

# **DART SAMPLING RIG - OPERATING INSTRUCTIONS**

### INTRODUCTION AND OVERVIEW

The Competitor sampling rig and associated tools together form an integrated system, offering an innovative solution to undisturbed soil core sampling, groundwater sampling and monitoring, contaminant logging, window sampling, standard penetration testing and dynamic probing. Competitor rigs are mechanically simple and easy to operate. The rigs are designed for use by a single operator and drilling can begin within minutes of arrival on site.

The Competitor is available in several different configurations to suit individual customer requirements:

**The Standalone Version:** consists of the upright rig unit together with hydraulic power pack (not shown). No trailer or undercarriage is provided. This solution is ideal for those customers wishing to mount the rig on their own vehicle or trailer and is the least expensive option.



Figure 1 Stand Alone Unit in Deployed Condition



**The Mini-tracked Versions:** consists of the rig mounted on a self-propelled tracked undercarriage. The entire unit can be tracked easily between borehole locations, up gentle slopes and inside buildings. This is the most popular option because of its ease of use and extreme mobility. This can be either a heavy duty version or a lightweight version depending on the tracked unit.



Figure 2 Heavy Duty Tracked Unit In Transport Configuration



Figure 3 Lightweight Tracked Unit in Transportation Configuration

**The Customised Versions:** on request we can design the rig to suit a number of specialised vehicles such as standard pick-ups, All-Terrain Vehicles and trailers.

The Competitor can be provided with Petrol or Diesel Engines and there is an option of electric start or recoil starter on each engine type. Diesel engines can be further provided with spark arrestors and Chalwyn valves for use on sites where flammable gases may be encountered.



# **RIG MOBILISATION**

### Tracked Unit (Heavy or Lightweight)

The rig is delivered mounted on the tracked power-carrier in transportation mode. The rig will be in the horizontal position and at the top of the mast will be attached to the frame with a securing pin. The unit can be safely maneuvered in this position.

Operators should read the separate manual that relates to the tracked power-carrier unit, become familiar with the controls and observe all safety instructions before operating for the first time.

To mobilize the unit, the engine should be started and the revs set at just over tick-over. Refer to the relevant track unit instruction manual for control of the movement, speed and direction of the unit.



# IMPORTANT SAFETY

Slopes should be negotiated with the front end facing uphill at all times.

Always keep sides of the unit clear when tracking

Figure 4 Correct Personnel Position for Tracked Unit on Slope NOT Greater Than 1:3

Care must be taken when driving the unit over uneven ground conditions - make sure that the area to the sides of the unit is clear of personnel. Should the unit become unstable it could tip on one side. Slopes and embankments up to 1 in 3 should be negotiated with the front of the rig facing uphill all the times, when both ascending and descending the slope.

Position the unit over the borehole position. Reduce the engine revs to tick-over, this will slow down the speed whilst the rig is being positioned. Remove the securing pin at the top of the mast assembly. Move to the left-hand side of the power-carrier where the control panel is located. Slowly pull forward the black hydraulic lever shown in Figure 6 marked TILT CYLINDER; and a ram on the power carrier will slowly lift the mast to the vertical position.







### **IMPORTANT SAFETY NOTE:**

Ensure that the **RED** safety spools are fitted to each lever on the valve controls. These are an important safety feature that prevents inadvertent activation of the controls. The unit <u>MUST NOT</u> be used if any of these are missing, serious injury can result

Figure 5 Valve Control Unit with Pressure Gauge and Engine E-Stop



Figure 6 Hydraulic Valve Lever Function Descriptions





Figure 7 Heavy Duty Tracked Unit In Deployed Condition



Screw down the front legs onto the load bearing plates so that the rig is level and mast vertical. This is very important to ensure that the rig is stable. Also note that tools may becoming stuck fast in a bore hole if the mast deviates significantly from the vertical position. The rig is now ready to begin sampling.



When moving the rig between different bore hole locations return the unit to the transportation mode as described above. Remember to secure the mast to the frame of the power-carrier and secure the weight with the retaining pins provided.



### **Standalone Unit**

The rig is delivered with a jockey wheel attached to the mast. Carefully, move the rig to the bore hole position, stand it upright and remove the jockey wheel. Fit the front and rear legs and screw the jacks down onto the load-bearing plates to level the rig.

Alternatively, the rig can be disconnected from the tracked power-carrier or trailer and used in stand-alone mode when necessary. To disconnect the rig, first stand it upright in the drilling position. Disconnect all the hydraulic hoses from the valve block on the control panel and secure them to the rig.

Place the hydraulic power pack at a distance of approximately 2 metres from the rig, on the opposite side to the drop weight. Fit the hydraulic hoses onto the power pack.



Removal of the locking pin from the rig will allow the Lifting Forks to be pulled free



Figure 8 Locking Pin in Fitted Position and with Locking Pin and Lifting Fork Removed

Remove the locking pin at the base and to the rear of the rig (where the rig locates onto the power-carrier/trailer frame). After removing the locking pin, the rig can be pulled free.



It is very important to fit rear stabilizing legs when using the rig in stand-alone mode otherwise the unit will become unstable.





Ensure that front and rear legs are fitted and that the mast is vertical before unit is used in stand-alone mode.



Figure 9 Standalone Unit with Outriggers Fitted

The four legs provided should now be slotted into the base of the rig and secured with pins supplied. Using steel load-bearing plates under each leg, screw down the legs to level the rig.

⚠

It is important to ensure that the rig is level and mast vertical prior to sampling, thus ensuring that the rig is stable. Also note that tools may become stuck fast in a borehole if the mast deviates significantly from the vertical position.



### WEIGHT CONFIGURATIONS

The drop weight and drop height are variable to enable either Standard Penetration Test (SPT) or Dynamic Probing (DP) to be undertaken. The rig is delivered in the SPT configuration.



This configuration shown in Figure 10 is for SPT, Super-Heavy Dynamic Probing and for general soil sampling, utilising a 63.5kg weight with a drop height of 760mm. The weight assembly is complete with two side plates fitted and with the lifting forks at the base of the weight block

Figure 10 SPT, SHDP and General Sampling Configuration

Figure 11 below shows the position needed for Dynamic Probing. This configuration utilizes a 50kg drop weight with a 500mm drop height.

To adjust the weight for Dynamic Probing it is necessary to remove the Add Weight section by removing the four hex-head bolts. The remaining lower weight then should be inverted so the lifting forks are at the top position. To do this the safety rubber bung situated at the top of the carriage assembly needs to be removed. The weight is then slid out from the top of the slide (channel section) and inverted. Finally replace the rubber safety bung at the top of the slide.



Figure 11 Heavy Dynamic Probing Configuration



### STANDARD SAMPLING PROCEDURE

Prior to sampling, remove the retaining pin that is securing the drop weight. On the control panel, pull the hydraulic lever back so that the carriage assembly begins to slide up the mast (see Figure 6 for lever functions). Lift the carriage to the maximum height. You are now ready to attach a sample tube.



Figure 12 Carriage at Maximum Extension with Guard Door Open to Show Detail

Figure 13 Carriage at Maximum Extension with Sample Tube Attached



A full description of the components and use of the Archway Simultaneous Casing system is given in the Appendices.

Detailed below is the correct method of attaching a sample tube to the rig prior to starting sample recovery operations.



Figure 14 Section Through Sample Tube Attachment

Position the hydraulic ram so the carriage assembly is sitting on top of the neoprene ring (NOT in contact with the anvil), with the sampler shoe resting on the ground.

Fully lower the hydraulic ram to the lowest position by pushing the lever forwards (see Figure 6 for lever functions).





It is important to ensure that the ram is lowered before sampling begins, otherwise the force of the weight will act on the hydraulic cylinder instead of on the sample tube, possibly causing damage to the ram



Remember to wear ear protectors when the drop weight is hammering. It is important that the area around the drop weight is clear of all personnel whilst sampling is in progress. There should be a safety zone around the drop weight extending to 2 meters in all directions. This area must be clear at all times.

Depress the lever to start the drop weight (see Figure 6 for lever functions). Stand clear until the sampler has been driven fully into the ground and then stop the drop weight. The drop weight must always be stopped at the bottom position (i.e. resting on the anvil). Once the sample tube has been driven all the way into the ground it can be extracted using the main lift cylinder.



Check that the front legs are firmly screwed onto the load-bearing plates. Ensure the area to the front of the rig is clear of all personnel.

You can now raise the carriage assembly using the hydraulic cylinder with the dolly fork securing the two parts together, which will pull the attached sample tube out from the ground (as in Figure 14).

If the sample tube is tight it may be necessary to increase the engine speed to provide additional power to the hydraulic system. Extreme care must be taken during jacking out as the hydraulic ram can generate up to 7 tonnes of pulling force. Operators and other personnel should stand clear of the front of the rig.

Lift the carriage assembly to the highest position and slide the footplate into the base of the slip bowl under the sample tube shoe. The sampler tube can then be lowered onto the footplate whilst it is uncoupled at the top end.





Figure 15 Sample Tube With Footplate in Position

Once the first meter has been sampled you can now repeat the process to sample the second meter. The quickest way to proceed is to select an empty, second sampler tube and drop it down the borehole to rest at 1 metre depth (This can only be done with the second meter). Then connect the first drill rod to the top of the sample tube. The first drill rod is a shorter than the standard 1-metre long rods and is known as the starter rod.





Figure 16 Schematic of Rod Through Drop Weight Extracting Samples >1m Depth

When the sample tube has been driven down to two metres below ground level it is then extracted from the borehole using the main lift cylinder. The sample tube is temporarily supported at the top end with a lay key fitted across the sampler sub, to secure it to the slip bowl whilst the drill rods are removed.





Figure 17 Sample Tube Secured with Lay Key to Remove Rods

The above cycle is repeated by fitting additional 1-meter long drill rods until the required depth is reached.

Whilst the rig is driving sample tubes into the ground, the operator can be extracting soil cores from sample tubes already taken, logging them and preparing the next sample tube ready for use. The extraction of soil cores from sample tubes is facilitated by use of Archway "windowless" samplers which incorporate clear plastic liners that retain the core in one piece. An alternative Simultaneous Casing Sampling system is also available for use with this rig – refer to separate operational instruction for that equipment.



### HEALTH AND SAFETY CONSIDERATIONS



A full Risk Assessment should be carried out by the owner/operator and reviewed on a regular basis



Operators should be fully trained in the safe use of the equipment. During the initial training period, operators should be closely supervised until they are completely familiar with the method of operation and all essential safety procedures. Thereafter operators should be monitored and refresher training given as necessary



Appropriate Personal Protective Equipment (PPE) must be used at all times during operation of the rig



A planned Maintenance Schedule should be put in place to ensure that the equipment is at all times in a safe working condition. In particular, the equipment should never be used unless guards and safety devices are in place and in good working order

# **IMPORTANT NOTE**

This document is provided for guidance purposes only in order to promote the use of safe working practices when operating the rig. It is not intended that this document should replace any acts, codes, regulations or other documents which have a legal or contractual standing. In particular, it must be noted that there is no intention within these guidance notes to negate any of the requirements of the Health & Safety at Work Act 1974, or other relevant safety standards, codes of practice and regulations that may apply in the country of use. It is the responsibility of the owner/operator to ensure that the equipment is maintained in a fit state of repair, that a full risk assessment is carried out and that operators are fully trained in the safe use of the equipment. Archway Engineering (UK) Ltd will not accept any responsibility for any accidents caused as a result of misuse or failure to maintain the equipment in good working order.



**APPENDICES** 



1

2

3

4



# **ARCHWAY SIMULTANEOUS CASING SYSTEM COMPONENTS**

115mm Casing with Drive and Lifting Heads (Green)

- 1. 115mm Duplex Casing Lifting Head
- 2. Spacer Tube
- 3. 115mm Drive Ring
- 4. 115mm Drive Head with Lugs
- 5. 115mm Duplex Casing Tube (1m Length)
- 6. 115mm Casing Cutting Shoe

### 101mm Windowless Liner Sampler (Purple)

- 1. 1 ½ " Whitworth Pin QS Pin Adaptor
- 2. 101mm Windowless Sample Head
- 3. 101mm Windowless Sample Head O-Ring
- 4. 101mm Windowless Sample Tube
- 5. 101mm Windowless Sample Liner (PVC)
- 6. 101mm Sample Liner Ring
- 7. 101mm Sampler Cutting Shoe

### QS (Quick Start) Rods

- 1. 0.5m Rod
- 2. Starter Rod
- 3. 1m Rod

### Accessories/Tools

- 1. 115mm Casing Lay Key & Bracket
- 2. Foot Plate
- 3. QS Rod Lay Key
- 4. Dolly Retaining Fork
- 5. 115mm Casing Slips Set (3 off)
- 6. Dart Drive Dolly





1



6







5

3

4



6

Figure 1 – COMPONENTS





1. Attach Drive Head and Cutting Shoe to Casing Tube

# Figure 2 – OPERATING PROCEDURE

- 2. Lower Sampler Assembly into Casing, slip Drive Ring and Spacer Tube onto Casing Drive Head then screw Dart Drive Dolly onto QS Pin Adaptor
- **3.** Attach Dart Drive Dolly/Sampler by placing Dart Anvil over Drive Dolly holding in place with Dolly Retaining Fork









**4.** Drive Casing and Sampler Assembly into ground until Casing Head is level with middle of Slip Bowl as shown

# Figure 3 – SAMPLE RETRIEVAL

- Insert 115mm Casing Lay Key into Slip Bowl and under Retaining Lugs. Using hydraulic Ram to withdraw full Sample Tube from Casing
- 6. To continue sampling whilst casing the hole, drop an empty complte Sample Tube down the borehole, adding a Drive Rod and additional lenth of Casing Tube
- **NOTE:** The first Drive Rod used should be the shorter 'Starter Rod', thereafter extend the drill string by adding standard 1.0m length rods









 After final sample is recovered, screw 115mm Casing Lifting Head, QS Pin Adaptor and Dolly into exposed Casing Tube

# Figure 4 – CASING RETRIEVAL

- 8. Use hydraulic Ram to connect Dolly to Anvil and withdraw Casing Tube, insert Casing Slips into Slip Bowl then unscrew Casing Tube. Remove from rig and remove Casing Lifting Head from Casing Tube
- 9. Repeat steps 7 and 8 until all Casing Tubes are recovered



# **RECOMMENDED MAINTENANCE SCHEDULE FOR DART RIG**

#### DAILY CHECKS

- 1. Check the condition of all hydraulic hose and couplings and replace if necessary
- 2. Check all guards and safety devices are securely fastened and in working order
- 3. Check that all securing pins are present and in place for safe transportation
- 4. Clean and grease the weight guide
- 5. Check tightness of the drive chain and adjust if necessary
- 6. Check engine oil level and top up if necessary
- 7. Check for fuel leaks from the engine
- 8. Ensure all valve lever safety toggles are fitted
- 9. Ensure Emergency stop is fitted and working
- 10. Check forward and reverse track controls are working
- 11. Ensure Dart weight rod clamping is fully functional
- 12. Ensure outriggers are present and used

#### WEEKLY CHECKS

- 1. Check condition of anvil and anvil bushing. Replace if cracks appear
- 2. Check all structural parts for any fatigue cracks
- 3. Check all securing bolts and tighten if necessary
- 4. Check hydraulic oil level and top up if necessary

#### **6-MONTHLY CHECKS**

- 1. Replace hydraulic oil filter and change hydraulic oil
- 2. Replace engine oil filter and change engine oil
- 3. Replace spark plug
- 4. Check condition of weight and weight guide and replace if there is excessive play when weight is moving along guide
- 5. Check drive and idle sprockets and oilite bushes and replace if necessary
- 6. Check hydraulic cylinder seals and replace if necessary
- 7. Check condition of tyres and tracks and replace if necessary
- 8. Check condition of wheel bearings (trailer only) and replace if necessary



# **HEALTH & SAFETY RISK ASSESSMENT/SAFE SYSTEM**

# **OPERATION**

#### TASK:

Soil Sampling and Probing using light & heavy duty dart Rig

#### PROCESS:

Use of soil sampling rig, dynamic probing, concrete coring

#### HAZARDS:

Tracked Soil Sampling Rig

#### **RISKS:**

- 1. Possible contact with drop weight potential for serious injury.
- 2. Possible entrapment with drive chain potential for serious injury.
- 3. Possible entrapment with coring unit potential for serious injury.
- 4. Possible entrapment between rig and track unit potential for serious injury.
- 5. Possible entrapment under rig on unstable ground or when loading/unloading from vehicle.
- 6. Possible risk of hearing impairment
- 7. Possible risk of burns

#### THOSE AFFECTED:

All operatives

Others in the vicinity.

#### SAFE SYSTEM:

- 1. All operatives to be fully trained in safe use of rig and familiar with all controls.
- 2. Appropriate P.P.E. to be worn at all times.
- 3. Machinery to be adequately guarded and guards tested prior to operation or repair.
- 4. All valve operation lever safety toggles in place
- 5. Remove ignition keys prior to any repair / maintenance work
- 6. Disconnect hydraulics prior to any engine repair / maintenance work
- 7. Ensure emergency stop / diverter valve in ON position prior to any hydraulic repair / maintenance work

#### TRANSPORTING/STORAGE:

- 1. If the engine has been running, allow it to cool for at least 15 minutes before loading the power carrier on the transport vehicle or placing it in storage. A hot engine and exhaust system can burn you and can ignite some materials.
- 2. Turn the fuel valve to the OFF position, and transport or store the power carrier in a level position. This will prevent carburettor (petrol engines) flooding and reduce the possibility of fuel leakage.
- 3. Petrol is highly flammable and explosive.
- 4. You can be burned or seriously injured when handling fuel.
- 5. Stop the engine and keep heat, sparks, and flames away.
- 6. Handle fuel only outdoors.
- 7. Wipe up spills immediately.



#### TRAINING REQUIREMENTS:

Operatives to be fully trained and supervised for an initial period until they are completely

Conversant with operation of rig and essential safety procedures.

#### FURTHER ACTION:

None identified

REVIEW COMPLETED BY:	DATE:

I the undersigned have read this risk assessment & fully understand the risk involved when operating the Archway Dart sampling rigs.

EMPLOYEE NAME:	DATE:
EMPLOYEE SIGNATURE:	DATE:
SUPERVISORS NAME:	DATE:
SUPERVISORS SIGNATURE:	DATE: