FUSIONMASTER®

EHF350

OPERATOR'S MANUAL

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1. Safety considerations

Know the machine

This machine should only be used by an operator fully trained in its use.

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.

Heater

The heater operates at over 200°C and contact can cause serious burns. Always wear 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 (eg. Computer cord).

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 jewelry to prevent these items being dragged into moving parts.

Hydraulic pressure

A sudden hydraulic oil leak can cause serious injury or even death if the pressure is high enough. Do not search for oil leaks with the fingers because a fine jet of pressurised oil could penetrate the skin causing serious injury. Use a piece of cardboard to test for leaks under pressure.

Avoid spraying oil into eyes when bleeding air from the system by wearing safety glasses and keeping the face clear of the area.

Keep fingers and limbs well clear of moving clamps, facer or heater to avoid crush injuries.

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.

Transporting the machine

Dixon equipment mounted on wheels is not designed for on-road towing. Any attempt to do so could result in machine damage and/or personal injury. Transportation should be by truck or similar, with the machine well secured. Do not allow the heater plate to contact the facer.

2. Machine Description

The FUSIONMASTER® EHF350 is designed for "single pressure – low pressure" butt welding of pipe from 355mm down to 110mm. It is a compact and manoeuvrable butt welding machine, ideally suited to joining PE pipe to pipe in the field.

The EHF350 machine strength is derived from its rigid steel main frame, hard chromed steel guide shafts, and high strength cast aluminium alloy clamps.

Two double ended hydraulic cylinders mounted along the axial centre line provide inherent rigidity and a balanced application of welding pressure.

The clamps are designed for side loading of pipe, which facilitates the removal of the machine from a completed pipe joint and especially from trench work. Pipe alignment is simply achieved by adjusting the unique eccentric cam mechanisms attached to the fixed clamps.

Four pneumatic tyred wheels positioned close to the centre of the machine make it very manoeuvrable. The wheel assemblies are easily removed for trench work or transportation. Two lifting holes in the main frame end plates enable overhead lifting.

2.1. General Specification

Machine dimensions	
Main clamp bore	355 mm
Length overall	1,230 mm
Width overall	690 mm
Height overall (wheels attached)	1,030 mm
Component Weights	
Butt machine with facer	150kg
Heater plate	12kg
Facer	11kg
Fittings chuck	8kg
Heater/Facer stand	8kg
Reducing liner sets	5kg (min.) to 13kg (max.)
Liner carry case (empty)	11kg
Liner carry case (loaded)	45kg
Hydraulic Specifications	
Cylinder area for weld calculation	1,233 mm²
Power pack	0.37kW, 240V, single phase, 26kg
Relief valve setting	9,500kPa
Pressure gauge	0 - 10,000kPa
System oil capacity	3 litre
Recommended hydraulic oil	Any brand with viscosity ISO 46
Heater plate	1400W, 240V, single phase
Recommended genset for field operation.	5kva, 240V, single phase
Recommended grease for facer drive	Shell Alvania EP/LF2

2.2. Hydraulic System

A portable electric hydraulic power pack applies pressure to the hydraulic cylinders to transport the moving clamps.

The maximum machine pressure is factory set by adjusting a pressure relief valve located inside the oil tank.

Three pressure regulators control the Carriage Cylinder Pressure during the fusion process. The regulators allow the operator to independently preset facing pressure, bead-up and/or welding-cooling pressure or drag pressure, depending on how the operator prefers to work. During travel in the reverse direction (clamp opening), the regulators do not control pressure, nor does the gauge register pressure.

A 3-way selector allows the operator to easily choose one of the pre-set pressures during the weld process.

Carriage motion direction is controlled by pushing the directional control valve lever in the required direction of travel.

2.3. Heater Plate

The 2400 watt, 240v, single phase aluminium heater plate has a cast in circular element to ensure uniform heat distribution. Temperature is controlled by an adjustable thermo-mechanical controller, and a LED indicates when power is flowing to the element. A dial thermometer indicates internal plate temperature. (Refer section on heater technology.) It takes less than 18 minutes to heat up to working temperature.

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.

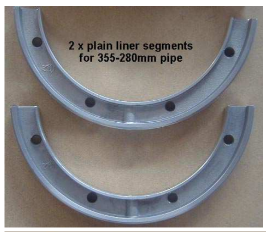
The detachable 1.8m electric cord has a high melting point outer sheath for protection against short periods of accidental contact with the heater.

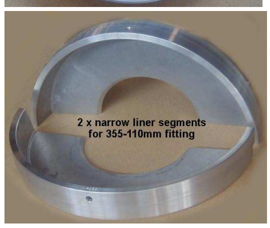
During welding the heater is stored in a floor stand, which is attached to the machine frame for transportation.

2.4. Facer

The facer is integrally mounted on the machine frame, providing effortless machining of pipe faces. The facer is driven by a 2 speed, high torque electric drill (1150W, 240V, 50hz). It has a single blade on each cutting face and can cut pipe from 355mm outside dia. to 75mm inside dia.

2.5. Reducing Liners





Each reducing liner size consists of 2 plain rings and 2 narrow rings.

When welding pipe to pipe the plain rings are usually mounted in the inner two clamps, with the narrow rings in the two outer clamps. The narrow rings are for clamping short leg moulded fittings and must be placed in the inner clamps when welding elbows.

The wide liners from 110mm to 180mm nest inside 200mm liners. All the narrow liner sizes fit directly into the main 355mm clamp.

Reducing liners can be manufactured to suit any pipe size from 324mm (12" imperial) to 110mm, in either metric or imperial dimensions.

Note: *The EHF350 is not able to hold 355mm short leg moulded elbows or most short leg moulded Tees. Such fittings should be purchased with long leg lengths to enable the Tee or elbow section to protrude beyond the end clamp.*

2.6. Accessory Case

Steel carry cases are available for storing reducing liners. Each case holds up to three sizes.

2.7. Fittings Attachment

The fittings attachment tool is used when butt welding stub flanges or shouldered end fittings to pipe. It is usually held in the inner 355mm main clamp on the hydraulic cylinder side. The tool centrally locates flanges or shouldered ends quickly and accurately. It will securely hold the fitting either by the outside or inside diameter depending on the fitting size.

2.8. High Pressure Welding

The EHF350 is not designed for high pressure welding. However the high pressure method may be used providing the combined welding + drag pressure for a particular job falls within the range of the fitted pressure gauge.

3. Using the EHF350 – single pressure low pressure method

3.1. Preparation

1. Connect only to a 240v, 50Hz power source. Ensure the output of any portable generator used is 240v ± 20v.
2. Check for air in the hydraulic system and bleed if necessary (see maintenance section).
3. Clean and/or 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.
4. Check, and if necessary adjust the heater surface temperature.
5. Install the correct reducing liners for the pipe to be welded.
6. Check the facer cutting action (the shaving thickness should be 0.30-0.40mm).
7. Before facing, clean inside and outside of each pipe end, and the cutter blades.
8. Record the drag pressure from the pressure gauge before every weld.
9. Add the drag pressure to the calculated pressure to determine the appropriate bead up and fusion gauge pressures.

1.2. Pipe Alignment

> TIP
>
> Put the top clamp over the pipe, then engage the bottom toggle bolt and hold it in place, then engage the upper toggle bolt, then tighten the toggle nuts.

Place the pipes in the clamp jaws with about 30mm of pipe extending past the clamps into the weld zone. Tighten the clamp toggle bolts securely using a shifter to prevent the pipe from moving when under hydraulic pressure. The outer ends of the pipe should be supported such that any external bending loads on the machine are eliminated and drag pressure is minimised

Move the pipe ends together until they are almost touching, then check for misalignment (maximum allowable misalignment is 10% of wall thickness). Reduce any misalignment to an acceptable amount by adjusting the top and bottom fixed clamp eccentric adjusters.

(Adjustment will not be possible if the pipe ends are in contact and under pressure.)

Move the pipe end clear of the weld zone and record the drag pressure. Add this value to the fusion pressure required to join the pipe (refer welding table).

3.2. Drag Pressure

"DRAG" is the amount of pressure required to overcome carriage friction plus the effort required to move the pipe. As drag pressure is a variable, it must be measured before every weld.

To determine the drag pressure, open the directional control valve and observe the pressure at which the carriage just begins to move. The EHF350 drag pressure without pipe loaded should be in the range 200-800kPa.

If drag pressure is excessive it may adversely affect the weld. Drag may be reduced by one or more of the following actions:

1. Use a low friction pipe support/roller system.
2. Ensure the pipe support/roller system maintains the whole length of the pipe level with the machine base to prevent bending forces acting on the machine frame.
3. Minimise the amount of pipe being pulled. Welding machines are not designed to pull multiple lengths of pipe.
4. Ensure the heater/facer rest bar does not obstruct carriage movement

All of these techniques are always important, but become critical when working near the limits of machine capacity.

3.3. Facing

Move the pipe ends apart and insert the facer. Ensure the facer retaining hook latches on to the rest bar to prevent the facer from jumping out of the machine during the facing operation.

Start the facer rotating. Move the pipe ends into contact with the facer and apply the minimum pressure necessary to achieve cutting until 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 carriage pressure – e.g. never exceed 2,000 kPa more than drag.

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. Raise the facer up and fully out of the machine.

3.4. Re-Check Pipe 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.

Move the carriage to bring the pipe faces into contact with the heater plate. Increase pressure to the predetermined “bead-up” pressure.

Maintain pressure until an initial bead has formed completely around the pipe circumference on both sides of the heater plate. The bead up time is variable, and is influenced by weather conditions and pipe dimensions.

3.6. Heat Soak

After bead up, reduce the pressure down to the drag pressure to maintain a slight positive pressure 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.

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

Bring the melted pipe faces into contact with each other immediately to minimise heat loss from the weld zone. Smoothly build up to the required fusion pressure to avoid squeezing out too much hot plastic.

Unless hydraulic pressure is maintained while the weld is cooling, shrinkage will occur and voids may form in the weld zone. It is essential to run the pump and maintain the pipe under pressure in the clamps until the weld/cooling time is complete.

3.8. Weld Quality Check

Inspect the uniformity of the bead size inside and out, top and bottom of the pipe. It is advisable to monitor and record times, temperatures and pressures at each phase of every joint for future reference. (See section on trouble-shooting weld failures.)

4. EHF350 Maintenance - Daily

4.1. Maintenance - Daily Check List

1. Keep the machine and accessories clean and free of dust and grease. Do not lubricate any HF350 components except for the facer drive (see later).
2. Inspect hydraulic components for leaks from connections and seals. Overhaul seals and fittings as necessary.
3. Check for air in the carriage cylinders (as evidenced by shuddering, and/or "springing back" of the cylinders). Air in the hydraulics will adversely affect weld quality and must be removed by bleeding (see later).
4. Check the pressure gauge needle returns to zero and does not stick.
5. 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.)

1. Do electrical safety checks.
2. Replace non-stick cloths if damaged in way of the weld area.
3. 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.
4. Ensure the facer drill is securely fixed into the facer body casting, if not the drive gears may not mesh properly causing extensive damage.
5. Feel for "sloppy" movement of the cutter plates. This indicates the need to adjust the facer drive internally.
6. 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, more detailed inspections of the key machine components should be carried out before commencing each new project, or after 250 operating hours. Any faults found should be corrected as described in this section.

5.1. General/Drag

Check the hydraulic cylinder shafts for cuts or dents likely to damage the hydraulic seals.

Check the machine frame, main carriage guide shafts, hydraulic shafts and heater rest bars are not damaged or bent such that excessive drag pressure results. Without pipe in the machine, drag pressure should not exceed 1200kPa

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 EHF350 heater is controlled by turning the adjusting screw on the top of the heater handle, clockwise for higher temperature, and anticlockwise for lower temperature.

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 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. Heater failure

If the heater does not power up, check for damage to leads or connectors, or failure of the temperature controller (thermo-switch), or failure of the element pad. Refer to heater drawing.

1. Always first test the power supply and the power cord on some other appliance to ensure those items are not at fault.
2. Use an electrician to test the heater element and the thermo-switch. The element resistance should be 24 ohms ± 10%. If there is a short circuit, or open circuit, the element pad must be replaced. If the element, leads and connectors are OK, check the thermo-switch.
3. To check the thermo-switch turn the adjusting screw and listen for an audible click as it switches. Placing a meter across the terminals will also show a change in resistance as it switches. If this doesn't happen the switch is faulty. Replace as necessary.
4. To remove the thermo-switch:
   - Remove the four screws securing the Bakelite handle to the heater bracket.
   - Disconnect the 4 conductors (2 quick connect, 2 screw lugs) and remove the earthing connectors.
   - Remove the four socket head cap screws which secure the heater bracket to the heater plate.
   - Remove the two 3/16" hex drive countersunk screws that retain the thermo-switch. Turn the thermo-switch adjustment screw fully counter-clockwise to enable its removal from the rubber grommet in the handle case. Extract the thermo-switch from the heater bracket and carefully withdraw the element leads, copper capillary tube and sensor bulb from the casting. Do not damage the capillary tube.

- Inspect insulation, wiring and connectors for damage. Repair as necessary.

5. Before refitting the thermo-switch, apply some silicon heat sink compound sparingly to the sensor bulb for improved thermal sensitivity.
6. To refit the thermo-switch, reverse the removal procedure taking care not to pinch or damage the capillary tube, sensor bulb, or electrical insulations. Ensure the earthing conductors are reconnected.
7. Plug the power cord into the handle and switch on. The neon should light immediately, indicating power on. When first fitted, allow 20 minutes for the heater to reach temperature and to stabilise, before making any adjustments. Always allow several minutes for the plate temperature to stabilise after making any adjustment.

5.7. Jammed Sensor Bulb

If the sensor bulb becomes jammed in the heater casting, it will need to be drilled out using a 9.8mm long series drill. Drilling depth is 160mm below the top face of the heater casting.

Caution: ***Use exactly a 9.8mm drill or the bulb will be too loose to allow good heat transfer from the casting. This will adversely affect temperature control. Drilling deeper than 160mm could damage the electric element.***

5.8. Operating Pressure

Start the hydraulic pump and note the gauge readings for each pressure regulator. The operating pressure of the EHF350 is limited to 9,500kPa by a relief valve that is located inside the oil tank adjacent to the pump. Should it be necessary to adjust the relief pressure contact the manufacturer for advice. Care should be taken if increasing the pressure above this setting as the pressure gauge may be damaged.
(Older models were fitted with a 0-8000kPa gauge with operating pressure limited to 7,500kPa.)

During normal operation the hydraulic oil temperature will reach up to 80°C, and the electric motor up to 70°C. Handle with care.

5.9. Pressure Gauge Calibration

Pressure gauges are easily damaged and may lose their accuracy. Periodically either

1. Remove the pressure gauge and check it against a known standard test gauge, or
2. Replace the pressure gauge with a certified gauge from time to time.

5.10. Synchronising The Carriage Cylinders

If air enters the cylinders, the carriage motion will eventually become out of phase or jerky. This will adversely affect the welding operation and air should be bled from the cylinders (see below).

The presence of air in the system could result from loose hydraulic fittings, damaged hydraulic cylinder shafts or seals. These should all be inspected and repaired if necessary before bleeding the system.

Caution: *The clamp cylinders are series connected to ensure both cylinders apply equal pressure. Do not change this configuration without consulting the manufacturer.*

The cylinder balance valve in the line between the clamp cylinders must remain closed during normal operation. This valve is only used when bleeding air from the system.

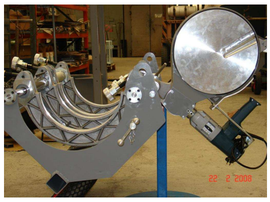
5.11. Hydraulics Bleeding Method

The following method is recommended for recharging the hydraulic system with oil, or when bleeding air from the cylinders.

1. Check that all fittings are tight. Remove the filler nut from the oil tank and insert a filling funnel.
2. Fill the tank 3/4 full and keep adding oil to maintain this level as it is taken up by the system. Operate the pump and the directional control lever alternately in each direction such that the cylinders begin to fill with oil, adding oil to the tank as

required until the cylinders start to move. Use any brand of oil with a viscosity of ISO 46.

3. Entrapped air will rise to the top of the cylinders. To ensure all air is able to escape from the cylinders, rock the machine over on 2 wheels (as shown right) such that the cylinder ports are pointing skywards during bleeding. Ensure the machine is safely supported when in this position.



Do not omit this step or air will remain in the system.

4. Shut the cylinder balance valve (in the line between the 2 cylinders) and pump the cylinders fully open.
5. Open the cylinder balance valve before reversing the directional control valve to ensure air exhausts to the tank rather than escaping back into the cylinders. Reverse the directional control valve slowly so as not to damage the pressure gauge. Maintain the oil tank level at 3/4 full. (If motion stops, the oil level is probably too low.)
6. Repeat this cycle in each direction until any change of the directional control lever, and the resultant motion of the carriage, is immediate and exactly in sequence. There should also be no clamp spring back at the end of the cylinder stroke (either end) on changing the directional control valve.
7. At this point all air should be fully expelled from the system. Top up the oil tank as necessary.
8. *At the end of this process ensure the cylinder balance valve is closed to lock the cylinders in phase.*

5.12. Facer Drive

Refer to Facer drawing.

1. Inspect the drill for mounting and alignment. Contact your local Bosch supplier with specific drill service enquiries.
2. Remove the drill and access the facer drive assembly by removing the securing screws from the idler cutter plate and removing the plate.
3. Clean out any dirt or plastic cuttings that could either damage the drive components, and/or significantly reduce facing efficiency.
4. Inspect the bevel gear assembly for wear. If replacement is deemed necessary, replace both the bevel bear and pinion as a set.
5. Check that the 119 tooth main drive sprocket is in contact with all four bronze rollers. Two rollers are concentrically bushed and two are eccentrically bushed. This design enables bronze roller or sprocket wear to be taken up by adjusting the two eccentric guide rollers. These are adjusted by loosening the holding bolts and rotating the bush in the direction of chain rotation, until the sprocket is supported by all 4 rollers.
6. Tension the chain by adjusting the eccentrically bushed idler sprocket as described above.
7. Once the rollers wear beyond the point of any further adjustment, the guide roller & bearing assemblies must be replaced.

5.13. Facer Bronze Roller Replacement

Refer to Facer drawing.

1. Remove the screws holding the idler cutter plate and remove the cutter plate.
2. Detach the driven cutter plate from the main sprocket by removing the 12 sprocket screws and carefully knocking the plate away from the sprocket. (The cutter plate locates in a groove machined into the sprocket face.)

3. Carefully note the location of the eccentric and concentric bronze roller assemblies and remove them.
4. Refit new concentric roller assemblies.
5. Hang main sprocket.
6. Refit new eccentric roller assemblies.
7. Adjust the eccentric rollers in the direction of chain rotation, so that all four bronze rollers support the main sprocket and the sprocket and rollers all turn freely.
8. Fit the chain and idler sprocket. Tension the chain by adjusting the eccentric bush in the idler sprocket.
9. Lubricate sparingly, and only with a high pressure grease e.g. Shell Alvania EP2.

   Do not use *graphite grease, molybdenumdisulphide or similar, as they may run and leak out of the facer, providing a potential weld contamination problem.*
10. Refit the driven cutter plate to the main sprocket, and test rotation before replacing the idler cutter plate.

5.14. 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 tool&cutter grinder. Shim the cutter blades if they are sharp, but shavings are too thin.

5.15. Eccentric Alignment Mechanism Repairs

See drawing “eccentric assembly” for part numbers referenced in the next three sections.

5.16. Damaged Eccentric Toggle Stud Thread

1. Should the ½" stud (BF350055) be broken off or the threaded hole damaged, it may be able to be repaired in situ using a ½" BSW 'heli-coil'.
2. Apply Loctite 290 to the stud when refitting and do up finger tight.

5.17. Seized (Front Or Bottom) Eccentric Assembly

1. Unscrew and remove the eccentric shaft pivot-long (BF350044).
2. Remove four shaft nut mounting screws (BF000231) from shaft nut-long (BF350030).
3. Unscrew the shaft nut – long (BF350030).
4. Remove the toggle screw (BF350055) from the bronze bush to enable the internal eccentric assembly to be pushed out of the steel tube.
5. If the assembly is seized, use a press to push the bronze eccentric assembly out of the outer steel tube.
6. Clean up any corrosion inside the steel casing.
7. Observe that there are no cracks in the silver solder joints between the bronze bushes and both ends of the stainless steel connector tube. If the solder is broken, the complete eccentric must be returned to the manufacturer for proper alignment and re-soldering, or a new part fitted.
8. Check for free rotation of the shaft pivot-long inside the bronze bushes. Ream Bushes if required.
9. Lightly grease the bronze bushes before reassembling.
10. Reassemble components in reverse order.
11. Replace the shaft nut (BF350030) and do it up tightly, then back off just enough to align the shaft nut mounting screw holes with the nearest hole in the frame plate.

5.18. Seized (Rear Or Top) Eccentric Assembly

1. Remove two pivot bolts (BF350053) from the left and right hand hinge plates (BF350042).
2. Rotate the upper eccentric assembly with the clamps attached clear of the side frame plates to allow access to the end of the eccentric adjuster.
3. Remove Toggle Nut (BF050028) and Washer (BF000272). (Use Anti-Seize on toggle nut when re-assembling.)
4. Remove stud (BF350055). (Use Loctite290 on screw when re-assembling. NOTE: do not tighten Set Screw.)
5. Push Connector Tube Assembly (BF350054) out of Tube (BF350006). (Apply Grease when reassembling.)
6. Remove Shaft pivot-short (BF350043) from top eccentric tube-bushed (BF350006) and check for free rotation, ream Bushes if required.

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 220 ±15°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.

7. 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.
8. 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.
9. The temperature is unlikely to be exactly the same at every point on the heater surface due to manufacturing tolerances.
10. 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.

11. Always wait 5 minutes after the heater has first reached set temperature for the temperature to stabilize before recording measurements.
12. 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.
13. **FUSIONMASTER®** heater plates are fitted with non-stick replaceable cloth. It is essential to use a contact probe 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.)
14. If a contact probe is used it should be held in position for several seconds before the reading is taken.
15. 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).
16. 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.

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)

1. *POP003 Butt Fusion Jointing of PE Pipes and Fittings - Recommended Parameters.*
2. *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 the EHF350 operating manual are based on POP003-SP-LP.

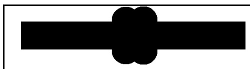
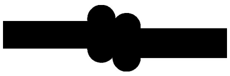
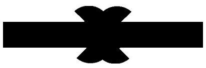
Operators should take care to determine the compatibility of materials for butt welding and only attempt to weld pipes and fittings made of the same polymer, eg PE to PE, PP to PP, PVDF to PVDF, etc.

The joint area must always be protected from adverse weather conditions, eg 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 eg 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 eg melt flow index.

9. Warranty

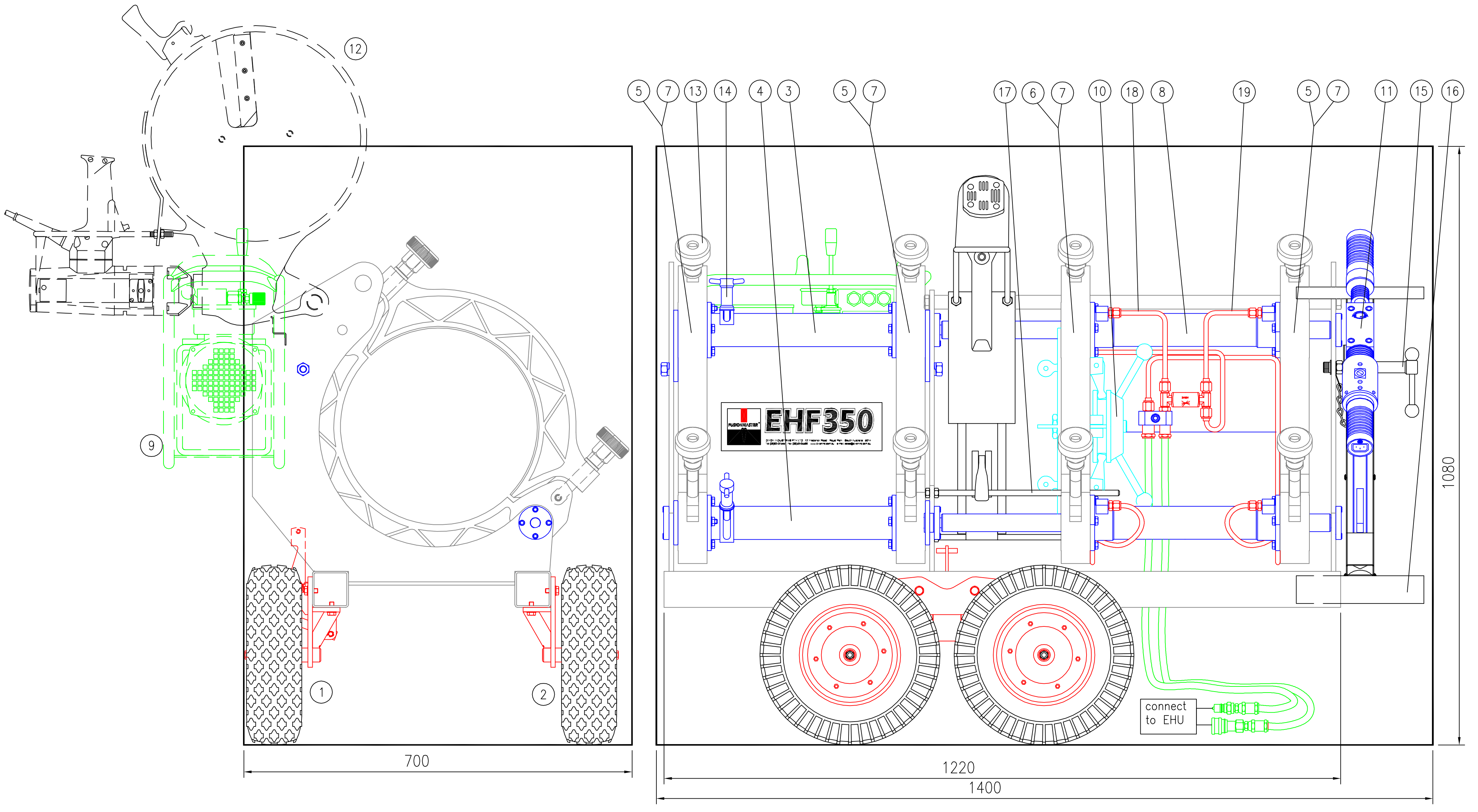
FUSIONMASTER® Butt Fusion Equipment

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.



ITEM	PART No.	PART NAME	QTY /KIT	ITEM	PART No.	PART NAME	QTY /KIT
19	BF350652	Steel Tube Assy EHF #13	1	13	BF350009	Toggle Nut (Clamp)	8
18	BF350651	Steel Tube Assy EHF #12	1	12	BF350200	Facer Assembly	1
17	BF350038	Heater/Facer Rest Bar	2	11	BF350100	Heater Assembly	1
16	BF350800	Heater Stand	1	10	BF350300	Fittings Chuck	1
15	BF200034	Toggle Nut (Htr. Stand)	1	9	EH350600	Electric Hydraulic Unit	1
14	BF050028	Toggle Nut (Eccentrics)	2	8	BF350634	Hydraulic Cylinder	2

ITEM	PART No.	PART NAME	QTY /KIT
7	BF350049	Clamp Top	4
6	BF350005-1	Clamp Bottom-drilled	1
5	BF350005	Clamp Bottom	3
4	BF350074	Bottom Eccentric Assy	1
3	BF350073	Top Eccentric Assy	1
2	BF350004	Wheel Assy (Unbraked)	1
1	BF350003	Wheel Assy (Braked)	1

Drawing Name: HF350 MACHINE ASSEMBLY (ELEC./HYD.) OPERATORS MANUAL ONLY

Scale: Not To Scale
Drawn: SR
Date: 8/05/09

CAD File: U:\DWG_Manual Dwg\HF350-MAN\BF3500A0-MAN.dwg

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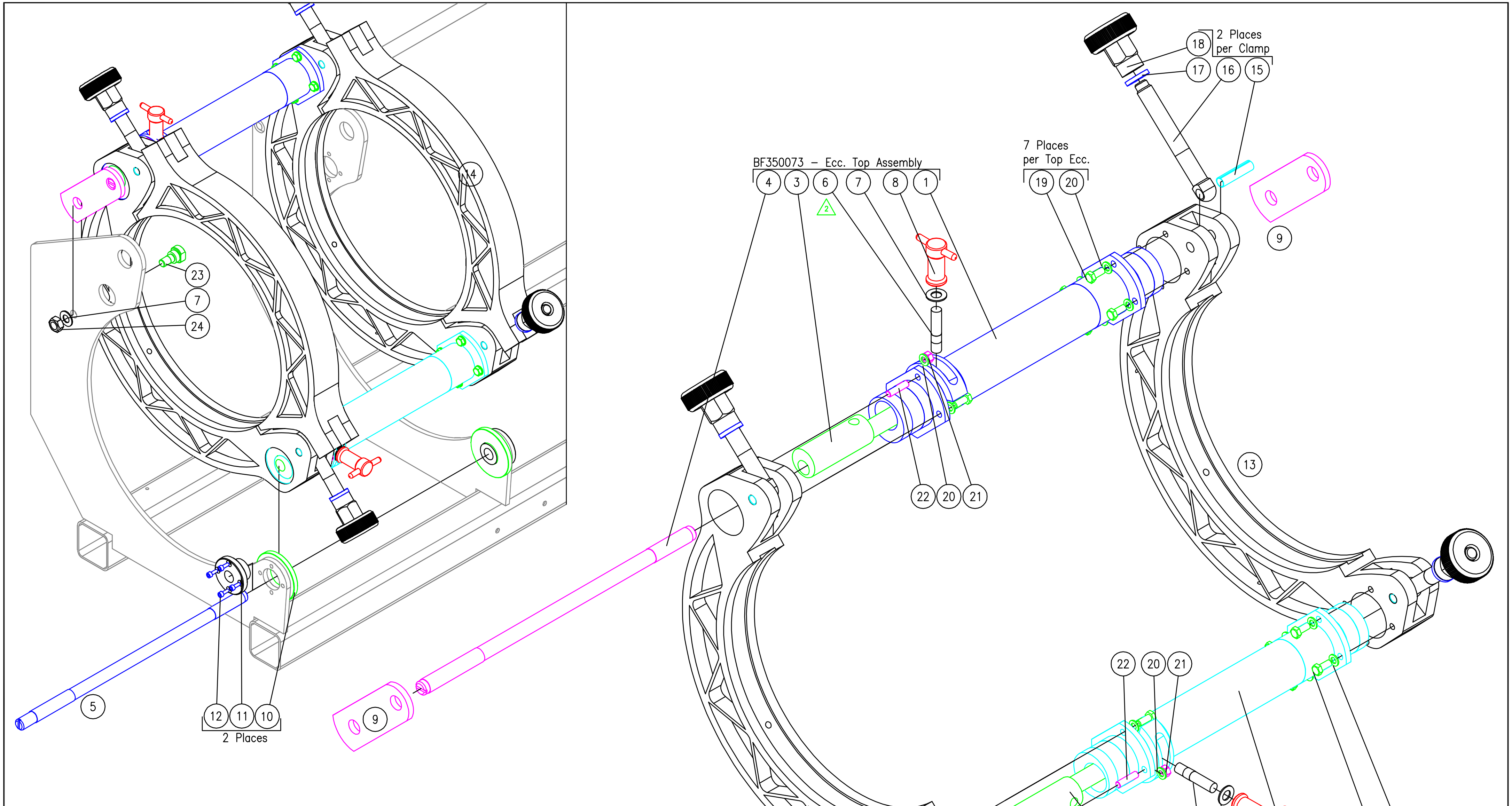

ITEM	PART No.	PART NAME	QTY
12	BF000231	Shaft Nut Mtg. Screw	8
11	BF350030	Shaft Nut, long	2
10	BF350045	Spacer Washer	2
9	BF350042	Hinge Plate	2
8	BF050028	Toggle Nut Assembly	2
7	BF000272	Flat Washer	4
6	BF350055	Ecc. Stud	2
5	BF350044	Pivot Shaft, long	1
4	BF350043	Pivot Shaft, short	1
3	BF350054	Ecc. Connector Tube A.	2
2	BF350072	Ecc. Tube Bushed, bottom	1
1	BF350006	Ecc. Tube Bushed, top	1

ITEM	PART No.	PART NAME	QTY
24	BF000275	Pivot Bolt Lock Nut	2
23	BF350053	Pivot Bolt	2
22	BF000241	Ecc. Tube Mtg. Screw	2
21	BF000245	Ecc. Tube Mtg. Nut	2
20	BF000121	Flat Washer	16
19	BF000243	Ecc. Tube Mtg. Bolt	14
18	BF350009	Toggle Nut	4
17	BF350052	Toggle Nut Washer	4
16	BF350008	Toggle Bolt	4
15	BF000276	Toggle Bolt Mtg. Pin	4
14	BF350049	Clamp, top half	2
13	BF350005	Clamp, bottom half	2

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Drawing Name:
HF350 ECCENTRIC ASSEMBLY
OPERATORS MANUAL ONLY

CAD File: U:\Dwg\Mech Desktop\HF350\BF350000\350077.dwg

Scale: Not To Scale
Drawn: SR
Date: 23/09/10

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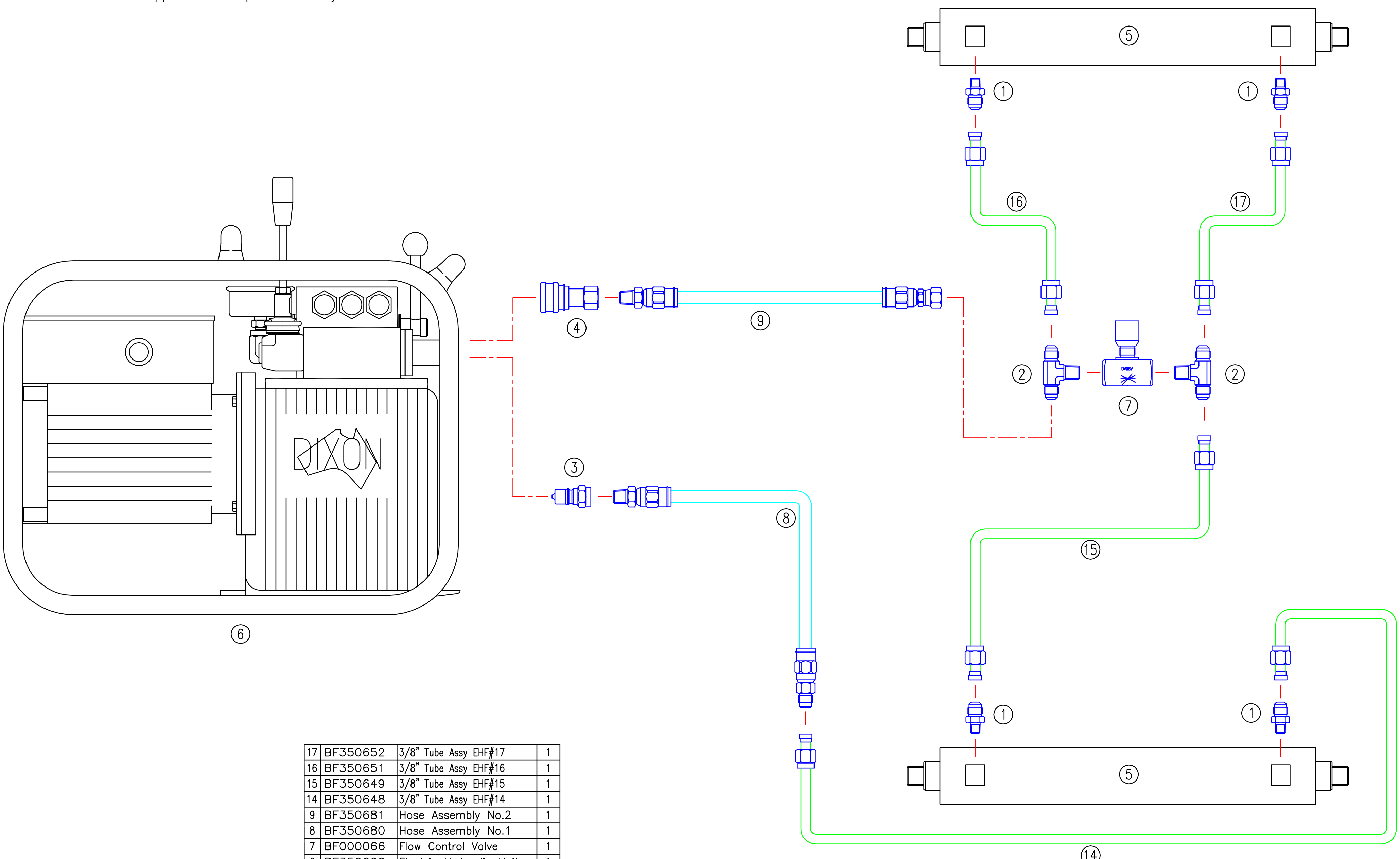
NOTE: Hoses and Tubes supplied as complete Assembly.



ITEM	PART No.	PART NAME	QTY /KIT
17	BF350652	3/8" Tube Assy EHF#17	1
16	BF350651	3/8" Tube Assy EHF#16	1
15	BF350649	3/8" Tube Assy EHF#15	1
14	BF350648	3/8" Tube Assy EHF#14	1
9	BF350681	Hose Assembly No.2	1
8	BF350680	Hose Assembly No.1	1
7	BF000066	Flow Control Valve	1
6	BF350600	Electric Hydraulic Unit	1
5	BF350634	Hydraulic Cylinder	2
4	BF000003	Female Quick Connector	1
3	BF000297	Male Quick Connector	1
2	BF000057	Tee	2
1	BF000058	Nipple	4

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Drawing Name: HF350 ELECTRO-HYDRAULIC ASSEMBLY OPERATORS MANUAL ONLY	Scale:	Not To Scale	DIXON INDUSTRIES PTY LTD A.B.N. 89 008 171 855
	Drawn:	SR	
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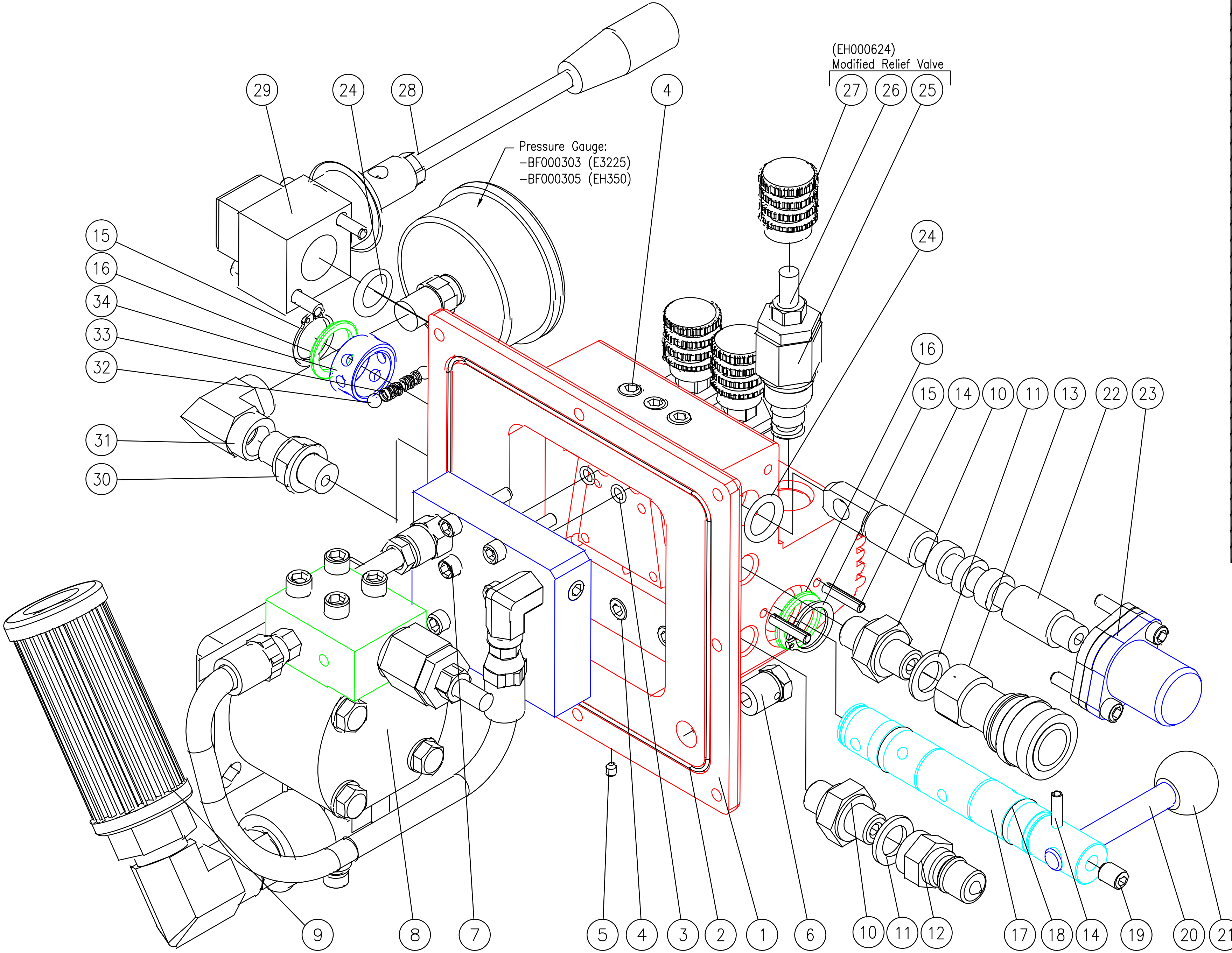

ITEM	PART No.	PART NAME	QTY /KIT
1	EH000602	Valve Body	1
2	BF000033	O-Ring (Tank Lid)	1
3	BF000029	O-Ring	2
4	BF000065	Dry Seal Plug	6
5	BF000105	Set Screw	1
6	EH000626	Modified Plug	1
7	BF000106	Pump Assy Mtg Screw	6
8	BF000036	Pump	1
9	BF000193	Suction Element	1
10	BF000600	Nipple	2
11	BF000400	Metal Back Seal	2
12	BF000297	Quick Connect Male	1
13	BF000003	Quick Connect Female	1
14	BF000094	Roll Pin	3
15	BF000026	Circlip	2
16	BF630671	Spacer Washer	2
17	BF630680	Spool	1
18	BF000031	O-Ring (Spool)	2
19	BF000122	Set Screw	1
20	EH000608	Lever	1
21	BF200011	Knob	1
22	BF000005	Spool Type SD4	1
23	BF000020	Spool Detent Version 9	1
24	BF000032	O-Ring (Spool)	2
25	BF000184	Relief Valve Cartridge	3
26	EH000611	Piston	3
27	EH000609	Aluminium Knob	3
28	BF000028	LEVER FOR D/C	1
29	BF000019	LEVER ASSY STANDART D/C	1
30	BF000601	Nipple	1
31	BF000050	Elbow	1
32	BF000470	S/S Brg. Ball	2
33	BF630674	Detent Spring	1
34	BF630673	Detent Ring	1

Drawing Name:	Scale:	Not To Scale
ELECTRIC HYDRAULIC UNIT OPERATORS MANUAL ONLY	Drawn:	SR
	Date:	25/03/11
CAD File: U:\DWG\Mech Dersktop\EH000\000636.dwg		

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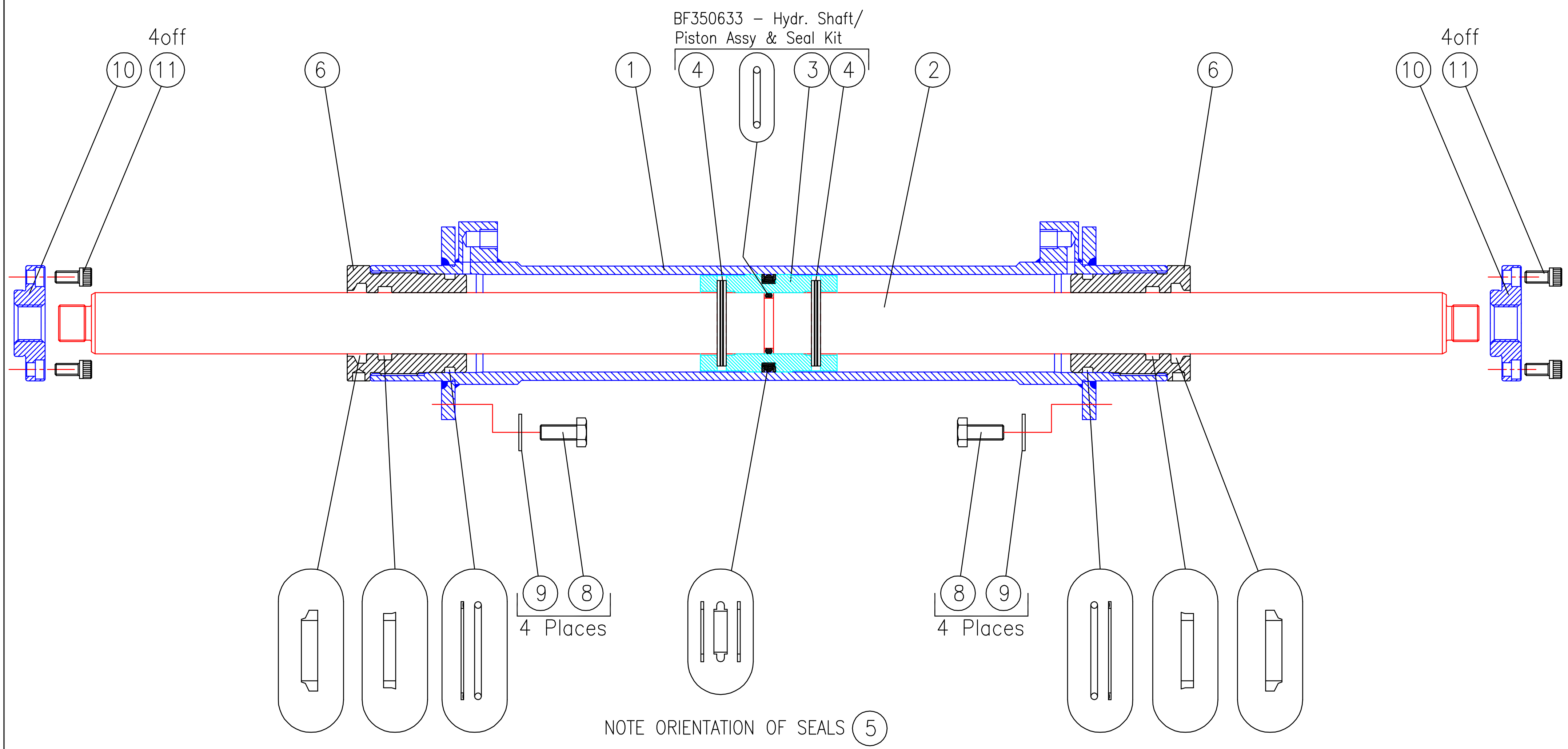

NOTE:
1. 1 off Shaft Nut required for Bottom Cylinder and
2 off Shaft Nuts required for Top Cylinder.
2. QTY for Top & Bottom Cylinder listet

ITEM	PART No.	PART NAME	QTY /KIT
11	BF000231	Shaft Nut Motg Screw	12
10	BF350031	Shaft Nut Short	3
9	BF000238	Flat Washer	16
8	BF000243	Mounting Screw	16
7			
6	BF350635	Gland Nut	2
5	BF350664	Seal Kit	1
4	BF000225	Roll Pin	2
3	BF350636	Piston (2)	1
2	BF350639	Shaft	1
1	BF350638	Barrel Weldment	1

Drawing Name: HF350 HYDRAULIC CYLINDER ASSEMBLY OPERATORS MANUAL ONLY	Scale:	Not To Scale
	Drawn:	SR
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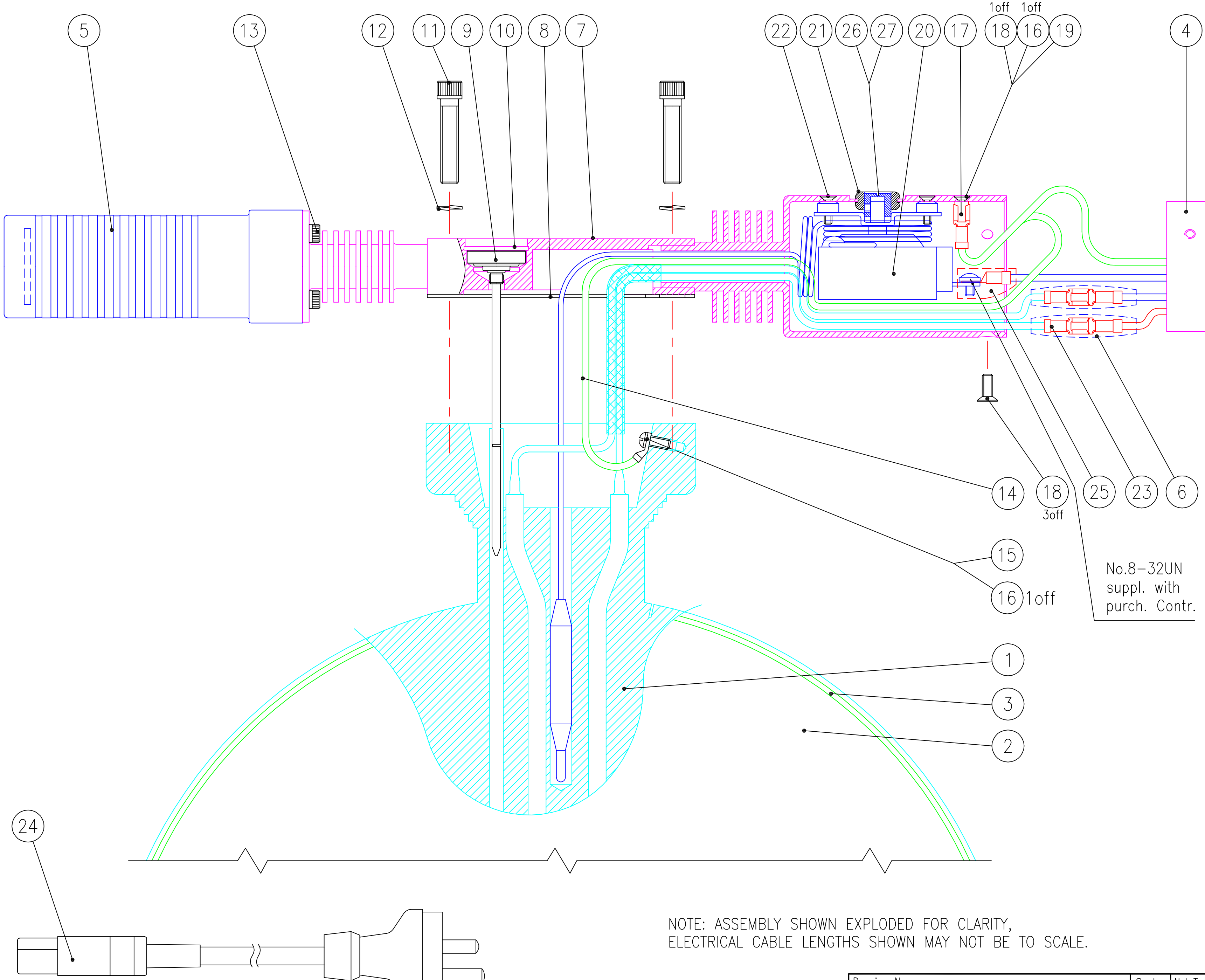
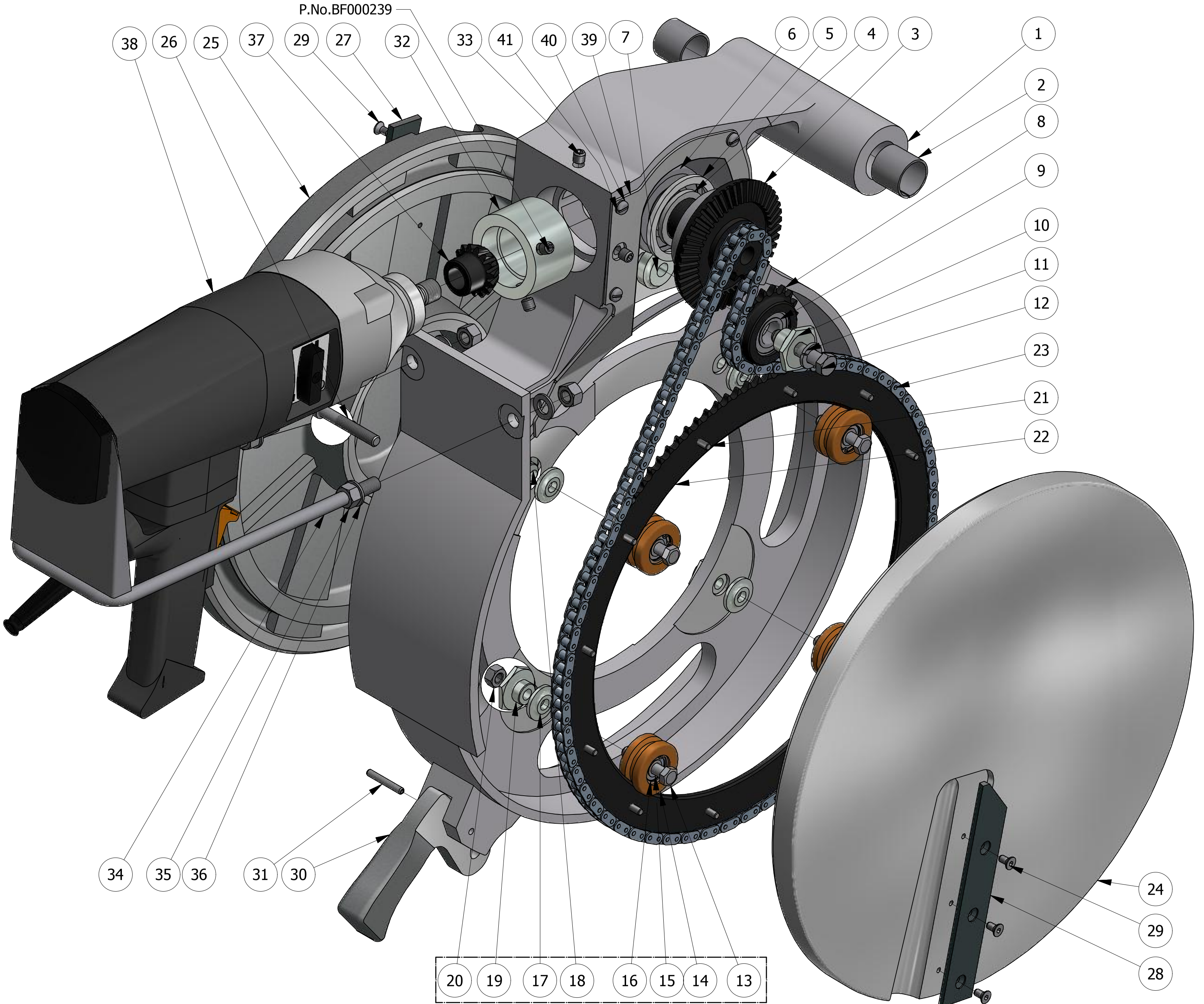


NOTE: ASSEMBLY SHOWN EXPLODED FOR CLARITY,
ELECTRICAL CABLE LENGTHS SHOWN MAY NOT BE TO SCALE.

	ITEM	PART No.	PART NAME	QTY /KIT
ref.	27	BF000105	SET SCREW	1
ref.	26	BF350123	ADJUSTING KNOB	1
ref.	25	BF100153	HEAT SHRINK TUBE	2
	24	BF100104	POWER CABLE	1
	23	BF000079	ELECTRICAL CONNECTOR	2
	22	BF000210	MOUNTING SCREW	2
	21	BF000024	GROMMET	1
	20	BF350113	TEMP. CONTROLLER	1
	19	BF000220	EARTH NUT	1
	18	BF000216	EARTH & MTG SCREW	4
	17	BF000076	ELECTRICAL CONNECTOR	1
	16	BF000221	EARTH SCREW	1
	15	BF000228	SPRING WASHER	2
	14	BF350116	EARTH LEAD ASSY	1
	13	BF000226	HANDLE MTG. SCREW	4
	12	BF000256	SPRING WASHER	4
	11	BF000254	PLATE MTG. SCREW	4
	10	BF000318	CIRCLIP	1
	9	BF000183	THERMOMETER	1
	8	BF350106	GASKET	1
	7	BF350105	HEATER BRACKET ASSY	1
	6	SV050117	INSULATING SLEEVE	2
	5	BF350112	DUMMY HANDLE ASSY	1
	4	BF350102	SOCKET HANDLE ASSY	1
	3	BF350111	SNAP RING – PAIR	1
	2	BF350110	PTFE CLOTH – PAIR	1
	1	BF350101	ELEMENT PAD	1

Drawing Name: HF350 HEATER PLATE ASSEMBLY OPERATORS MANUAL ONLY	Scale: Not To Scale	DIXON INDUSTRIES PTY LTD	
	Drawn: SR		
	Date: 05/05/09	A.B.N. 89 008 171 855	www.dixonind.com.au
CAD File: U:\DWG_Manual Dwg\HF350–MAN\BF3501A0–MAN.dwg			

UNCONTROLLED DOCUMENT



typ. 4 places, except Item 18 & 19,
- locate Ecc. Bush (Item 18) closest to Idler Sprocket and Bevel Gear

Assembly	Item	Part No.	Part Name	QTY
	41	BF000219	Cover Plate Mtg. Screw	4
	40	BF000218	Cover Plate Mtg. Washer	4
	39	BF350228	Cover Plate	1
	38	BF350244	Bosch Drill	1
	37	BF350214	Bevel Pinion	1
BF350234 Drill Mount A., supplied as Assembly	36	BF000260	Drill Mount Mtg. Washer	4
	35	BF000265	Drill Mount Mtg. Nut	4
	34	BF350234W	Drill Mount Weldment	1
	33	BF000239	Set Screws	2
	32	BF350208	Drill Adaptor & 2 Set Screws	1
	31	BF000337	Handle Lock Pin	1
	30	BF350233	Handle Lock	1
BF350212 Cutter Blades & Screws, supplied as kit	29	BF000217	Blade Mtg. Screw	6
	28	BF350212B	Driver Cutter Blade	1
	27	BF350212A	Idler Cutter Blade	1
	26	BF000255	Cutter Plate Mtg. Screws	2
	25	BF350220	Cutter Plate, Idler	1
	24	BF350202	Cutter Plate, Driven	1
	23	BF350219	Drive Chain & Link	1
	22	BF350203	Main Sprocket 114T- 3/8"Pitch	1
	21	BF000226	Main Sprocket Mtg. Screws	12
	20	BF000133	Mtg. Nut, Guide Roller Assy	4
	19	BF350210	Concentric Bush	2
	18	BF350209	Eccentric Bush	2
	17	BF350231	Guide Roller Bearing Spacer	4
BF350206 Guide Roller/ Bearing A., supplied as Assembly	16	BF000082	Circlip	4
	15	BF000022	Bearing	8
	14	BF350226	Guide Roller	4
	13	BF350221	Mtg. Bolt, Guide Roller Assy	4
	12	BF000338	Idler Screw	1
	11	BF000268	Spring Washer	1
	10	BF350218	Idler Eccentric Bush	1
BF350216 Idler Spr./Brg.A suppl.as Assy	9	BF000021	Bearing	1
	8	BF350205	Idler Sprocket	1
	7	BF350217	Idler Spacer	1
BF350211 Bevel Gear/ Sprocket/ Bearing A. supplied as Kit	6	BF000319	Bearing	2
	5	BF350207	Outer Spacer Ring	1
	4	BF350215	Inner Spacer Ring	1
	3	BF350204	Bevel Gear & Sprocket	1
	2	BF000074	Glycodur Bush	2
	1	BF350201	Facer Body	1

Drawing Name:
HF350 Facer Assembly
OPERATORS MANUAL ONLY

Scale:	not to scale
Drawn:	SR
Update:	5/12/2014

CAD File: U:\Inventor\HF350\BF350200\BF3502A0.idw

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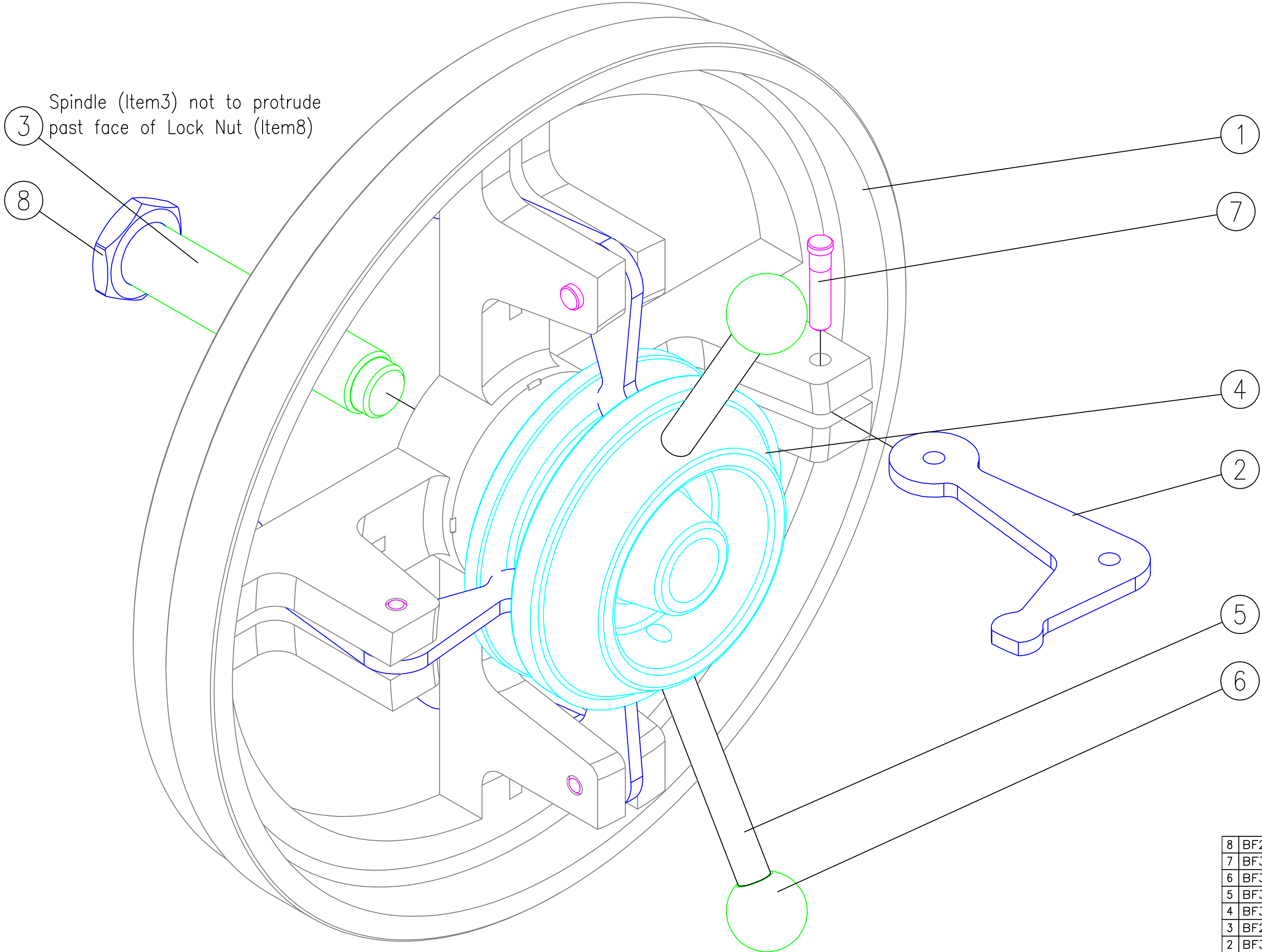

ITEM	PART No.	PART NAME	QTY /KIT
8	BF200305	Lock Nut	1
7	BF350310	Pivot Pin	4
6	BF350308	Handle Knob	2
5	BF350307	Tee Bar	2
4	BF350306	Adjuster Nut	1
3	BF200304	Spindle	1
2	BF350303	Finger Lever	4
1	BF350301	Body	1

Drawing Name: HF350 FITTINGS ATTACHMENT ASSEMBLY OPERATORS MANUAL ONLY	Scale:	Not To Scale
	Drawn:	SR
	Date:	6/05/09
CAD File: U:\Dwg\Mech Desktop\HF350\BF350300\3503a0.dwg		

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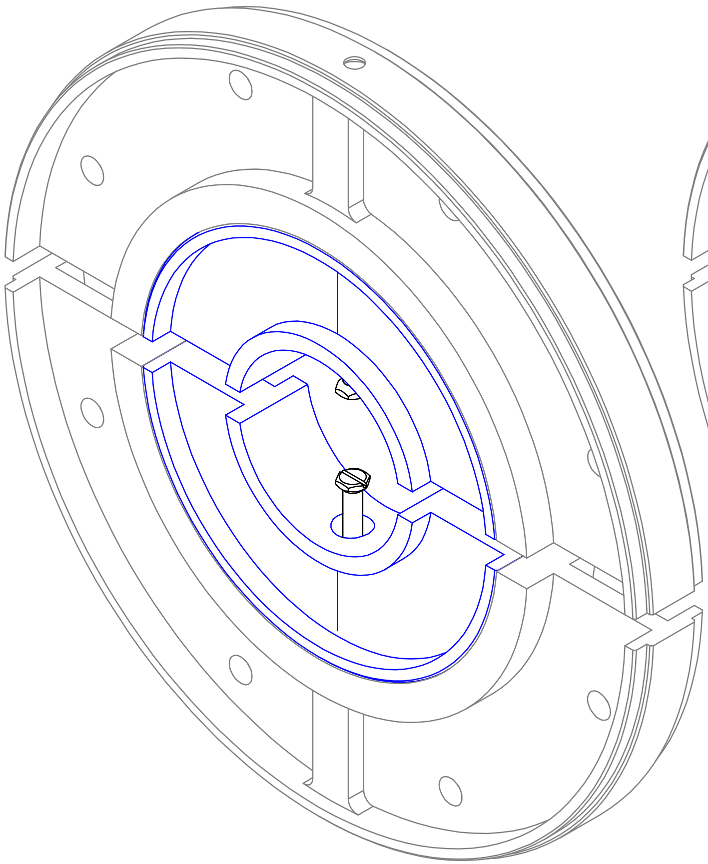
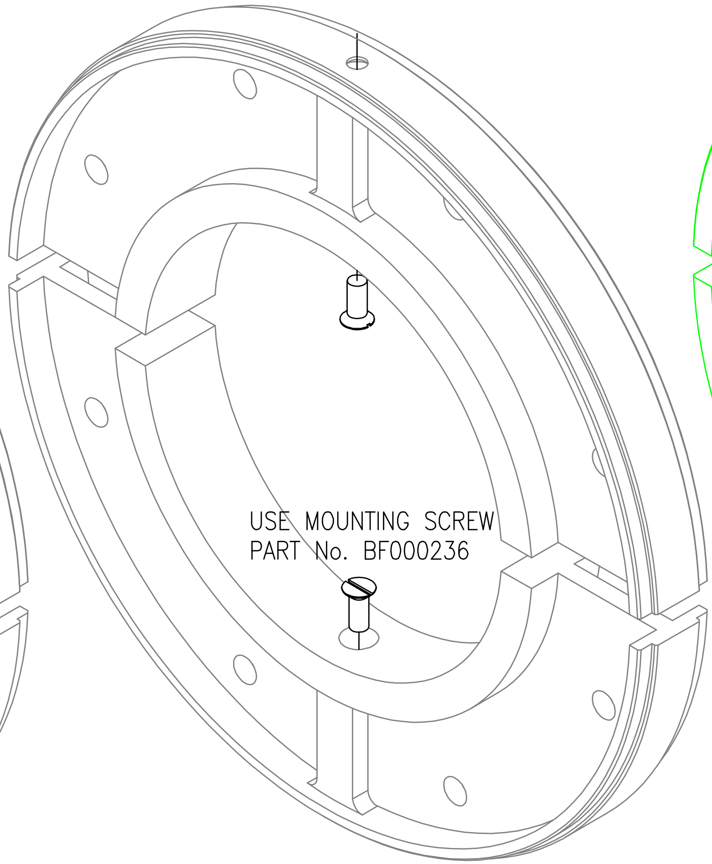


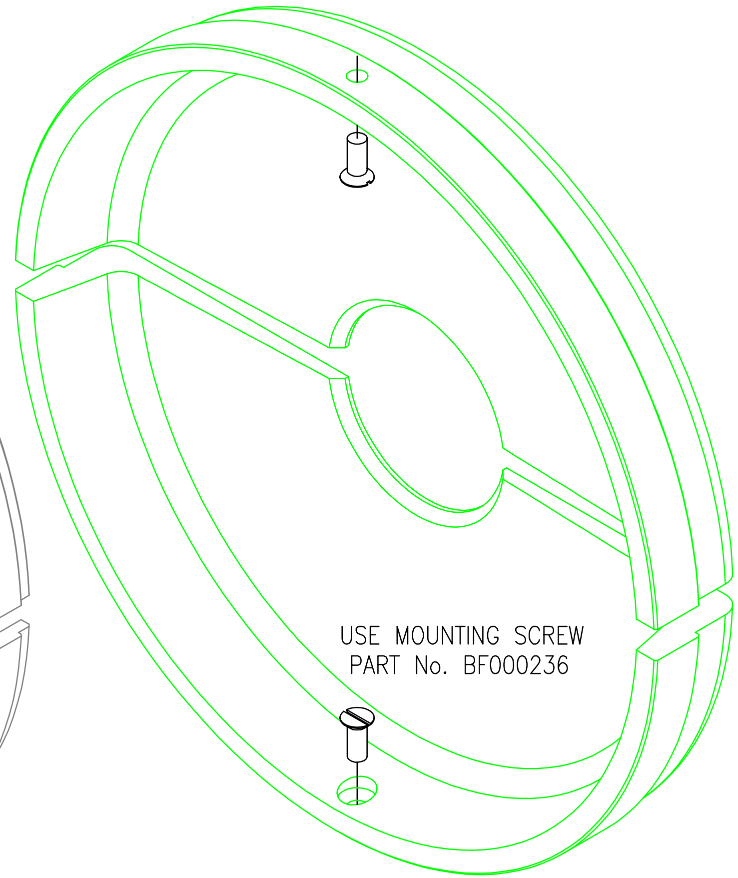
PART No.	SIZE
BF350909P	200–90
BF350911P	200–110
BF3509125P	200–125
BF350914P	200–140
BF350916P	200–160
BF350918P	200–180

200–90 SHOWN
LINERS FIT INTO 355–200 LINERS
USE MOUNTING SCREW PART No. BF350997



PART No.	SIZE
BF350920P	355–200
BF3509213P	355–213
BF3509219P	355–219
BF3509225P	355–225
BF350925P	355–250
BF3509273P	355–273
BF350928P	355–280
BF3509315P	355–315
BF350932	355–322

355–200 SHOWN
LINERS FIT INTO MACHINE CLAMPS



PART No.	SIZE
BF350909N	355–90
BF350911N	355–110
BF350912N	355–125
BF350914N	355–140
BF350916N	355–160
BF350918N	355–180
BF350920N	355–200
BF3509213N	355–213
BF350921N	355–219
BF350922N	355–225
BF350925N	355–250
BF350928N	355–280
BF350931N	355–315

355–90N SHOWN
LINERS FIT INTO MACHINE CLAMPS

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Drawing Name: HF350 CLAMP LINERS OPERATORS MANUAL ONLY	Scale:	Not To Scale
	Drawn:	SR
	Date:	7/05/09
CAD File: U:\DWG_Manual Dwg\HF350–MAN\BF350900–MAN.dwg		

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Parameters based on PIPA Guideline POP003: 6.1 issued Sept 2011 **350 hydraulic cylinder area 1233mm²**

nominal pipe od		D	mm	355	355	355	355	355	355	355	355	355	315	315	315	315	315	315	315	315	315
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
mean wall thickness		t	mm	9.2	10.3	12.8	15.8	19.7	27.5	33.9	41.7	51.0	8.2	10.3	12.8	15.8	19.7	24.5	30.1	37.1	45.2
		Parameter																			
mean heater surface temp		220+/-15	°C	220	220	220	220	220	220	220	220	220	220	220	220	220	220	220	220	220	220
allowable axial misalignment		0.1t	mm	0.9	1.0	1.3	1.6	2.0	2.8	3.4	4.2	5.1	0.8	1.0	1.3	1.6	2.0	2.4	3.0	3.7	4.5
bead up pressure	P1	170+/-20	kPa	1378	1531	1898	2322	2862	3902	4715	5654	6716	1084	1354	1676	2048	2520	3078	3715	4461	5283
+ measured drag	P3	+drag	kPa																		
total bead up pressure	P3		kPa																		
soak pressure	P2	drag	kPa	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag
soak time	T2	(11±1)t	second	101	113	141	174	217	303	373	458	561	90	113	141	174	217	269	331	408	497
heater out	T3	0.1t + 4	second	5	5	5	6	6	7	7	8	9	5	5	5	6	6	6	7	8	9
pressure up	T4	0.4t + 2	second	6	6	7	8	10	13	16	19	22	5	6	7	8	10	12	14	17	20
welding & cooling pressure	P3	170+/-20	kPa	1378	1531	1898	2322	2862	3902	4715	5654	6716	1084	1354	1676	2048	2520	3078	3715	4461	5283
+ measured drag	P3	+drag	kPa																		
total welding & cooling pressure	P3		kPa																		
minimum welding & cooling time in the clamps	T5	t + 3	minute	12	13	16	19	23	31	37	45	54	11	13	16	19	23	27	33	40	48
cooling time out of clamps before rough handling	T6	t + 3	minute	12	13	16	19	23	31	37	45	54	11	13	16	19	23	27	33	40	48

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: 6.1 issued Sept 2011 **350 hydraulic cylinder area 1233mm²**

nominal pipe od		D	mm	280	280	280	280	280	280	280	280	280	250	250	250	250	250	250	250	250	250
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
mean wall thickness		t	mm	7.3	9.1	11.3	14.2	17.5	21.7	26.8	33.0	40.3	6.6	8.2	10.2	12.6	15.6	19.4	23.9	29.4	36.0
		Parameter																			
mean heater surface temp		220+/-15	°C	220	220	220	220	220	220	220	220	220	220	220	220	220	220	220	220	220	220
allowable axial misalignment		0.1t	mm	0.7	0.9	1.1	1.4	1.8	2.2	2.7	3.3	4.0	0.7	0.8	1.0	1.3	1.6	1.9	2.4	2.9	3.6
bead up pressure	P1	170+/-20	kPa	863	1068	1316	1630	1990	2428	2935	3526	4185	696	854	1055	1291	1584	1938	2341	2806	3337
+ measured drag	P3	+drag	kPa																		
total bead up pressure	P3		kPa																		
soak pressure	P2	drag	kPa	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag
soak time	T2	(11±1)t	second	80	100	124	156	193	239	294	362	443	73	90	112	138	172	213	263	323	396
heater out	T3	0.1t + 4	second	5	5	5	5	6	6	7	7	8	5	5	5	5	6	6	6	7	8
pressure up	T4	0.4t + 2	second	5	6	7	8	9	11	13	15	18	5	5	6	7	8	10	12	14	16
welding & cooling pressure	P3	170+/-20	kPa	863	1068	1316	1630	1990	2428	2935	3526	4185	696	854	1055	1291	1584	1938	2341	2806	3337
+ measured drag	P3	+drag	kPa																		
total welding & cooling pressure	P3		kPa																		
minimum welding & cooling time in the clamps	T5	t + 3	minute	10	12	14	17	21	25	30	36	43	10	11	13	16	19	22	27	32	39
cooling time out of clamps before rough handling	T6	t + 3	minute	10	12	14	17	21	25	30	36	43	10	11	13	16	19	22	27	32	39

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: 6.1 issued Sept 2011 **350 hydraulic cylinder area 1233mm²**

nominal pipe od		**D**	**mm**	**225**	**225**	**225**	**225**	**225**	**225**	**225**	**225**	**225**	**200**	**200**	**200**	**200**	**200**	**200**	**200**	**200**	**200**
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**
mean wall thickness		**t**	**mm**	**5.9**	**7.3**	**9.1**	**11.4**	**14.2**	**17.5**	**21.6**	**26.5**	**32.4**	**5.2**	**6.6**	**8.2**	**10.2**	**12.6**	**15.5**	**19.2**	**23.6**	**28.8**
		Parameter																			
mean heater surface temp		**220+/-15**	**°C**	220	220	220	220	220	220	220	220	220	220	220	220	220	220	220	220	220	220
allowable axial misalignment		**0.1t**	**mm**	0.6	0.7	0.9	1.1	1.4	1.8	2.2	2.6	3.2	0.5	0.7	0.8	1.0	1.3	1.6	1.9	2.4	2.9
bead up pressure	**P1**	**170+/-20**	**kPa**	556	689	852	1055	1293	1573	1904	2275	2703	439	553	678	835	1019	1239	1504	1804	2133
+ measured drag	**P3**	**+drag**	**kPa**																		
total bead up pressure	**P3**		**kPa**																		
soak pressure	**P2**	**drag**	**kPa**	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag
soak time	**T2**	**(11±1)t**	**second**	64	80	100	125	156	193	238	291	356	57	73	90	112	138	171	211	260	316
heater out	**T3**	**0.1t + 4**	**second**	5	5	5	5	5	6	6	7	7	5	5	5	5	5	6	6	6	7
pressure up	**T4**	**0.4t + 2**	**second**	4	5	6	7	8	9	11	13	15	4	5	5	6	7	8	10	11	14
welding & cooling pressure	**P3**	**170+/-20**	**kPa**	556	689	852	1055	1293	1573	1904	2275	2703	439	553	678	835	1019	1239	1504	1804	2133
+ measured drag	**P3**	**+drag**	**kPa**																		
total welding & cooling pressure	**P3**		**kPa**																		
minimum welding & cooling time in the clamps	**T5**	**t + 3**	**minute**	9	10	12	14	17	21	25	29	35	8	10	11	13	16	19	22	27	32
cooling time out of clamps before rough handling	**T6**	**t + 3**	**minute**	9	10	12	14	17	21	25	29	35	8	10	11	13	16	19	22	27	32

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: 6.1 issued Sept 2011 **350 hydraulic cylinder area 1233mm²**

nominal pipe od		D	mm	180	180	180	180	180	180	180	180	180	160	160	160	160	160	160	160	160	160
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
mean wall thickness		t	mm	4.7	5.9	7.3	9.1	11.3	14.1	17.3	21.2	25.9	4.3	5.2	6.6	8.2	10.1	12.5	15.4	18.9	23.1
		Parameter																			
mean heater surface temp		220+/-15	°C	220	220	220	220	220	220	220	220	220	220	220	220	220	220	220	220	220	220
allowable axial misalignment		0.1t	mm	0.5	0.6	0.7	0.9	1.1	1.4	1.7	2.1	2.6	0.4	0.5	0.7	0.8	1.0	1.2	1.5	1.9	2.3
bead up pressure	P1	170+/-20	kPa	357	445	547	674	826	1010	1220	1459	1729	287	349	439	537	653	796	965	1153	1368
+ measured drag	P3	+drag	kPa																		
total bead up pressure	P3		kPa																		
soak pressure	P2	drag	kPa	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag
soak time	T2	(11±1)t	second	52	65	80	100	124	155	190	233	285	47	57	73	90	111	137	169	207	254
heater out	T3	0.1t + 4	second	4	5	5	5	5	5	6	6	7	4	5	5	5	5	5	6	6	6
pressure up	T4	0.4t + 2	second	4	4	5	6	7	8	9	10	12	4	4	5	5	6	7	8	10	11
welding & cooling pressure	P3	170+/-20	kPa	357	445	547	674	826	1010	1220	1459	1729	287	349	439	537	653	796	965	1153	1368
+ measured drag	P3	+drag	kPa																		
total welding & cooling pressure	P3		kPa																		
minimum welding & cooling time in the clamps	T5	t + 3	minute	8	9	10	12	14	17	20	24	29	7	8	10	11	13	15	18	22	26
cooling time out of clamps before rough handling	T6	t + 3	minute	8	9	10	12	14	17	20	24	29	7	8	10	11	13	15	18	22	26

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: 6.1 issued Sept 2011 **350 hydraulic cylinder area 1233mm²**

nominal pipe od		D	mm	140	140	140	140	140	140	140	140	140	125	125	125	125	125	125	125	125	125
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
mean wall thickness		t	mm	3.8	4.6	5.8	7.1	8.8	10.9	13.4	16.6	20.3	3.3	4.2	5.1	6.4	7.9	9.8	12.1	14.8	18.1
		Parameter																			
mean heater surface temp		220+/-15	°C	220	220	220	220	220	220	220	220	220	220	220	220	220	220	220	220	220	220
allowable axial misalignment		0.1t	mm	0.4	0.5	0.6	0.7	0.9	1.1	1.3	1.7	2.0	0.3	0.4	0.5	0.6	0.8	1.0	1.2	1.5	1.8
bead up pressure	P1	170+/-20	kPa	222	270	335	409	501	610	735	885	1051	174	218	265	327	399	487	590	705	837
+ measured drag	P3	+drag	kPa																		
total bead up pressure	P3		kPa																		
soak pressure	P2	drag	kPa	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag
soak time	T2	(11±1)t	second	41	51	63	78	97	120	147	182	223	36	46	56	70	86	107	133	162	199
heater out	T3	0.1t + 4	second	4	4	5	5	5	5	5	6	6	4	4	5	5	5	5	5	5	6
pressure up	T4	0.4t + 2	second	4	4	4	5	6	6	7	9	10	3	4	4	5	5	6	7	8	9
welding & cooling pressure	P3	170+/-20	kPa	222	270	335	409	501	610	735	885	1051	174	218	265	327	399	487	590	705	837
+ measured drag	P3	+drag	kPa																		
total welding & cooling pressure	P3		kPa																		
minimum welding & cooling time in the clamps	T5	t + 3	minute	7	8	9	10	12	14	16	20	23	6	7	8	9	11	13	15	18	21
cooling time out of clamps before rough handling	T6	t + 3	minute	7	8	9	10	12	14	16	20	23	6	7	8	9	11	13	15	18	21

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: 6.1 issued Sept 2011 | **350 hydraulic cylinder area 1233mm²**

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
mean wall thickness		t	mm	2.9	3.7	4.6	5.7	7.0	8.6	10.6	13.0	16.0	2.4	3.0	3.8	4.6	5.8	7.0	8.7	10.7	13.0
		Parameter																			
mean heater surface temp		220+/-15	°C	220	220	220	220	220	220	220	220	220	220	220	220	220	220	220	220	220	220
allowable axial misalignment		0.1t	mm	0.3	0.4	0.5	0.6	0.7	0.9	1.1	1.3	1.6	0.2	0.3	0.4	0.5	0.6	0.7	0.9	1.1	1.3
bead up pressure	P1	170+/-20	kPa	135	169	211	256	313	378	457	547	650	92	114	141	171	210	252	307	368	434
+ measured drag	P3	+drag	kPa																		
total bead up pressure	P3		kPa																		
soak pressure	P2	drag	kPa	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag
soak time	T2	(11±1)t	second	32	40	51	62	77	95	117	143	175	26	33	41	51	63	77	96	118	143
heater out	T3	0.1t + 4	second	4	4	4	5	5	5	5	5	6	4	4	4	4	5	5	5	5	5
pressure up	T4	0.4t + 2	second	3	3	4	4	5	5	6	7	8	3	3	4	4	4	5	5	6	7
welding & cooling pressure	P3	170+/-20	kPa	135	169	211	256	313	378	457	547	650	92	114	141	171	210	252	307	368	434
+ measured drag	P3	+drag	kPa																		
total welding & cooling pressure	P3		kPa																		
minimum welding & cooling time in the clamps	T5	t + 3	minute	6	7	8	9	10	12	14	16	19	5	6	7	8	9	10	12	14	16
cooling time out of clamps before rough handling	T6	t + 3	minute	6	7	8	9	10	12	14	16	19	5	6	7	8	9	10	12	14	16

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

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