FUSIONMASTER®

EHF350

OPERATORS MANUAL

Contents

DIXON® INDUSTRIES PTY LTD

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Safety precautions

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.

Report anything that doesn't look right, sound right, smell right, feel right, or is in any way different from what you expect, or that you think may be unsafe.

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 is supplied with a short extension cord that will melt through if allowed to contact the hot plate. The factory supplied cord has a high melting point outer sheath that will delay, but will not prevent, the inevitable life threatening situation that could occur.

Always use an earth leakage safety device in any circuit connected to the heater.

Never use a standard appliance cord with low melting point PVC sheath.

Never stand the heater plate such that the temperature controller handle is vertically above the hot plate.

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

Because of the nature of the machine it is not practical to guard the operational area. Do not attempt to remove shavings from the cutting area while the facer is running.

Wear appropriate apparel
The heater is very hot and should be handled carefully. Wear gloves to prevent burns.

Remove loose clothing or jewellery to prevent injury from these items being dragged into moving parts.

Hydraulic pressure
Remember that a sudden hydraulic oil leak can cause serious injury, or even death if the presure 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.

Any body parts caught in the machine when the hydraulics are operated will be crushed. Keep fingers, arms, etc, well clear of the clamp area.

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 cords.

Transporting the machine
Dixon equipment supplied with 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 unit well secured.

It is particularly important to ensure that heater plate non-stick surfaces are protected from damage during transportation.

Butt Welding Equipment
Limited Warranty

1) Subject to the terms below, Dixon Industries Pty Ltd ("**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.

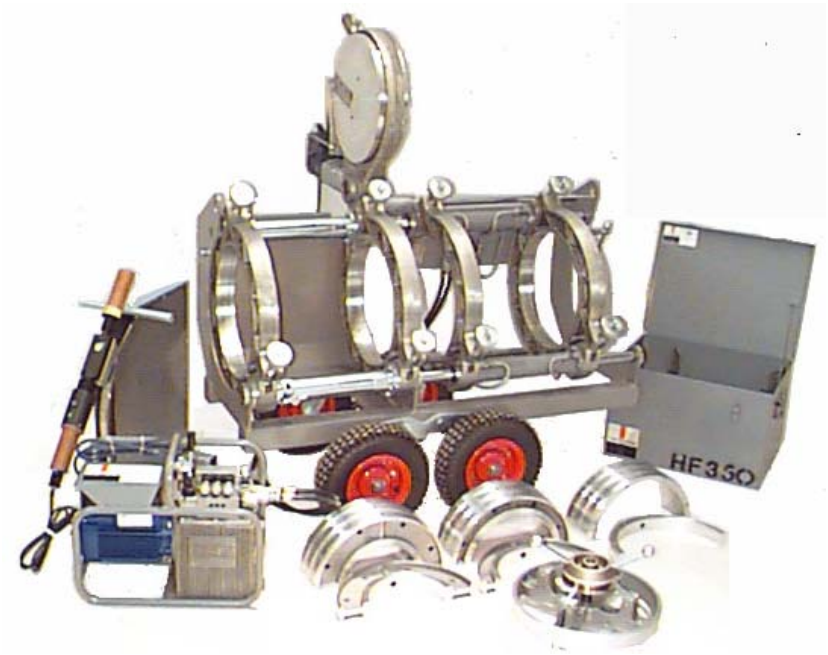
6) All costs of returning product to the customer shall be paid by the customer.

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.

FUSIONMASTER®

Simply Better

EHF350 electric hydraulic butt welder.



Machine Description

The **FUSIONMASTER®** EHF350 is a compact butt welding machine for fast accurate joining of polyolefin pipe or fittings up to 355mm O.D using the "single pressure and low fusion pressure" butt weld procedure. The optimum working range of the EHF350 is 355-200mm. For added flexibility the machine is capable of joining pipe as small as 110mm, although working in the 200-110mm range requires greater operator control.

The EHF350 is a robust machine built around a rigid steel main frame supporting hard chromed, high strength steel guide shafts, and high strength cast aluminium alloy pipe clamps and pipe alignment assembly.

The clamps are designed for side loading of pipes which facilitates the removal of the machine from a completed pipe joint and especially from trenchwork.

Pipe alignment is simply achieved through adjustment of eccentric cam mechanisms attached to the fixed clamps. Two double ended hydraulic cylinders mounted along the axial centre line provide inherent rigidity and a balanced application of welding pressure.

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

Machine Specification

Main clamp bore	355mm
Length overall	1,230mm
Width overall	690mm
Height (to top of clamp, wheels attached)	1,000mm

(See machine assembly drawing BF3500AO-MAN.)

Hydraulics

The EHF350 has a portable electric-hydraulic pump that applies pressure to a pair of hydraulic cylinders that transport the moving clamps.

Maximum welding pressure is limited to 9,500 kPa by a relief valve in the oil tank accessible only by removing the main valve block from the top of the tank. (This is not recommended without consultation with the manufacturer.)

Hydraulic Specification

Electric pump .37kW, 240V, single phase	
Relief valve setting	9,500kPa
Pressure gauge	0 - 10,000kPa
Effective cylinder area	1,233mm^2
System oil capacity	3 litres
Recommended oil:	viscosity rating ISO 46

EHF350 electric hydraulic butt welder.

Heater Plate

The 2,400W, 240V, 50hz aluminium heater plate has a cast in circular element to ensure uniform heat distribution across the 390mm effective heating diameter.

Plate temperature is controlled with an adjustable thermo-mechanical controller. A neon lamp indicates when power is flowing to the element and a dial thermometer indicates internal plate temperature. It takes approximately 18 minutes to heat up to working temperature.

Replaceable non-stick cloths are used to cover the heater faces to eliminate hot plastic adhesion. The cloths are secured by snap rings that enable quick and easy field repair if the surface is damaged.

The detachable 1.2m, 7.5 amp electric cord has a melt resisting outer sheath for protection against short periods of accidental contact with the heater.

(See heater assembly drawing BF3501AO-MAN.)

Facer

The facing machine is integrally mounted on the machine, providing effortless machining of pipe faces. A single blade cutting arrangement provides efficient, fast joint preparation.

It is driven by a 2 speed, high torque electric drill (1,150W, 240V, 50hz). It has one blade on each cutting face and can cut pipe from 355mm outside dia. to 75mm inside dia.

(See facer assembly drawing BF3502AO-MAN.)

Fittings Attachment

The self centering fittings attachment securely holds flanged or shouldered end fittings, etc, either by the ouside or inside diameter. This tool quickly and accurately centres fittings, and when used in conjunction with the eccentric pipe alignment mechanism, greatly increases productivity.

(See fittings attachment assembly drawing BF3503AO-MAN.)

Reducing Liners

Clamp liners for the EHF350 can be supplied to suit any pipe size from 324mm to 90mm, in either metric or imperial dimensions. There are four rings to each liner size comprising 2 wide rings (for pipe to pipe) and 2 narrow rings (for holding short leg moulded fittings).

The wide 110, 125, 140, 160, and 180mm liners nest inside 200mm liners, while all the narrow liners fit directly into the main 355mm clamp.

When welding pipe to pipe the wide rings are placed in the inner two clamps, with the narrow rings in the two outer clamps. (See drawing HF350900-MAN.)

Accessory Case

Each EHF350 kit is dispatched complete with a steel accessory case (530 x 390 x 320mm) capable of storing three sets of reducing liners.

Shipping Container

The EHF350 ships in a plywood crate.

Electrical Power Requirement.

A portable power supply of 5kW, 240V, single phase is recommended for field operation.

Component weights

Machine with facer	140kg
Heater plate	10kg
Fittings chuck	8kg
Heater stand	7kg
Reducing liner sets	5kg (min.) to 13kg (max.)
Accessory case (loaded)	45kg
Hydraulic power unit	28kg

Using the EHF350

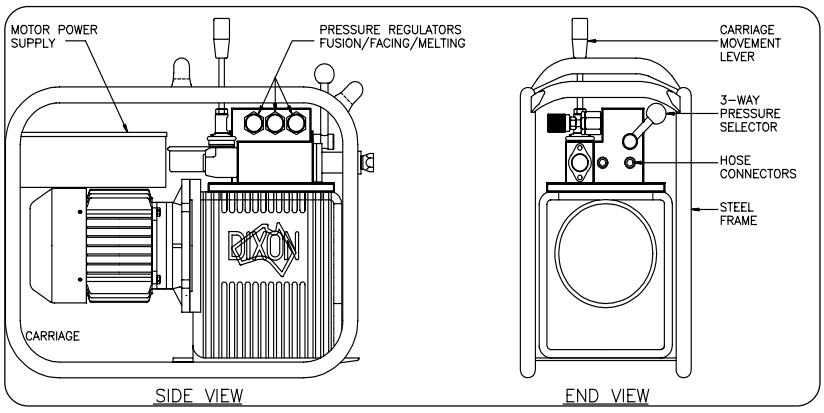
Hydraulic Controls

Operators should be thoroughly familiar with the hydraulic controls before start up.

Pressure regulators

Three pressure regulators allow the operator to preset pressures independently. These may be used to pre-set *facing, heat soak, welding-cooling or drag* pressures, depending on how the operator prefers to work.

The pressure regulators control the *Carriage Cylinder Pressure* during the fusion process, ie when the pipe ends are being brought together. During travel in the reverse direction the regulators do not control pressure, nor does the gauge register pressure.



Pressure selector

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

Carriage Movement Lever

This is operated to open or close the carriage.

Preparation

- Connect only to a 240v power source. Ensure the output of any portable generator used is 240v +/- 20v and 50hz to protect the electronic temperature controller from electric damage.
- Test for air in the hydraulic system. Bleed as necessary.
- Clean and/or replace the non-stick cloths. Clean the plate before every weld with clean dry paper or cotton cloth - never use synthetic materials that may melt.
- Check, and if necessary adjust the heater surface temperature.
- Check the facer cutting action (the shaving thickness should be 0.3-0.4mm).
- Install the correct reducing liners for the pipe to be welded.
- Clean each pipe end and the cutter blades before facing.
- Read the drag pressure from the pressure gauge before every weld.
- Add the drag pressure to the calculated pressure to determine the appropriate heat soak and welding gauge pressure.

Drag Pressure

The "drag" pressure is that required to just maintain motion of the carriage. The size of the drag will depend both on the friction acting inside the cylinders and on the effort required to move the pipe. It must therefore be measured before every weld and added to the calculated welding pressure for the pipe.

To determine the drag pressure: Switch on the pump, select one of the *Pressure Regulators,* apply the *Directional Control* lever, adjust the *Pressure* regulator, and observe the gauge pressure at which the carriage just begins to move. This is the drag pressure.

Pipe Alignment

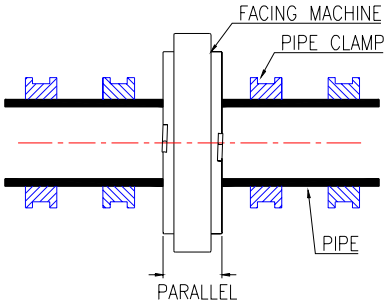
Place the pipes in the clamp jaws with about 30mm of pipe extending from the clamps into the weld zone, and tighten the clamps. Using the hydraulics, move the pipe ends together and check for alignment. The other ends of the pipe should be supported in a way that eliminates any external bending loads on the machine and minimises drag on the pipe.

To adjust out any misalignment, the fixed pipe clamps can be axially adjusted 5mm in two directions by cams located on the top and bottom guide bars. Tighten the clamp toggle bolts securely to prevent the pipe from moving when under hydraulic pressure.

Move the pipe end clear of the weld zone and **record the drag pressure** which must be added to the fusion pressure (refer table) required to join the pipe.

Facing

Move the pipe ends apart and lower the facing machine down between the pipe faces. Ensure the facer retaining hook latches on to the rest bar or it may be thrown out of the machine during this 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.

Move the pipe away from the facer before stopping facer rotation to prevent any step forming.

Caution:
The facer is driven by a high torque, 2 speed electric drill. Drill life will be extended by operating at the lower speed where maximum torque is available.

Take care not to overload the facer by applying excessive pressure. Never exceed 2,000 kPa more than drag.

Check Alignment

Remove the facer and clear away all plastic cuttings without contaminating the pipe ends. Do not touch the cut surface or reclean it.

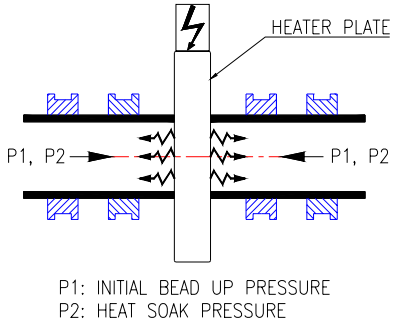
Re-check pipe alignment (maximum misalignment 10% of wall thickness) as this is extremely important in obtaining uniform heating and minimising stresses at the finished joint.

Always reface if it becomes necessary to rotate the pipe in the clamps after initial facing.

Heating Cycle

Always check the heater plate temperature before commencing each joint.

Place the heater plate between the pipe faces.



Move the pipe faces into contact with the heater plate and increase pressure to the predetermined heating pressure.

Maintain pressure until an initial bead has formed uniformly around both sides of the heater plate. This commences the heat soak period.

Then, while maintaining the heater/pipe face contact, reduce the pressure down to the drag pressure for the remainder of the heat soak time period. Failing to reduce pressure forces hot plastic out of the joint zone and can lead to a "cold joint".

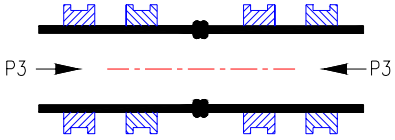
On completion of heat soak time, reverse the carriage direction to “crack” the heater plate away from the melted pipe and move the heater plate out of the weld zone as quickly as possible. (Refer to parameters table for allowable changeover time).
The unique non-stick cloths allow a "peeling off" action 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.

Fusion Cycle

Bring the melted pipe faces into contact with each other gently without delay to minimise heat loss from the weld zone. Build up to the required fusion pressure gradually to avoid squeezing out too much hot plastic.



P3: WELDING & COOLING PRESSURE

Shrinkage will occur as the weld cools allowing the pressure to fall. It is essential to run the pump and maintain pressure until shrinkage ceases.

It is recommended that the pump not be switched off until the end of the cooling period. Maintain the pipe in the clamps and under pressure until the weld/cooling time is complete.

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.)

Maintenance - daily checks

1. Keep the machine and accessories clean and free of dust and grease. Do not lubricate any part of the 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 rams). Air in the cylinders will adversely effect weld quality and must be removed by bleeding.

4. Check the pressure gauge operates and returns to zero.

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 +/- 15°C from the desired welding temperature. (Refer later section on heater plates.)

6. Check for bare electric wires.

7. Replace non-stick cloths if damaged in way of the weld area.

8. Facing blades should be sharp and have defect free cutting edges to provide continuous swarf of uniform thickness. Sharpen or replace cutter blades if blunt or chipped.

9. Ensure the facer drill is securely fixed into the facer body casting, if not the drive gears may not mesh properly causing expensive damage.

10. Look for "slop" in the cutter plates, which is indicative of needing to adjust the facer drive internally.

11. If using a portable generator, ensure its output is 240v +/- 20v and 50hz, to protect electronic equipment from permanent damage.

Maintenance - Periodic

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

General

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

2. 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 be less than 800kPa.

Heater

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

2. Heaters with non-stick cloths have a vent machined in the edge of the casting to prevent air being trapped under the cloth. This vent should always be kept clear.

Facer drive

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 bevel and pinion as a complete assembly.

5. Check that the main drive sprocket is in contact with all four bronze rollers. Two rollers are concentrically bushed and two are ecentrically bushed. This design enables bronze roller or sprocket wear to be taken up by adjusting the two eccentric guide rollers. These are adjusted in the direction of chain rotation, until the sprocket is supported by all 4 rollers. Once the rollers wear beyond the point of any further adjustment, replace the guide roller assemblies.

6. Tension the chain with the idler sprocket eccentric adjustment.

Facer bronze roller replacement

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 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 rollers.

5. Hang main sprocket.

6. Refit (new) eccentric rollers.

7. Adjust the eccentric rollers in the direction of chain rotation, so that all 4 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 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.

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.

Heater Temperature adjustment

The temperature setting of the HF350 heater is controlled by turning the adjusting screw on the top of the heater handle, clockwise for higher temperature, and anticlockwise for lower temperature.

Heater failure

1. If the heater does not power up it could be due either to failure of the element pad or failure of the thermoswitch.

2. However always first test the power supply and the power cord on some other appliance to ensure those items are not at fault.

3. Then use an electrician to test the heater element and the temperature controller 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, the thermoswitch will be faulty and must be replaced.

4. To remove the thermoswitch:
   - Remove the three 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 thermoswitch. Turn the thermoswitch adjustment screw fully counter-clockwise to enable its removal from the rubber grommet in the handle case. Extract the thermoswitch from the heater bracket and carefully withdraw the element leads, copper capillary tube and sensor bulb from the casting.
   - Inspect insulation and connectors for damage. Replace as necessary.

5. To check the thermo-switch turn the adjusting screw. There is 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.

6. Before refitting the thermoswitch, apply some silicon heat sink compound sparingly to the sensor bulb for improved thermal sensitivity.

7. To refit the thermostat, reverse the removal procedure taking care not to pinch or damage the capillary tube, sensor bulb, or electrical insulations. Ensure earthing conductors are reconnected.

8. 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.

Jammed sensor bulb

If the sensor bulb becomes jammed in its hole it can be drilled out. Drill to a depth of 160mm below the top face of the heater casting using a 9.8mm long series drill.

Caution:
If a larger diameter drill is used, the replacement bulb will be too loose to allow good heat transfer from the casting, which will adversely affect temperature control.

Drilling deeper than 160mm could damage the electric element.

Non-stick cloth replacement

The non-stick cloths should be replaced if they become torn, contaminated or overheated.

Do not attempt to remove the cloths unless the plate temperature is less than 40°C because the snap rings will not release above this temperature. Use the following procedure.

1. Use a screw driver to lever the snap rings out of their securing grooves. This takes very little force.

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.

Hydraulic Operating Pressure

Start the hydraulic pump and note the gauge readings for each pressure regulator. The operating pressure of the EHF350 is factory set to 9,500 kPa. Increasing pressure above this setting will damage the pressure gauge. Should it be necessary to adjust the relief pressure contact the manufacturer for advice.

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

Synchronising the carriage cylinders

If air gets into the cylinders, the carriage motion will eventually become out of phase or jerky. This will adversely affect the welding operation and the cylinders should be bled. When synchronisation is restored, close the balance valve, and leave it closed.

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

Caution:
The clamp cylinders are connected in series not parallel. Never change this piping configuration.

The cylinder balance valve in the line between the clamp cylinders is normally closed except when bleeding the system.

Hydraulic Bleeding Method

Should the hydraulic cylinder need to be drained for any reason, the following method is recommended for recharging with oil.

1. Check that all fittings are tight. Remove the filler nut from the top of the oil tank and insert a filling funnel.

2. Fill the tank to the top of the level gauge. Use any ISO 46 viscosity oil. Start the pump and operate the directional control lever alternately about 50mm in each direction such that the cylinder begins to fill. Check the oil reservoir level and top up as required. Repeat until the cylinder starts to move.

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 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.

7. 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.

8. At this point all air should be fully expelled from the system. Top up the oil tank as necessary.

9. Close the cylinder balance valve to lock the cylinders in phase.

Eccentric alignment mechanism repairs

See drawing eccentric adjusters.

Damaged toggle screw 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.

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. When replacing the shaft nut (BF350030), 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.

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 Assy (BF350054) out of Tube (BF350006). (Apply Grease when re-assembling.)

6. Remove Shaft pivot-short (BF350043) from top eccentric tube-bushed (BF350006) and check for free rotation, ream Bushes if required

The manufacturer reserves the right to vary this specification without notice.

Notes about heater plates and temperature

PE welding temperatures

The temperature range at which polyethylene pipe should be welded is 220° +/-15°C. This should be the temperature between the interface of the heater surface and the pipe material.

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.

Either situation will eventually lead to joint failure

Heater plate temperature

Heater plate temperature displays usually indicate the internal temperature of the plate. However the actual surface temperature may vary from that displayed for a number of reasons.

1) The rate of heat lost from the heater surface will depend on the design of the heater plate and the type of temperature controller used. The surface temperature could be up to 25°C cooler than the thermometer indication. This variation will be greatest on cold, windy days - which is one reason for using a shelter when welding.

2) The temperature will change as power is being pumped into the heater. 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 surface, and there may also be small variations from side to side, 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. As it is the welding temperature that is important, it is recommended to check the heater surface temperature during the heat soak phase.

Measuring surface temperature

- To ensure the temperature of the heater plate has stabilised, wait 5 minutes after the heater has reached set temperature before recording measurements.
- Take readings at several points (North, South, East, West) on both sides of the heater, at the diameter of the pipe being welded .
- If a contact probe is used it should be held in position for 3-5 seconds before the reading is taken.
- With **FUSIONMASTER®** heater plates using non-stick cloth, it is essential to use a contact probe which forces the cloth into contact with the plate. (Incorrect readings may result if the cloth system traps an insulating air layer between the cloth and the heater surface.)
- If an infra red pyrometer is used, care must be taken to ensure its emissivity is correctly calibrated for use on the non-stick cloth, AND care must be taken to ensure no air is trapped between the plate and the cloth or an incorrect reading is likely to result (see suggestion below).
- 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 edge of a heater plate) or a gross error will result.

Suggestion

Infra-red pyrometers are good tools for reading heater plate temperatures, but should always be used with a "spot control adapter" (Dixon part number AF000104).

The "spot control adapter" clips to the end of a Thermotwin pyrometer. When pressed square against the heater surface this correctly focuses the infra-red beam every time, and when used on **FUSIONMASTER®** heaters, it expels trapped air from beneath the non-stick cloth, ensuring consistently accurate measurements.

Butt welding - general procedure

The butt welding method of joining polyolefin pipe requires application of a combination of appropriate temperature, time and pressure to ensure a sound weld.

Operators should take care to determine the suitability of materials for butt welding. Join only pipes and fittings made from the same raw materials, eg PE to PE, PP to PP, PVDF to PVDF, etc.

The joint area must always be protected from adverse weather conditions, eg dampness, excessive cold or heat, or strong winds, which could lead to the pipe wall developing non-uniformly heated zones.

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

In the absence of an Australian Standard on butt welding, a table of welding parameters is given on the next page.

The basic welding process

a) Prepare the ends of the pipe or fittings to be joined so they are clean and parallel to each other.

b) Heat the ends at pressure P_1 and for time T_1 to melt the plastic until a bead just forms completely around both ends.

c) Heat soak the ends at pressure P_2 and for time T_2. (Time $T_1 + T_2$ is critical to achieving good weld quality and should never be shortened.)

d) Remove the heater plate and bring the pipe ends gently into contact with each other within time T_3. (If T_3 is too long, too much heat is lost from the weld area allowing PE recrystallization to commence prematurely.)

e) Raise the pressure gradually to pressure P_3 within time T_4. (If pressure is applied too fast it can cause too much melt to be forced out of the weld area with adverse results.)

f) Maintain pressure at P_3 for time T_5 before unclamping and removing pipe from the machine. Never artificially accelerate the cooling process.

Weld test - destructive

Cutting out and testing of trial welds is frequently required to qualify the welding machine, operator, welding parameters, pipe material, or when the consequences of failure are significant.

Tensile testing is widely used. The ratio of ductile:brittle appearance is usually indicative of weld acceptability.

Weld failure trouble shooting

Uniform bead - correct welding.

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, orheater 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.

Butt welding equipment is designed to apply the temperatures and pressures specified by the parameters. 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.

Plastics Industry Pipe Association of Australia Limited (PIPA) Butt Welding Guidelines.

PIPA recommends using the butt fusion procedures and parameters as specified in ISO 21307. Please refer to PIPA Guideline POP003, issue 6.0, 2009 for detailed information. The section of Guideline POP003 which is relevant to this machine is reproduced below for reference.

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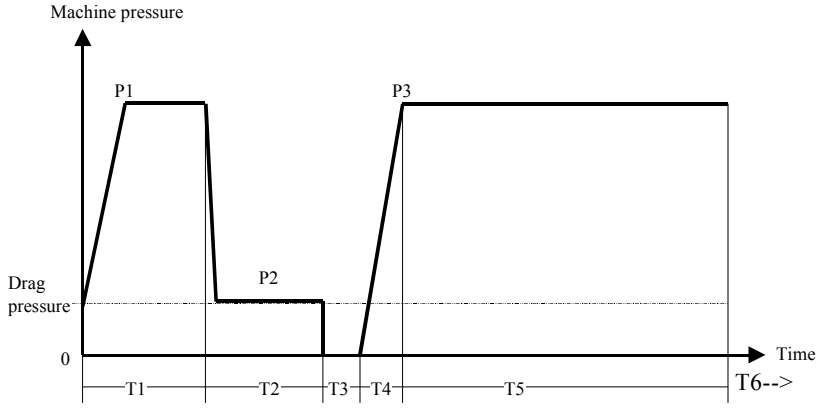
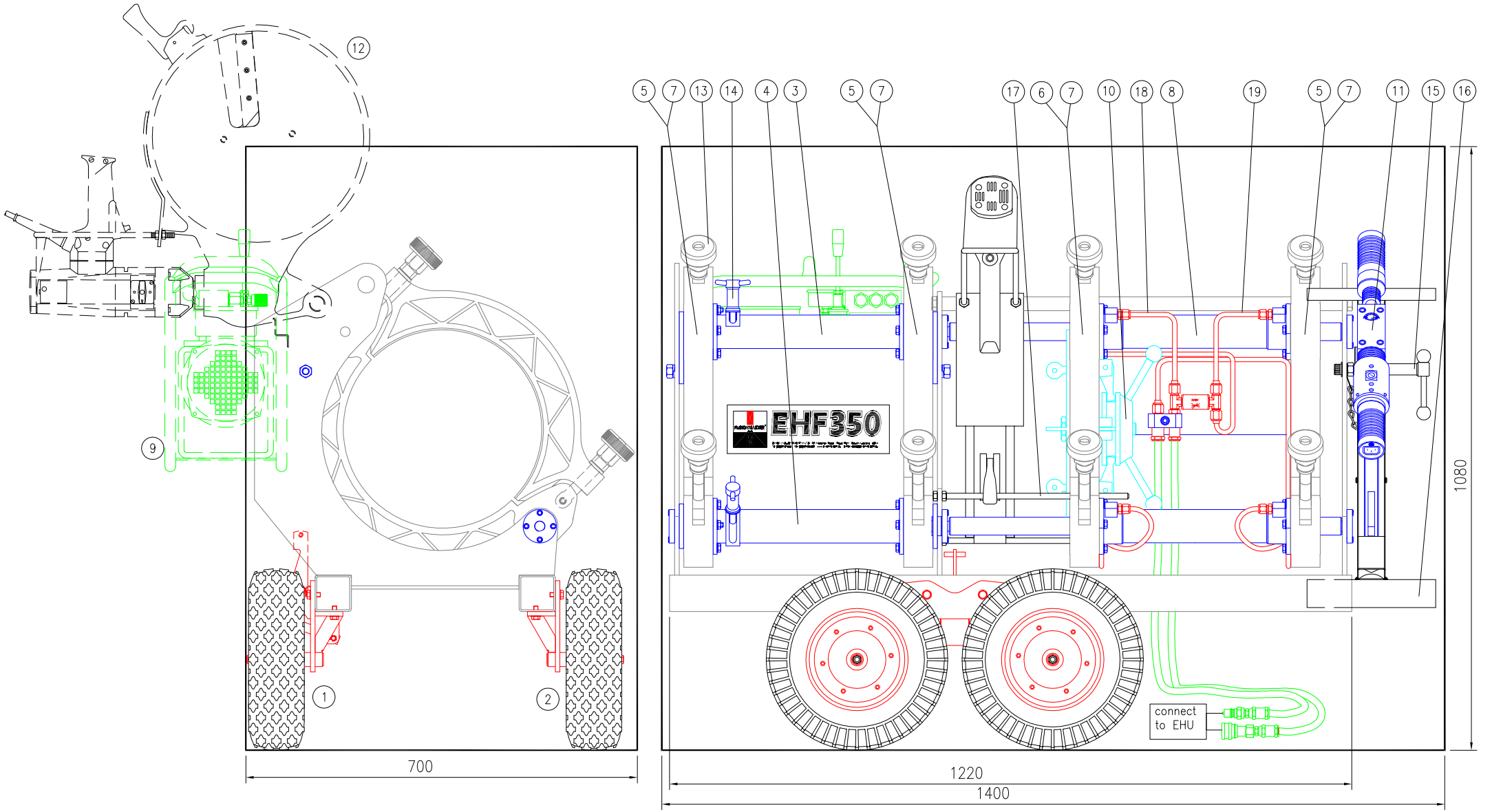
single pressure and low fusion jointing pressure procedure		**Units**	**Value**	**Comments**
Heater plate temperature		°C	200-245	
Pressure value: Bead up	P1	kPa	170 ± 20	Calculate (see note 5). Always add drag pressure to calculated pressure.
Approx. bead width after bead up		mm	$0.5 + 0.1e_n$	max. 6mm.
Bead up time	T1	second		Varies with ambient conditions and pipe size.
Heat soak pressure	P2	kPa	Drag only	
Minimum heat soak time	T2	second	$(11 \pm 1)\ e_n$	
Maximum heater plate removal time	T3	second	$0.1e_n + 4$	
Max. time to achieve welding pressure	T4	second	$0.4e_n + 2$	
Fusion jointing pressure	P3	kPa	170 ± 20	Calculate (see note 5). Always add drag pressure to calculated pressure.
Minimum cooling time in machine under pressure	T5	minute	$e_n + 3$	Time in clamps
Minimum cooling time out of machine	T6	minute	$e_n + 3$	Before "rough" handling is allowed.



Notes:

1. These parameters apply to the butt fusion of PE80 or PE100 polyethylene materials as specified in AS/NZS4131.
2. These parameters may also apply to the butt welding of PE80 **to** PE100. This may result in slightly different bead formation without reducing weld quality. If in doubt refer to the pipemaker.
3. Only pipes and fittings of the same diameter and wall thickness should be butt fused together.
4. e_n = mean pipe wall thickness calculated from AS4130 min/max values, rounded to the nearest mm.
5. Pressure calculation formula: {pipe annulus area, mm²}÷{hydraulic cylinder area, mm²}x{pressure value, kPa}.
   where pipe annulus area = pi (D_n - e_n) e_n and D_n means nominal pipe diameter.
6. Cooling times may require lengthening or shortening depending on ambient temperature.



ITEM	PART No.	PART NAME	QTY /KIT
19	BF350652	Steel Tube Assy EHF #13	1
18	BF350651	Steel Tube Assy EHF #12	1
17	BF350038	Heater/Facer Rest Bar	2
16	BF350800	Heater Stand	1
15	BF200034	Toggle Nut (Htr. Stand)	1
14	BF050028	Toggle Nut (Eccentrics)	2

ITEM	PART No.	PART NAME	QTY /KIT
13	BF350009	Toggle Nut (Clamp)	8
12	BF350200	Facer Assembly	1
11	BF350100	Heater Assembly	1
10	BF350300	Fittings Chuck	1
9	EH350600	Electric Hydraulic Unit	1
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

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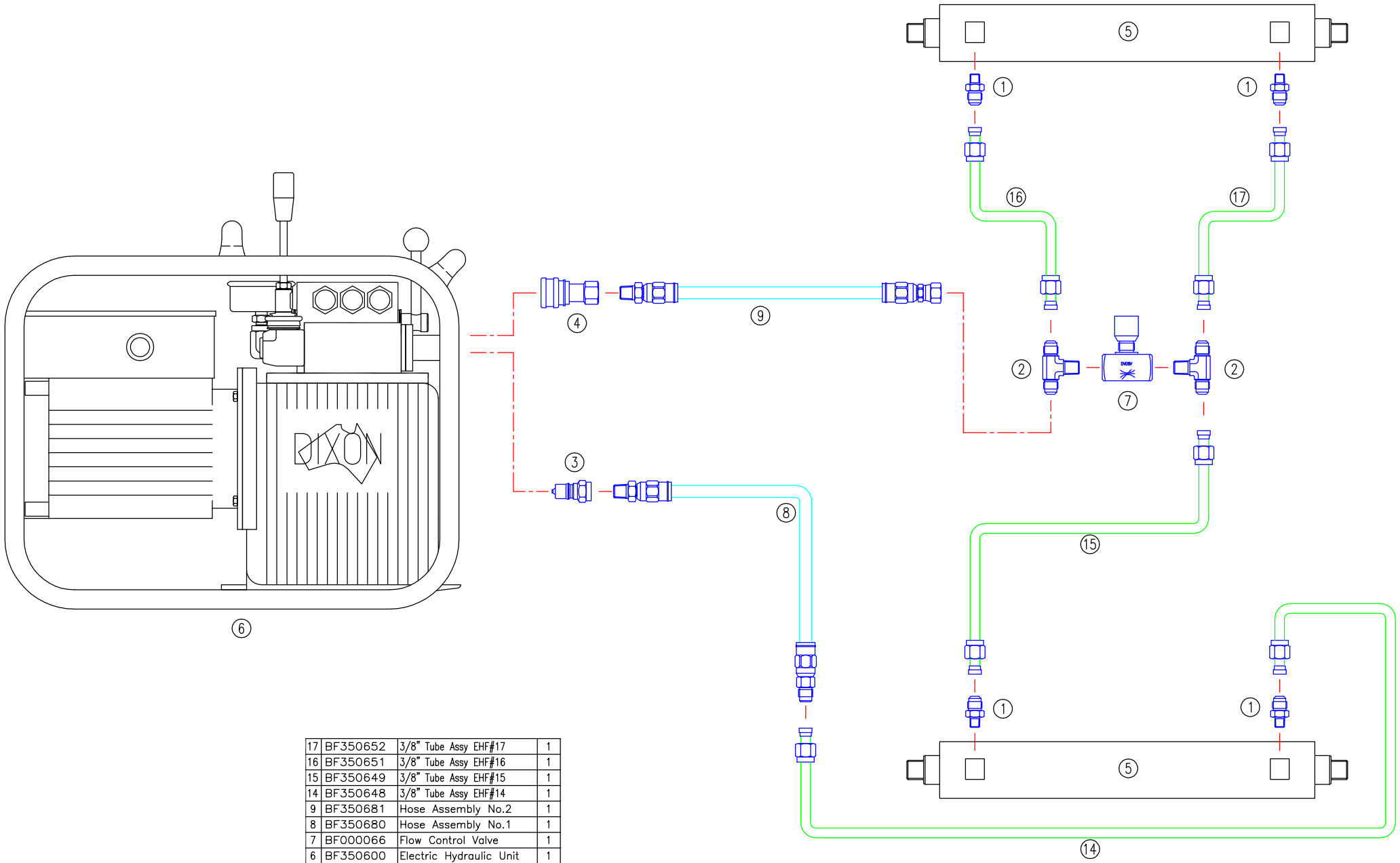
NOTE: Hoses and Tubes supplied as complete Assembly.



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
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Date:	12/05/10
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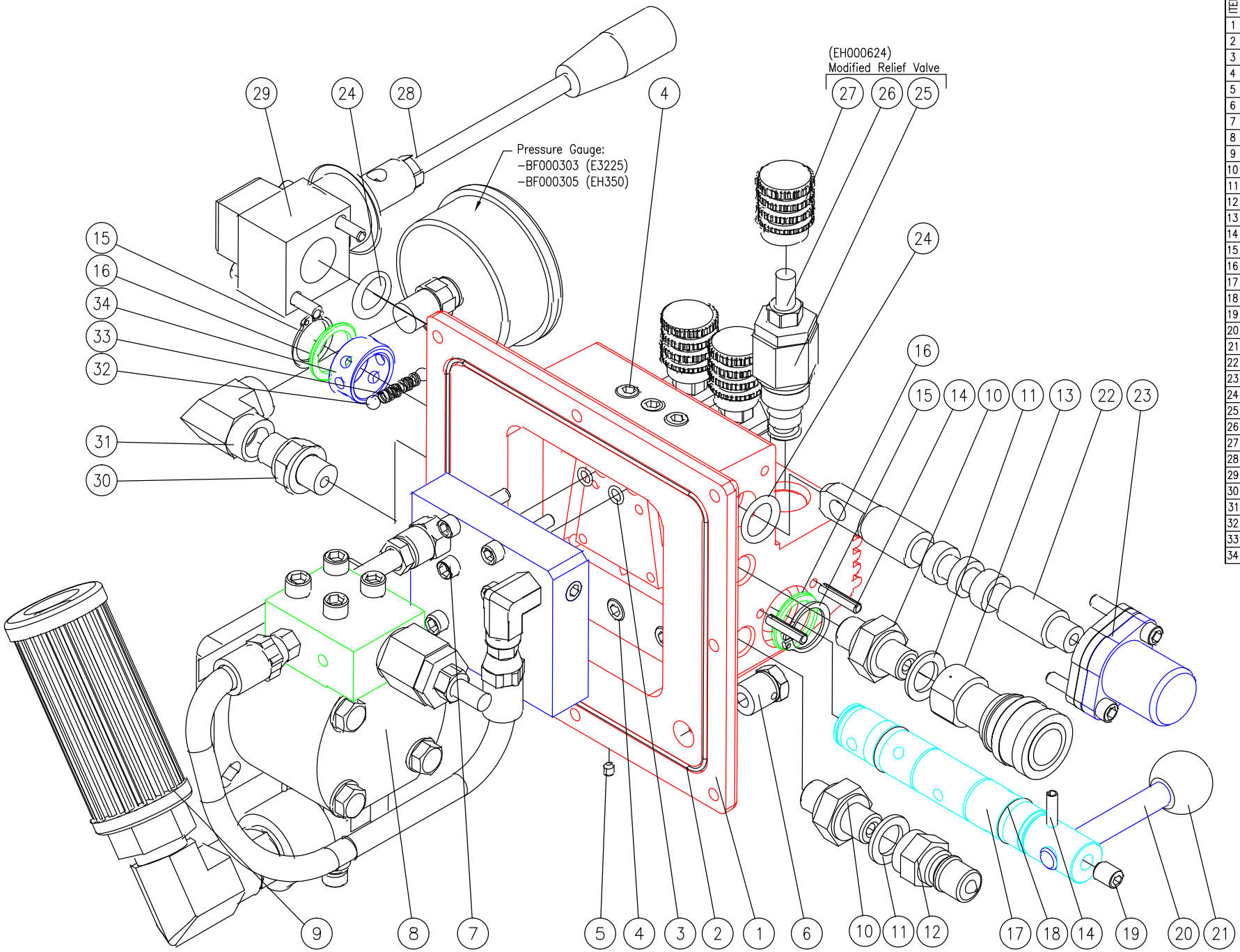

ITEM	PART No.	PART NAME	QTY /KIT
1	EH000602	Valve Body	1
2	BF000033	O-Ring (Tank Lid)	1
3	BF000029	O-Ring	2
4	BF000065	Dry Seal Plug	6
5	BF000105	Set Screw	1
6	EH000626	Modified Plug	1
7	BF000106	Pump Assy Mtg Screw	6
8	BF000036	Pump	1
9	BF000193	Suction Element	1
10	BF000600	Nipple	2
11	BF000400	Metal 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

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Drawing Name: ELECTRIC HYDRAULIC UNIT OPERATORS MANUAL ONLY		Scale:	Not To Scale
		Drawn:	SR
		Date:	25/03/11
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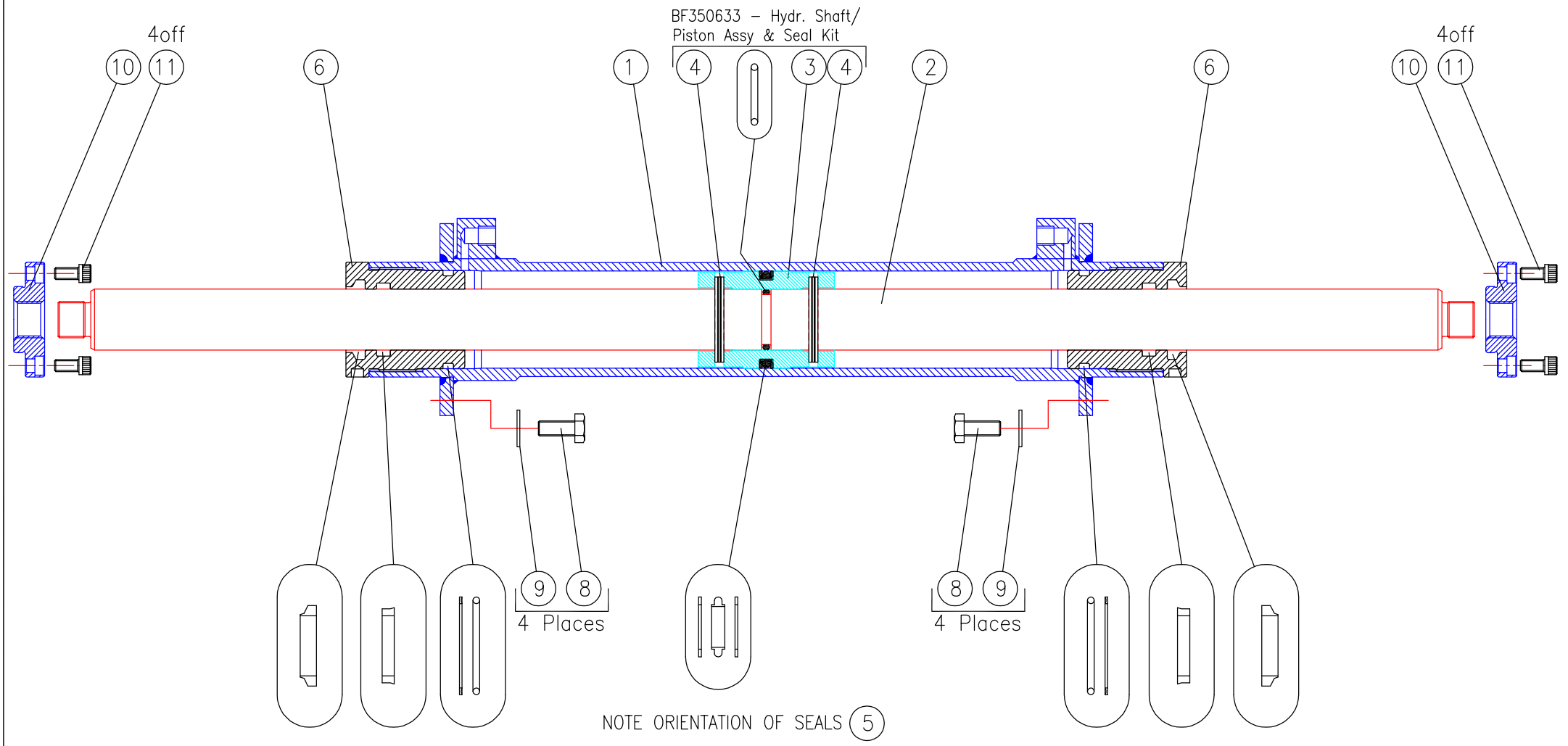

11	BF000231	Shaft Nut Motg Screw	12
10	BF350031	Shaft Nut Short	3
9	BF000238	Flat Washer	16
8	BF000243	Mounting Screw	16

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
ITEM	PART No.	PART NAME	QTY /KIT

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

Drawing Name: HF350 HYDRAULIC CYLINDER ASSEMBLY OPERATORS MANUAL ONLY	Scale:	Not To Scale
	Drawn:	SR
	Date:	22/03/11
CAD File: U:\Dwg_Manual Dwg\HF350-MAN\BF3506A0-MAN.dwg		

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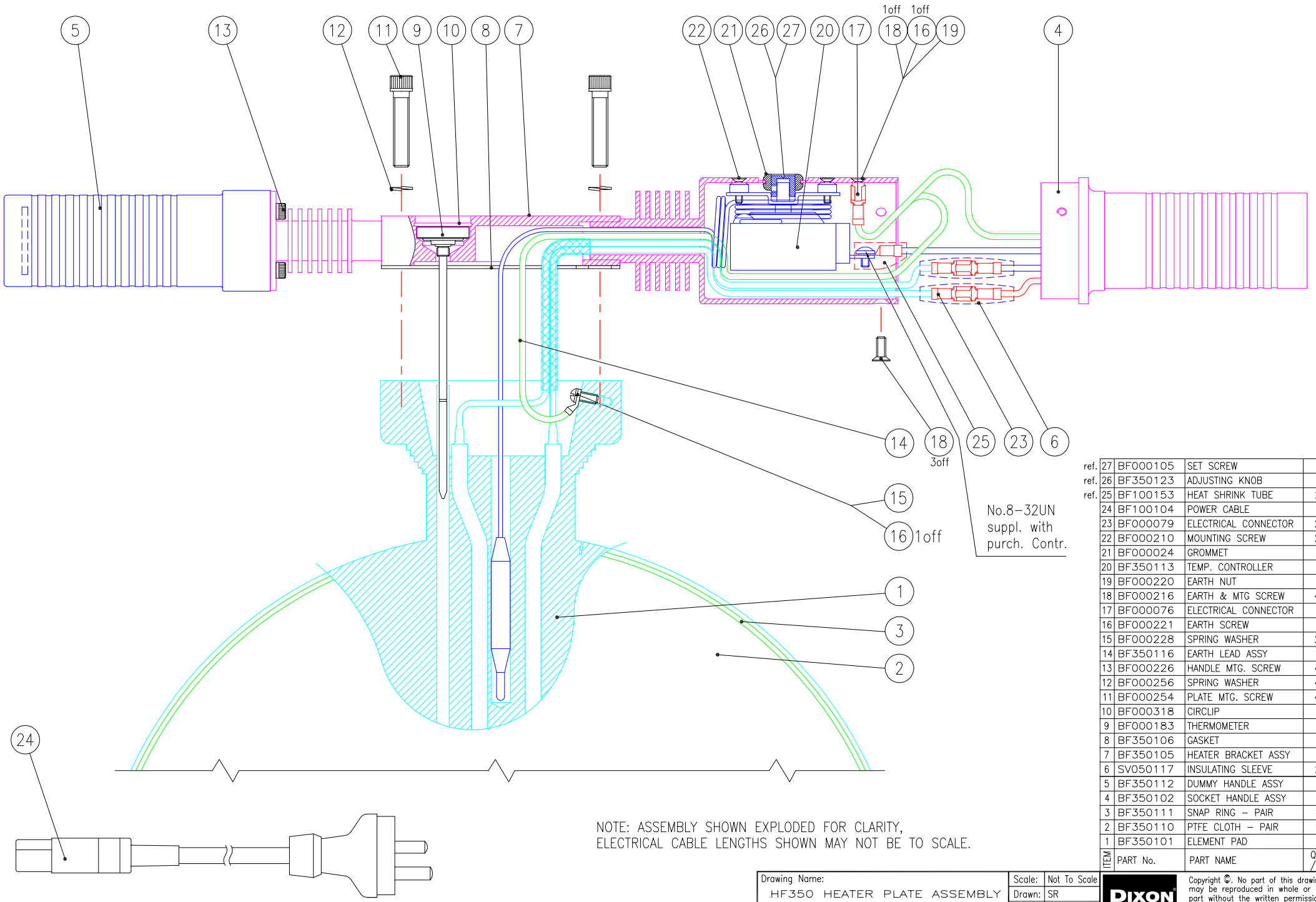

ITEM	PART No.	PART NAME	QTY /KIT
ref.	27	BF000105	SET SCREW	1
ref.	26	BF350123	ADJUSTING KNOB	1
ref.	25	BF100153	HEAT SHRINK TUBE	2
	24	BF100104	POWER CABLE	1
	23	BF000079	ELECTRICAL CONNECTOR	2
	22	BF000210	MOUNTING SCREW	2
	21	BF000024	GROMMET	1
	20	BF350113	TEMP. CONTROLLER	1
	19	BF000220	EARTH NUT	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
Drawn:	SR
Date:	05/05/09
CAD File:	U:\DWG_Manual Dwg\HF350–MAN\BF3501A0–MAN.dwg

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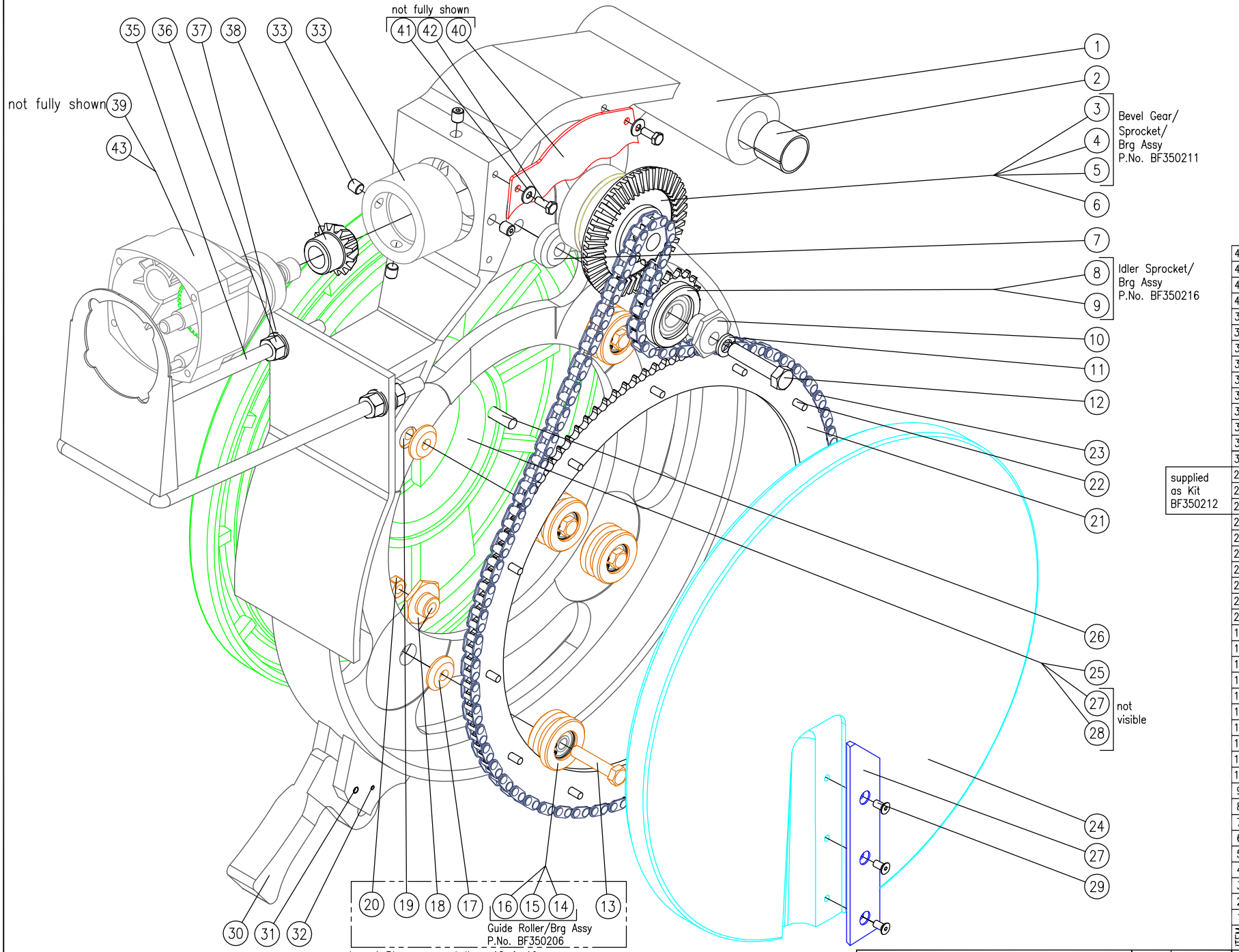

ITEM	PART No.	PART NAME	QTY /KIT
43	BF000666	Gear Housing End	1
42	BF000219	Cover Plate Screw	4
41	BF000218	Cover Plate Washer	4
40	BF350228	Cover Plate	1
39	BF350244	DRILL	1
38	BF350214	BEVEL PINION	1
37	BF000260	WASHER	4
36	BF000265	NUT	4
35	BF350234	DRILL MOUNT ASSY.	1
34	BF000239	SET SCREW	4
33	BF350208	ADAPTOR	1
32	BF000471	SPRING PIN	1
31	BF000337	SPRING PIN	1
30	BF350233	LOCKING HANDLE	1
supplied as Kit BF350212	29 BF350212B	DRIVER CUTTER BLADE	1
	28 BF350212A	IDLER CUTTER BLADE	1
	27 BF000217	BLADE SCREW	6
26	BF000255	CUTTER PLATE MTG SCREW	2
25	BF350220	CUTTER PLATE, IDLER	1
24	BF350202	CUTTER PLATE, DRIVEN	1
23	BF350219	DRIVE CHAIN & LINK	1
22	BF000226	SPROCKET MTG. SCREW	12
21	BF350203	MAIN SPROCKET	1
20	BF000133	NUT	4
19	BF350209	ECCENTRIC BUSH	2
18	BF350210	CONCENTRIC BUSH	2
17	BF350231	Guide Roller Bearing Spacer	4
16	BF350226	Guide Roller	4
15	BF000082	INT. CIRCLIP	4
14	BF000022	BEARING	8
13	BF350221	BOLT	4
12	BF000338	IDLER SCREW	1
11	BF000268	SPRING WASHER	1
10	BF350218	IDLER ECCENTRIC BUSH	1
9	BF000021	BEARING	1
8	BF350205	IDLER SPROCKET	1
7	BF350217	IDLER SPACER	1
6	BF000319	BEARING	2
5	BF350207	OUTER SPACER RING	1
4	BF350215	INNER SPACER RING	1
3	BF350204	BEVEL GEAR	1
2	BF000074	BEARING	2
1	BF350201	BODY	1

Drawing Name: HF350 FACER ASSEMBLY OPERATORS MANUAL ONLY

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Date: 05/05/09

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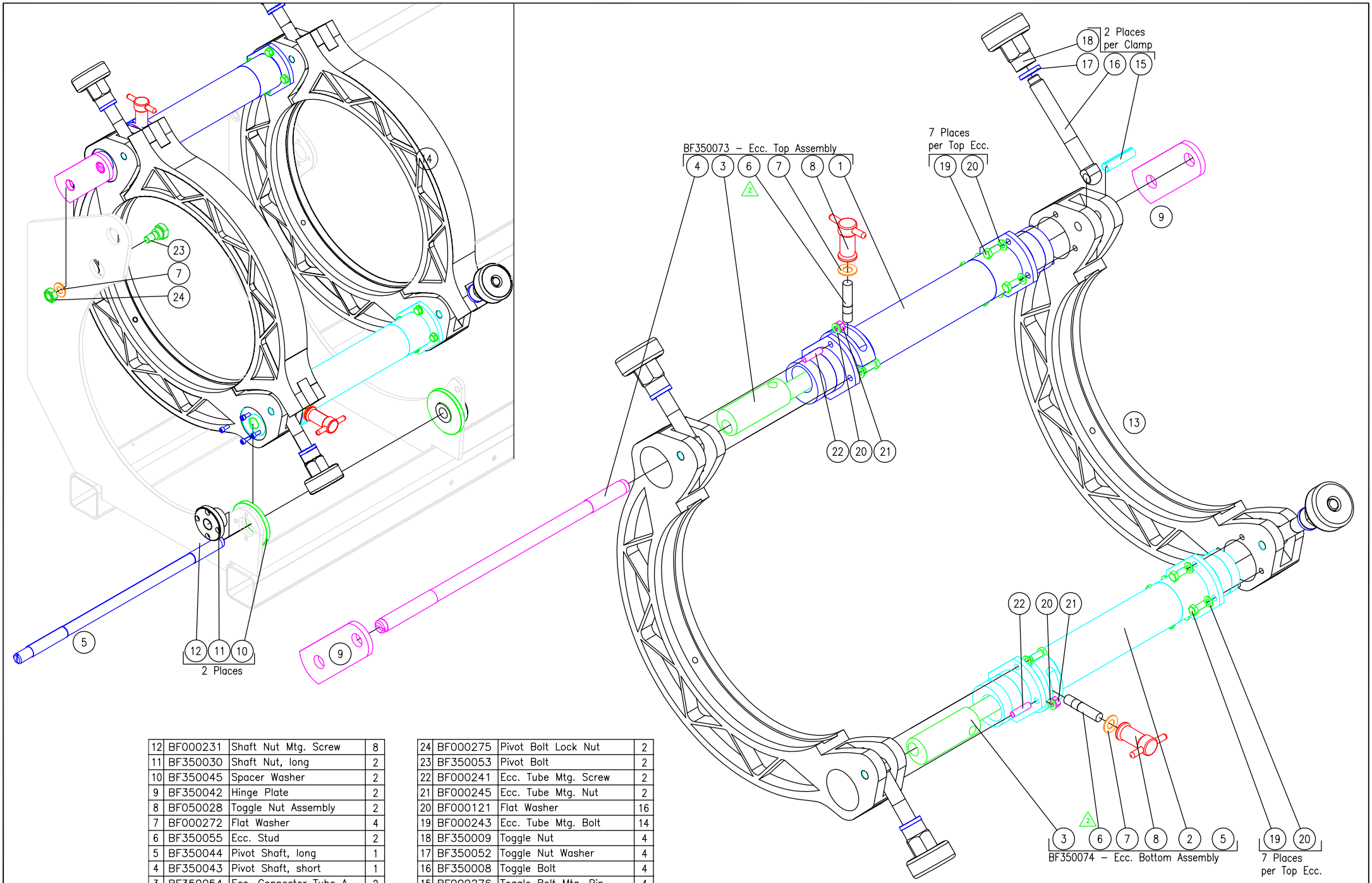

ITEM	PART No.	PART NAME	QTY
12	BF000231	Shaft Nut Mtg. Screw	8
11	BF350030	Shaft Nut, long	2
10	BF350045	Spacer Washer	2
9	BF350042	Hinge Plate	2
8	BF050028	Toggle Nut Assembly	2
7	BF000272	Flat Washer	4
6	BF350055	Ecc. Stud	2
5	BF350044	Pivot Shaft, long	1
4	BF350043	Pivot Shaft, short	1
3	BF350054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

Scale: Not To Scale
Drawn: SR
Date: 6/05/09

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

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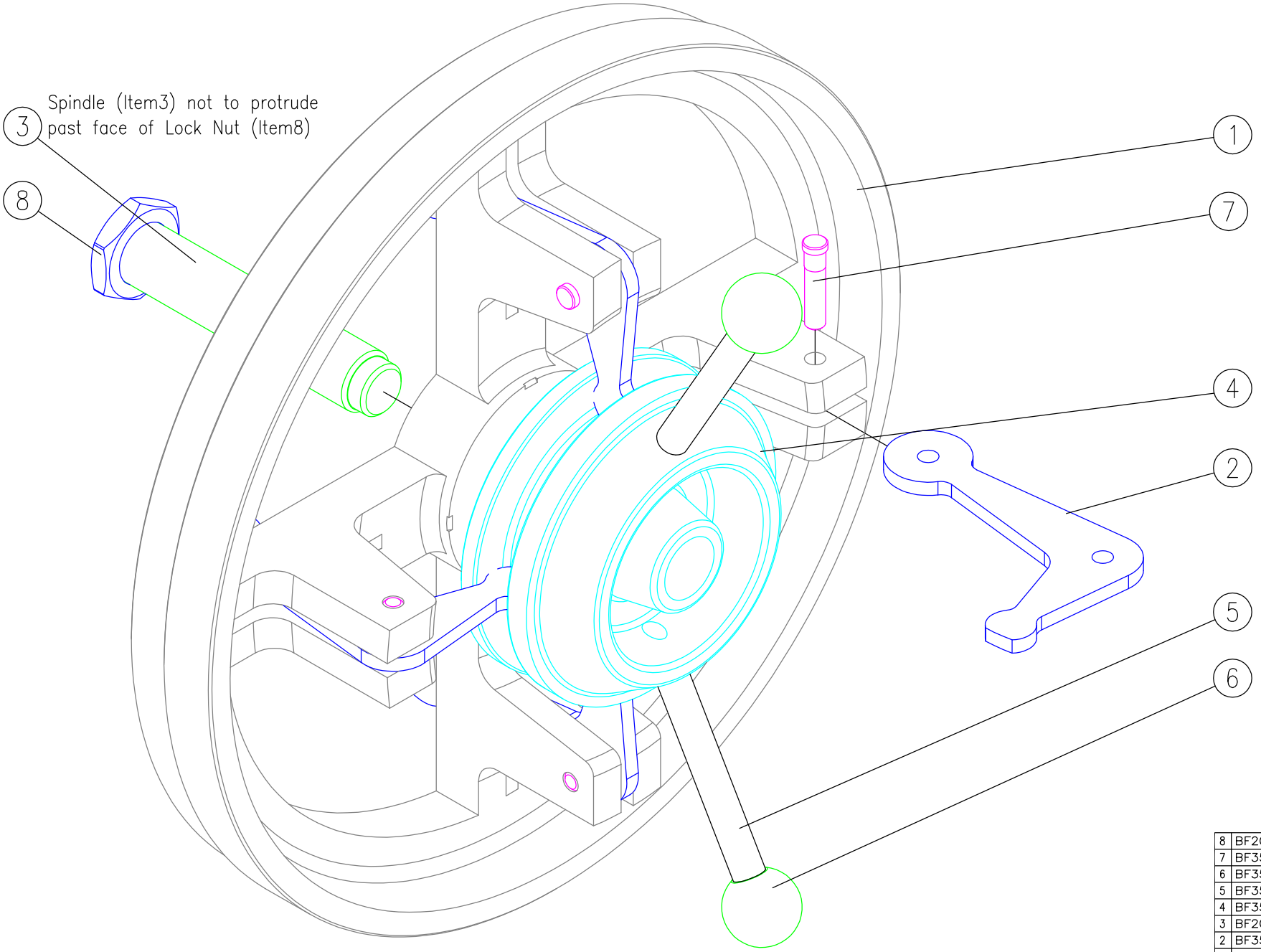

ITEM	PART No.	PART NAME	QTY /KIT
8	BF200305	Lock Nut	1
7	BF350310	Pivot Pin	4
6	BF350308	Handle Knob	2
5	BF350307	Tee Bar	2
4	BF350306	Adjuster Nut	1
3	BF200304	Spindle	1
2	BF350303	Finger Lever	4
1	BF350301	Body	1

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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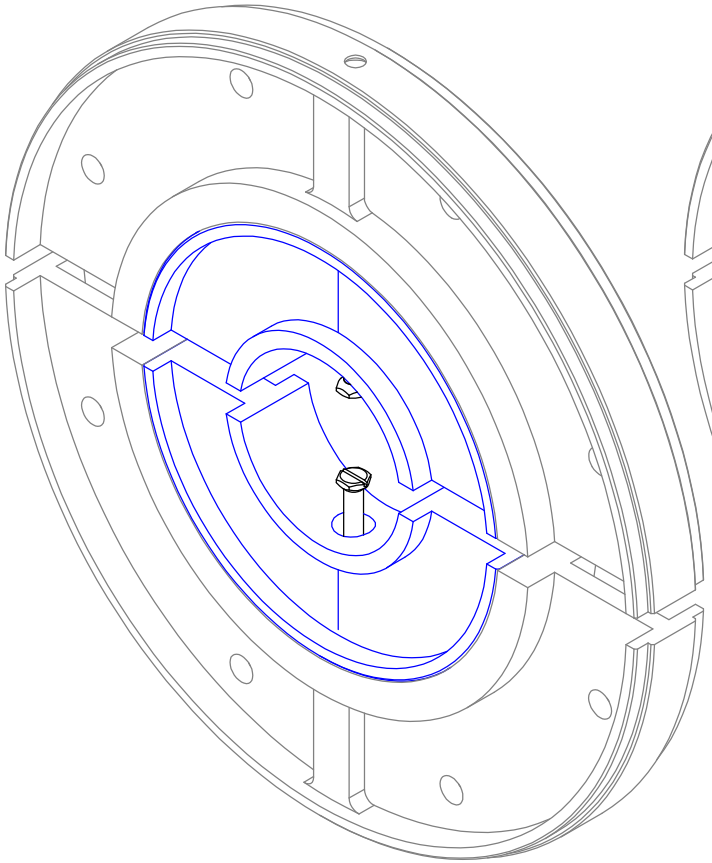
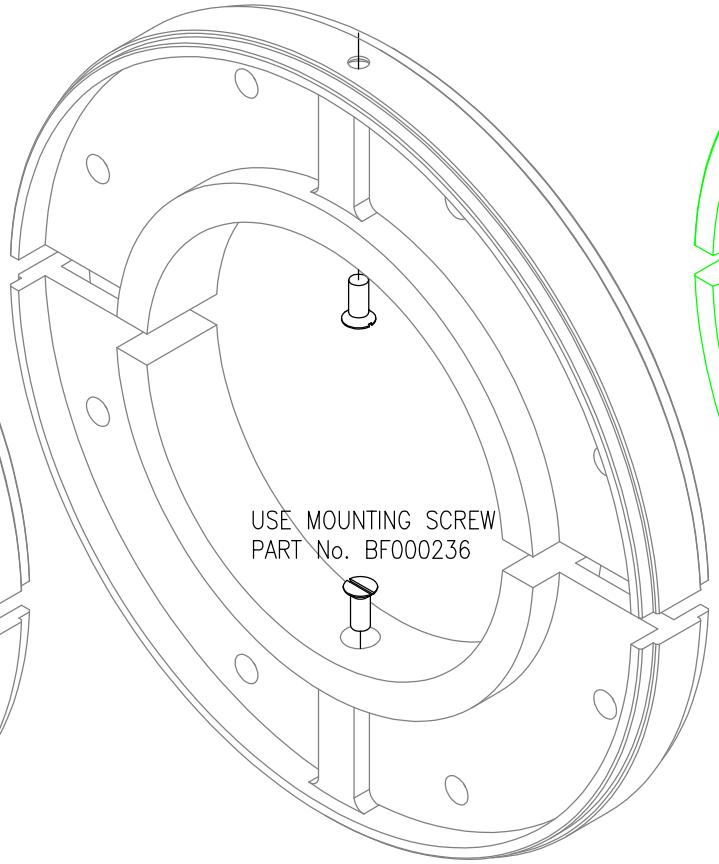


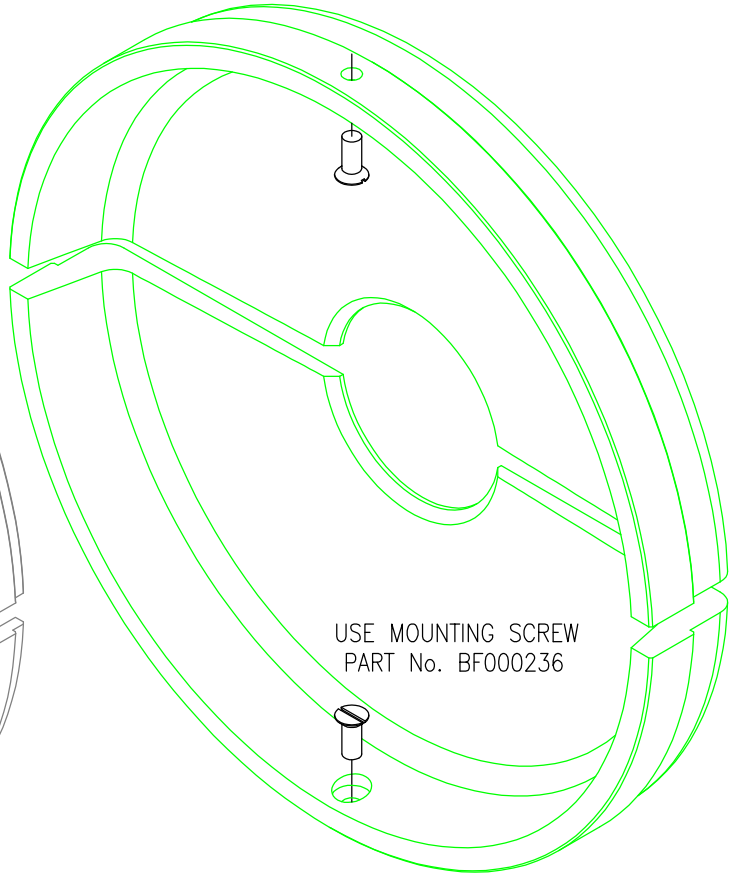
PART No.	SIZE
BF350909P	200–90
BF350911P	200–110
BF3509125P	200–125
BF350914P	200–140
BF350916P	200–160
BF350918P	200–180

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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	Drawn:	SR
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DIXON INDUSTRIES PTY LTD
A.B.N. 89 008 171 855

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nominal pipe od		Dn	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		en	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+/-20	°C	220	220	220	220	220	220	220	220	220	220	220	220	220	220	220	220	220	220
allowable axial misalignment		0.1en	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	P1	+drag	kPa																		
Total bead up pressure	P1		kPa																		
Bead up time	T1																				
Heat soak pressure	P2	0 to drag	kPa	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag
Minumum heat soak time	T2	(11 ± 1)en	second	101	113	141	174	217	303	373	458	561	90	113	141	174	217	269	331	408	497
Maximum heater plate removal time	T3	0.1en + 4	second	5	5	5	6	6	7	7	8	9	5	5	5	6	6	6	7	8	9
Maximum time to achieve interfacial pressure	T4	0.4en + 2	second	6	6	7	8	10	13	16	19	22	5	6	7	8	10	12	14	17	20
Fusion jointing 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 cooling time in machine under pressure	T5	en + 3	minute	12	13	16	19	23	31	37	45	54	11	13	16	19	23	27	33	40	48
Minimum cooling time in machine without pressure	T6	en + 3	minute	12	13	16	19	23	31	37	45	54	11	13	16	19	23	27	33	40	48
adjust time depending on ambient conditions																					

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

nominal pipe od		Dn	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		en	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+/-20	°C	220	220	220	220	220	220	220	220	220	220	220	220	220	220	220	220	220	220
allowable axial misalignment		0.1en	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	P1	+drag	kPa																		
Total bead up pressure	P1		kPa																		
Bead up time	T1																				
Heat soak pressure	P2	0 to drag	kPa	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag
Minumum heat soak time	T2	(11 ± 1)en	second	80	100	124	156	193	239	294	362	443	73	90	112	138	172	213	263	323	396
Maximum heater plate removal time	T3	0.1en + 4	second	5	5	5	5	6	6	7	7	8	5	5	5	5	6	6	6	7	8
Maximum time to achieve interfacial pressure	T4	0.4en + 2	second	5	6	7	8	9	11	13	15	18	5	5	6	7	8	10	12	14	16
Fusion jointing 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 cooling time in machine under pressure	T5	en + 3	minute	10	12	14	17	21	25	30	36	43	10	11	13	16	19	22	27	32	39
Minimum cooling time in machine without pressure	T6	en + 3	minute	10	12	14	17	21	25	30	36	43	10	11	13	16	19	22	27	32	39
adjust time depending on ambient conditions																					

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

nominal pipe od		Dn	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		en	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+/-20	°C	220	220	220	220	220	220	220	220	220	220	220	220	220	220	220	220	220	220
allowable axial misalignment		0.1en	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	P1	+drag	kPa																		
Total bead up pressure	P1		kPa																		
Bead up time	T1																				
Heat soak pressure	P2	0 to drag	kPa	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag
Minumum heat soak time	T2	(11 ± 1)en	second	64	80	100	125	156	193	238	291	356	57	73	90	112	138	171	211	260	316
Maximum heater plate removal time	T3	0.1en + 4	second	5	5	5	5	5	6	6	7	7	5	5	5	5	5	6	6	6	7
Maximum time to achieve interfacial pressure	T4	0.4en + 2	second	4	5	6	7	8	9	11	13	15	4	5	5	6	7	8	10	11	14
Fusion jointing 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 cooling time in machine under pressure	T5	en + 3	minute	9	10	12	14	17	21	25	29	35	8	10	11	13	16	19	22	27	32
Minimum cooling time in machine without pressure	T6	en + 3	minute	9	10	12	14	17	21	25	29	35	8	10	11	13	16	19	22	27	32
adjust time depending on ambient conditions																					

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

nominal pipe od		Dn	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		en	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+/-20	°C	220	220	220	220	220	220	220	220	220	220	220	220	220	220	220	220	220	220
allowable axial misalignment		0.1en	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	P1	+drag	kPa																		
Total bead up pressure	P1		kPa																		
Bead up time	T1																				
Heat soak pressure	P2	0 to drag	kPa	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag
Minumum heat soak time	T2	(11 ± 1)en	second	52	65	80	100	124	155	190	233	285	47	57	73	90	111	137	169	207	254
Maximum heater plate removal time	T3	0.1en + 4	second	4	5	5	5	5	5	6	6	7	4	5	5	5	5	5	6	6	6
Maximum time to achieve interfacial pressure	T4	0.4en + 2	second	4	4	5	6	7	8	9	10	12	4	4	5	5	6	7	8	10	11
Fusion jointing 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 cooling time in machine under pressure	T5	en + 3	minute	8	9	10	12	14	17	20	24	29	7	8	10	11	13	15	18	22	26
Minimum cooling time in machine without pressure	T6	en + 3	minute	8	9	10	12	14	17	20	24	29	7	8	10	11	13	15	18	22	26
adjust time depending on ambient conditions																					

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

nominal pipe od		Dn	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		en	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+/-20	°C	220	220	220	220	220	220	220	220	220	220	220	220	220	220	220	220	220	220
allowable axial misalignment		0.1en	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	P1	+drag	kPa																		
Total bead up pressure	P1		kPa																		
Bead up time	T1																				
Heat soak pressure	P2	0 to drag	kPa	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag
Minumum heat soak time	T2	(11 ± 1)en	second	41	51	63	78	97	120	147	182	223	36	46	56	70	86	107	133	162	199
Maximum heater plate removal time	T3	0.1en + 4	second	4	4	5	5	5	5	5	6	6	4	4	5	5	5	5	5	5	6
Maximum time to achieve interfacial pressure	T4	0.4en + 2	second	4	4	4	5	6	6	7	9	10	3	4	4	5	5	6	7	8	9
Fusion jointing 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 cooling time in machine under pressure	T5	en + 3	minute	7	8	9	10	12	14	16	20	23	6	7	8	9	11	13	15	18	21
Minimum cooling time in machine without pressure	T6	en + 3	minute	7	8	9	10	12	14	16	20	23	6	7	8	9	11	13	15	18	21
adjust time depending on ambient conditions																					

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

nominal pipe od		Dn	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		en	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+/-20	°C	220	220	220	220	220	220	220	220	220	220	220	220	220	220	220	220	220	220
allowable axial misalignment		0.1en	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	P1	+drag	kPa																		
Total bead up pressure	P1		kPa																		
Bead up time	T1																				
Heat soak pressure	P2	0 to drag	kPa	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag	drag
Minumum heat soak time	T2	(11 ± 1)en	second	32	40	51	62	77	95	117	143	175	26	33	41	51	63	77	96	118	143
Maximum heater plate removal time	T3	0.1en + 4	second	4	4	4	5	5	5	5	5	6	4	4	4	4	5	5	5	5	5
Maximum time to achieve interfacial pressure	T4	0.4en + 2	second	3	3	4	4	5	5	6	7	8	3	3	4	4	4	5	5	6	7
Fusion jointing 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 cooling time in machine under pressure	T5	en + 3	minute	6	7	8	9	10	12	14	16	19	5	6	7	8	9	10	12	14	16
Minimum cooling time in machine without pressure	T6	en + 3	minute	6	7	8	9	10	12	14	16	19	5	6	7	8	9	10	12	14	16
adjust time depending on ambient conditions																					

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