6	1.9	2.3	2.8	3.5
		Parameter																			
Mean heater surface temp		225+/-10	°C	225	225	225	225	225	225	225	225	225	225	225	225	225	225	225	225	225	225
Allowable axial misalignment		0.1t	mm	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.4	0.4	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.4
Bead up pressure	P1	170+/-20	kg	3	3	3	3	3	4	4	5	6	2	2	2	2	2	3	3	3	4
+ measured drag	P3	+drag	kg																		
Total bead up pressure	P3		kg																		
Minimum bead-up size		0.5 + 0.1t	mm	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.9	0.9	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.9
Soak pressure	P2	drag	kg	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag
Soak time	T2	(13.5±1.5)t	second	22	22	22	22	26	32	39	49	59	22	22	22	22	22	26	31	38	47
Maximum Heater Plate removal time	T3	ISO12176-1	second	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Pressure up	T4	0.03D + 3	second	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Welding & cooling pressure	P3	170+/-20	kg	3	3	3	3	3	4	4	5	6	2	2	2	2	2	3	3	3	4
+ measured drag	P3	+drag	kg																		
Total welding & cooling pressure	P3		kg																		
Minimum welding & cooling time in clamps	T5	t + 3	minute	5	5	5	5	5	5	6	7	7	5	5	5	5	5	5	5	6	7
Recommended cooling time out of clamps before rough handling	T6	t + 3	minute	5	5	5	5	5	5	6	7	7	5	5	5	5	5	5	5	6	7

NB the drag pressure must be re-measured and added to the calculated weld pressure for each new joint .

Parameters based on PIPA Guideline POP003:V7.0 June 2018, Single Pressure - Low Pressure.

FUSIONMASTER® LF110

Nominal pipe size			**inch**	**2**	**1½**	**1¼**	**1**
Class				**Rural B**	**Rural B**	**Rural B**	**Rural B**
Pipe OD		**D**	**mm**	**57.6**	**43**	**36**	**29**
Nominal bore			**mm**	**50**	**38**	**32**	**25**
Minimum wall thickness (AS4130:2018)		**t**	**mm**	**3.8**	**2.5**	**2.0**	**2.0**
		Parameter					
Mean heater surface temp		**225+/-15**	**°C**	225	225	225	225
Allowable axial misalignment		**0.1t**	**mm**	0.4	0.3	0.2	0.2
Bead up pressure	**P1**	**170+/-20**	**kg**	11	6	4	3
+ measured drag	**P3**	**+drag**	**kg**				
Total bead up pressure	**P3**		**kg**				
Soak pressure	**P2**	**drag**	**kg**	drag	drag	drag	drag
Soak time	**T2**	**(13.5±1.5)t**	**second**	51	34	27	27
Heater out	**T3**	**0.1t + 4**	**second**	4	4	4	4
Pressure up	**T4**	**0.03D + 3**	**second**	5	4	4	4
Welding & cooling pressure	**P3**	**170+/-20**	**kg**	11	6	4	3
+ measured drag	**P3**	**+drag**	**kg**				
Total welding & cooling pressure	**P3**		**kg**				
Minimum welding & cooling time in the clamps	**T5**	**t + 3**	**minute**	7	6	5	5
Recommended cooling time out of clamps before rough handling	**T6**	**t + 3**	**minute**	7	6	5	5

DIXON INDUSTRIES PTY LTD

ABN 89 008 171 855

17 Frederick Road, Royal Park
South Australia, 5014.
Tel: (08) 8240 1555
Fax: (08) 8240 5588