

State of Vermont  
PDD/Structures Design Section  
National Life Building – Drawer 33  
Montpelier, VT 05633-5001  
[www.aot.state.vt.us](http://www.aot.state.vt.us)

Agency of Transportation

[phone] 802-828-01611  
[fax] 802-828-3566  
[ttd] 800-253-0191

January 29, 2016

CCS Constructors, Inc.  
138 Munson Avenue  
Morrisville, VT 05661

**Project Name: New Haven BRF 0183(1)**

**Structure Identification: TH 2, Bridge 10**

The drilled shaft submittal associated with Items 900.640 Special Provision (Drilled Shaft in Earth)(8-FT), 900.640 Special Provision (Drilled Shaft Obstruction Drilling and Removal)(8-FT), and 900.645 Special Provision (Mobilization of Drilled Shaft Equipment has been reviewed and is being returned herewith.

Please incorporate all review comments and resubmit.

Sincerely,



Todd A. Sumner P.E.  
Project Manager



# HUB

Foundation Co., Inc.

SUBMITTAL REVIEW	
Review is only for general conformity to the contract drawings and specifications and shall not relieve the contractor of his entire responsibility under the contract, including among other things, dimensions to be confirmed and correlated at the job site, and information that pertains to the fabrication processes or to techniques of construction.	
<input type="checkbox"/>	NO EXCEPTIONS TAKEN
<input type="checkbox"/>	MAKE CORRECTIONS NOTED
<input type="checkbox"/>	RESUBMITTAL NOT REQUIRED
<input checked="" type="checkbox"/>	AMEND AND RESUBMIT
<input type="checkbox"/>	REJECTED - SEE REMARKS
BY:	<i>Rob M. Steel</i> DB AMERICAS, INC.
DATE:	1/27/16

**Drilled Shafts  
Means and Methods Submittal**  
River Road Bridge Replacement Project  
BRF 0183(1)  
New Haven, VT

Prepared for: CCS Constructors Inc.  
Prepared by: Hub Foundation Co. Inc.  
Date: December 30, 2015

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# HUB FOUNDATION CO., INC.

139 BILLERICA ROAD  
CHELMSFORD, MA. 01824

1-978-456-2387  
1-978-456-9201 FAX

December 30, 2015

## Submittal

PROJECT: Drilled Shafts  
River Road Bridge Replacement Project  
BRF 0183(1)  
New Haven, VT

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## Section 1

### Name and Experience of Superintendents and Operators

Depending on the scheduled start time, Hub anticipates that one of the following Superintendents and one of the following Operating Engineers will perform the work at this project. Should it become necessary to change key personnel from those listed, appropriate information will be provided to the Resident Engineer.

All of Hub Foundation's Superintendents, Foremen, and Equipment Operators have a minimum of 5 years drilling experience in varied conditions on sites throughout New England, Upstate New York, Pennsylvania, and Washington, DC. Most have significantly longer careers in the drilling industry either with Hub Foundation Co. or other drilling contractors. Their experiences cover almost every conceivable drilling condition that can be encountered in the diverse geologies of the New England region. Each is capable of providing reliable drilling expertise for installation of the drilled shaft for the River Road Bridge Replacement Project.

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It appears the plan is missing the following information:

A drawing showing the layout of the project site; including staging and lay down area, slurry tanks, drill rig locations etc.

Details for lifting the cage, the centralizers and the method to suspend the cage.

Concrete testing locations, QC test frequency, and batching/delivery frequency.

Procedure for the planned Construction joint and a procedure for an unplanned construction joint.

Procedure to re-insert the tremie.

1. The submittal includes three different polymer products each by a different manufacturer. It is not clear which will be used or if they will be used in combination. This needs to be clarified.
2. Special Provision 61.(a)9 requires the services of a technical representative for the slurry to be present and the personnel doing the slurry are to have a training certificate from the manufacturer of the slurry certifying their training in the use of the product. This has not been provided.
3. Special Provision 61.(a)15 requires a procedure for an emergency construction joint if needed. This has not been provided.
4. Special Provision 61.(a)17 requires a procedure for reinsertion of the tremie tube if needed. This has not been provided.
5. Special Provision 61.(g) requires the CSL tubes to be filled with water prior to placing of concrete. This has not been addressed.
6. Special Provision 61.(g) requires the CSL tubes to extend to within 6" of the bottom of the shaft. The shop drawing indicates the tubes will be 3' above the bottom of the shaft. Need to revise drawings to comply with the Special Provision.

Comments from Daryl Sargent, PB Materials Engineer

**Gregory W. Maxwell**  
**General Superintendent**

Experience:

1990-1994	Graduate of Tufts University, Class of 1994 Part time Laborer and Foreman for Hub Foundation
1994-Present	Foreman and General Superintendent for Hub Foundation Union member since 1990

Job Specific Training: Geology courses at Tufts University  
OSHA 40 Hour Hazardous Materials School  
OSHA 8 Hour Confined Entry Course  
Osterberg Seminar on Testing by Load Cell  
ADSC National Slurry School  
ADSC Supervisory Course  
ADSC Anchor and Minipile School  
NETTCP Certified Drilled Shaft Inspector

Completed Projects: - Emergency Access, Florida, MA

- Route 2 Widening, Lincoln, MA
- Quincy Concourse Bridge, Quincy, MA
- C01A3, C14B1, C14A2, C14C4, C17A2, C19E1, C17A1, C01A7, C19B8, C14C2, C17A6, C21C2, C19BA, Central Artery, Boston, MA
  - o Responsible for rigging and picking points for lifting a 60 ton drill rig out of SNE tunnel on C17E1
  - o Responsible for rigging and setting 110' I-beams along the expressway for SOE on C17A6
- Bridge Reconstruction, Waterbury, CT
- Decking over East Milton Square, Milton, MA
- Route 202 Bridge over B & M Tracks, Templeton, MA
- Drilled 4' diameter shafts between two in service B & M tracks for Route 63 Bridge, Montague, MA
- Multiple Contracts for Route 146, Millbury, MA
  - o Drilled 4', 5' and 6' diameter fully cased holes up to 90' deep using a specialized casing oscillator
- Route 27 Bridge over Amtrak, Acton, MA
- Pine Street Bridge over Conrail, Grafton, MA
- Mobil Oil platform support, East Boston, MA
  - o Drilling from a barge in a tidal creek and being required to abandon partially completed holes while oil tankers unloaded in extreme safety environment
- Troy Parking Garage, Troy, NY
- Green Line Modernization, Boston, MA
- 155 Portland Street
- Super Wick-Wells, Hingham, MA
- Memorial Bridge, Portsmouth, NH
- Sagamore Creek Bridge Replacement, Portsmouth NH

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**Jeffrey F. Maxwell**  
**Vice President and Superintendent**

Experience:

1987-1992 Graduate of Tufts University, Class of 1992  
Part time Laborer and Foreman for Hub Foundation  
1992-Present Foreman and General Superintendent for Hub Foundation  
1999-Present Vice President for Hub Foundation  
Union member since 1987

Job Specific Training:

BS in Geologic Sciences at Tufts University  
OSHA 40 Hour Hazardous Materials School  
OSHA 8 Hour Confined Entry Course  
Osterberg Seminar on Testing by Load Cell  
ADSC National Slurry School  
ADSC Supervisory Course  
ADSC Anchor and Minipile School  
NETTCP Certified Drilled Shaft Inspector

Completed Projects:

- Emergency Access, Florida, MA
- Route 2 Widening, Lincoln, MA
- Quincy Concourse Bridge, Quincy, MA
- C01A3, C14B1, C14A2, C14C4, C17A2, C19E1, C17A1, C01A7, C19B8, C14C2, C17A6, C21C2, C19BA, Central Artery, Boston, MA
  - o Gilmore Bridge Access Ramps, Hub was responsible for rigging and setting 4' diameter rebar cages 120' long, in one piece, between train tracks and I-93
- Decking over East Milton Square, Milton, MA
- Route 202 Bridge over B & M Tracks, Templeton, MA
- MBTA Green Line Modernization, Boston, MA
- Emerson College, Boston, MA
- Hale Street Bridge Reconstruction, Lowell, MA
- Sound Barrier Wall, Exton, PA
- Logan Airport Terminal E, done at night while maintaining pedestrian access at all times, Boston, MA
- Logan Airport Roadways with 8' and 9' diameter shafts, 220' deep with concrete pours of over 400 cubic yards
- Manulife Financial Building, Boston, MA
- Rte 1 over Harris and High St, Dedham, MA
- MVP Medical Office Building, Schenectady, NY
- Revere Street Bridge, low overhead drilling, Revere, MA
- Harvard University, Blackstone Tunnel, Cambridge, MA
- Secant pile wall for the Truman School, New Haven, CT
- Brosnihan Sq., Hurley Square and other various Rte 146 and I-290 rebuilding, Worcester, MA
- NStar Plant Relocation, Beverly, MA
- Mt. Vernon St. Bridge Replacement, Newport City, VT
- Sagamore Creek Bridge Replacement, Portsmouth NH

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**Gordon Penney  
Operating Engineer**

Experience:

1998 – 2001	Operator for Nicholson, including Drilling at Ground Zero, NYC
2001 – 2002	Operator for Trevilcos
2003	Operator for Hayward Baker
2004-present	Operator for Hub Foundation Co., Inc.

Training:

- OSHA 10                      MBCR                      40 Hr HazWoper
- Amtrack ROW MBTA/ROW

Experience:

- Numerous Central Artery/Tunnel contracts C01A3, C14B1, C14A2, C14C4, C17A2, C19E1, C17A1, C01A7, C19B8, C14C2, C17A6, C19BA and C21C2.
- Clinton, MA, Rte 62 & 70 bridge over the Nashua River
- New Haven, CT, secant pile wall for the Truman School
- Boston, MA, 131 Clarendon Street, top down drilling project with H-Beams and cages placed with stringent tolerances
- Boston, MA, drilled shafts by the Mass Pike for the proposed Columbus Center Project
- Bridgewater – Middleboro, MA, Rte 18 over Taunton River
- Falmouth, MA, musco lighting for the Cape Cod league
- Williamstown, MA, retaining wall for Route 43
- Bourne, MA Sagamore Bridge Rotary and flyover
- Westport, MA, Hix River Bridge, Worked off of constructed supports to drill existing bridge under difficult circumstances
- Boston, MA Massachusetts General Hospital. Installed 6' shafts to 100 plus feet in depth.
- Boston, MA, Russia Wharf. Installed 5' diameter shafts with 40 foot rock sockets.
- Dedham, MA installed 4'6" shafts on bridge while bridge still open. MHD
- Dorchester, MA, installed 4' shafts on Fairmont corridor for MBTA
- Ashmont, MA, installed drill shafts on Ashmont Station Platform while platform was kept open. MBTA
- Lowell, MA, installed 2', 3' and 4' shafts.
- New York, NY Installed tiebacks to repair damaged slurry wall while hanging off of a platform at the World Trade Center
- Boston, MA Copley Station installed secant pile "plug" for bottom stability of deep excavation adjacent to the Boston Public Library

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**Shawn M. Skinner  
Operating Engineer**

Experience:

1995 – 1999                      Laborer and Labor Foreman for Hub Foundation Co., Inc.  
1999-present                    Operator for Hub Foundation Co., Inc.

Among some of the challenges that Shawn has faced are:

- Numerous Central Artery/Tunnel contracts C01A3, C14B1, C14A2, C14C4, C17A2, C19E1, C17A1, C01A7, C19B8, C14C2, C17A6, C19BA and C21C2.
  - Drilled 6' and 8' diameter shafts on C19BA
  - Operator in charge of a 60 ton drill rig which was lifted out of SNE tunnel on C17E1
- Logan Airport, where 8' and 9' diameter shafts were drilled up to 220' deep
- Manulife Financial Building, 4' and 6' diameter drilled shafts to a depth of 100', 2002
- Green Line Modernization, Boston, MA
  - Drilling 7' diameter shafts, 60' – 80' deep within 1 foot of the Fleet Center
- 155 Portland Street, Boston MA
- Multiple Contracts for Route 146, Millbury, MA
  - Drilled 4', 5' and 6' diameter fully cased holes up to 90' deep using a specialized casing oscillator
- Route 2 Bridge over Bike Path, Arlington, MA
- NStar Plant Relocation, Beverly, MA
- Stryker Chiller Relocation, Laconia, NH
- Sound Barrier, Rte 93, Manchester NH
- Windham – Salem, sound wall
- Bedford, sound wall
- Tyngsboro, Rte 113 and 3A
- Bridge replacement, Plaistow, NH
- 8' and 10' diameter shafts at Blackfan Research Center, Boston, MA
- Worcester, Brosnihan Square
- Bridge Replacement, Littleton, MA
- Bridge over the MBTA, Mattapan, MA
- Scituate, Marshfield Bridge, MA - 4' diameter shafts, including double jack Osterberg Test, which determined the load capacity of dense sand and gravel

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The primary piece of drilling equipment will be a Soilmec R930 hydraulic drill rig. We have enclosed data on the R930 in Appendix A.

We are also enclosing copies of catalogue cuts showing drill tooling. Our tooling consists of heavy duty earth augers, drilling buckets, rock augers and core barrels. The earth augers and drilling buckets generally use ESCO T-18 and T-25 teeth. The rock augers generally use Kennametal C-21 tungsten carbide tipped teeth and the rock augers use Kennametal C-31 and C-41 teeth. It is anticipated that most of the drilling for this project will use plain water as the drilling fluid. When drilling under fluids we will use typically use drilling buckets for removal of soil. Catalog cuts of typical drilling tools are included in Appendix B.

For pumping of fluids back to a storage tank we will use a Gorman-Rupp self-priming centrifugal pump. Pumping slurry (if used) to the shaft will be accomplished by gravity feed or by using a Wilden diaphragm pump. Catalog cuts of the self-priming pump and Wilden diaphragm pump are included in Appendix A.

We plan on installing casing by spinning and crowding the casing with the drill rig and/or by using a vibratory hammer. Catalog cuts on the vibratory hammer are included in Appendix A. Casing will be left in place.

Information pertaining to a crane to be used to install and extract casing; unload, lift and set the rebar cage; and service the drill rig, will be provided by the General Contractor separately from this submittal.

Note: Equipment may be modified or substituted depending on field conditions. Modifications will be submitted to the Resident Engineer for approval prior to being implemented.

Note: The drawings for the tooling shown in Appendix B are to be interpreted for conceptual use only. Hub Foundation's manufacturer produces tooling for Hub exclusively in the New England market and all of the tooling is built to our exact specifications and other custom requirements. Drawings will not be made available.

**Spec. Prov. Section 61(a)(9) and 63(c)(1) requires the slurry manufacturer technical rep to be onsite during mixing and drilling of the shaft. The current phone number of the slurry manufacturer tech rep and HUB personnel training certs must be supplied.**

It is anticipated that drilling fluid will be required to stabilize the excavation below the bottom of the casing. It is our intent to use polymer slurry which will be introduced to the hole after the casing is driven to the desired embedment depth. The slurry to be used will be manufactured by one of the following companies: KB International, (423) 266-6964, Cetco, (847) 851-1800, or Matrix Construction Products (877) 791-0893. Information for KB Technologies, Cetco, and Matrix polymer slurries are included in Appendix C.

**The catalog cuts show polymer slurry of different types, i.e KB vinyl resin, Shore pac acry;late/acrylamide. Each product has different characteristics and requirements that must be met. Fluid pH has to be kept buffered to 10 or less to prevent loss of slurry performance. Use additives as required to maintain performance.**

Ground condition indicate a higher viscosity in the range of 80 to 100 + will be required depending on type used.

is this normal to choose at which point to check? I forget the max time allowed from cleaning hole to starting concrete so maybe the time from placing the cage to concrete is small enough to not matter?

slurry will meet the following parameters unless otherwise required by the manufacturer:

spec states density of 1025 kg/m3 max ~ 64 pcf; spec also states viscosity of 32 to 135 sec/qt

in excavation will be 63 to 67 lbs. per cub. ft. of slurry in excavation will be a minimum of 55 seconds using the Marsh funnel method. The maximum viscosity at the time of concrete placement will be 70 seconds. Mixing at the slurry plant may be thicker to allow for slurry degradation during the drilling of the hole.

8 to 11.5

cannot exceed 11.5 para. 59(e)

- 3. Ph of slurry in the excavation will be 9 to 12.
- 4. Dwell time in the mixer will be 15 minutes.
- 5. Sand content will be less than 1% measured 12 inches above the bottom of the hole immediately prior to placing reinforcing or concrete.
- 6. The slurry level will be held a minimum of 5' above groundwater table/river level during drilling and until concrete placement is started.

measure at 10ft above bottom as well. Spec Prov 63(c)

Drilling fluid will be topped off to an approximate height of 5' above the groundwater/river level at the end of the day. If drilling fluid loss is consistent in any given area, a float shut-off device will be installed to maintain the level.

Desanding equipment is not required for polymer slurries. Sand size particles drop out of the slurry quickly and are removed by the cleanout bucket.

The polymer slurry will be batched in mixing tank which uses a splash plate to introduce the powdered slurry into a stream of water and bubblers (air) to agitate the slurry to thoroughly mix it. It will then be transferred to the shaft or storage tanks for later use depending on need.

Drilling fluid will be returned to storage tanks as the hole is poured.

sampler may need to be

A slurry sampler is shown in Appendix A

Include name and phone number of slurry supplier and slurry supplier

Shaft design capacity was evaluated based on an elevation of 190 for side friction. Casing should not be driven below this elevation without further evaluation of shaft capacity

Section 1  
Drilled Shaft Installation Procedure

Include drawings showing consecutive steps of drilled shaft

"missing inch mark"

Final top elevation of casing to be left in place needs to be specified in work plan.

Casing will be advanced to approximately 5 ft. into the gravelly silty sand layer (top of stratum approx. 60 ft. below mudline) by driving with a vibratory hammer and/or by spinning and crowding with the drill rig. The casing will be 8'-3" OD x minimum 0.625" (nominal) wall thickness. Casing will be new or used (at our option) meeting the requirements of ASTM A252 Gr 2 (or better) and left in place. It is anticipated that one field splice will be required. The splice will be adequate to allow installation of the casing to the desired depth and will not be tested. During construction of the shaft the top of the casing will be approximately 3 ft. above the grade of the work platform.

Once the casing has been advanced to the desired embedment into the gravelly silty sand layer, the soils within the casing will be drilled out using earth augers, drilling buckets, or rock augers as needed.

Borings indicate that artesian water pressures of up to Elev. 254+/- may be encountered in the soil below the clay/silt layer, casing may need to be extended above this elevation to provide adequate head within the casing.

Approx. what grade will this be?

**Spec Prov. Sec. 63(c) requires a 30 minute wait time to allow sediment to settle after completion of the excavation.**

3. In the event the casing is not able to be advanced to the desired embedment into the gravelly silty sand layer due to soil friction, the casing will be cleaned out approximately to the tip of casing and soil below the casing loosened, but not removed. The casing will then be advanced again. If an obstruction is found below the casing, it will be removed as discussed in Section 9. Plumbness of the casing will be checked with a level every 10' during the installation of the casing.
4. Once the casing has been cleaned out, excavation of the remainder of the shaft to the design tip elevation will be completed under drilling fluid using earth augers, drilling buckets, and rock augers as needed to advance the hole. During excavation, the plumbness of the kelly bar will be monitored with built in spirit levels.
5. Once the excavation has been advanced to the design depth, the bottom of the shaft will be cleaned with a cleanout bucket. Once cleaned, the shaft will be inspected (with Owner's Representative) to verify the depth and cleanliness with a weighted tape.
6. Once the shaft has been inspected and determined to be of the appropriate depth and cleanliness the reinforcing cage will be installed with crosshole sonic testing access tubes attached (see Section 11).
7. Concrete will be placed by tremie placement methods using tremie pipe or concrete pump (see Section 12). During placement of concrete, the displaced water or slurry will be pumped back to a storage tank.
8. The concrete in the shaft will be overpoured by ~~approximately~~ **minimum (Sec. 63(k))** 2', to allow for any contaminated concrete to rise above the top of shaft elevation.
9. Poor quality concrete, concrete, and/or laitance above the cutoff grade (El. 241) will be removed, using a vac truck, immediately after the completion of the placement.
10. The permanent casing will be cut to final grade as soon as practicable following completion of the shaft.

**Special Provision Sec. 63(f) requires a MiniSid be provided for inspection**

**Note: rebar extends 6 ft above cutoff**

### Section 5

#### Excavation Procedures

1. Excavation of the overburden will be performed by rotary drilling using a heavy duty earth auger, drilling bucket, and/or rock auger.
2. After introduction of drilling fluid or encountering groundwater, granular material will generally be removed with a drilling bucket. Cohesive material may be removed with either an earth auger or a drilling bucket. Hard drilling may require the use of a rock auger to loosen soil before removal with the bucket.
3. Obstruction removal may require the use of a rock auger and/or a core barrel. When obstructions are encountered, the Engineer (or his/her designee) will be notified to verify an obstruction has been encountered and so that pay quantities can be determined.
4. While drilling, Hub will maintain the drilling fluid approximately five feet above river levels or as needed to ensure shaft stability.

**Borings indicate that artesian water pressures of up to Elev. 254+/- may be encountered in the soil below the clay/silt layer, casing may need to be extended above this elevation at a minimum to provide adequate head within the casing.**

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5. Shaft layout will be provided by the General Contractor's survey team.
6. In the event of a sudden loss of drilling fluid, loss of slurry stabilization properties, or sudden ground loss around the shaft during drilling, drilling will immediately stop and one or more of the following actions will occur as needed: the casing will be advanced to seal the hole; the hole will be backfilled with drilling spoils; slurry viscosity will be increased; the hole will be backfilled with lean mix concrete.

Method used to fill or eliminate voids

### Section 6

Any advance of the casing below El. 190 will require assessment of remaining shaft vertical capacity.

Spoils handling, transport, disposal, and management of any temporary stockpiling sites will be by others. Hub will spin drilled material off the augers or dump them from drilling buckets onto the working platform next to the drill rig for removal by others.

Work Plan needs to detail how slurry will be disposed of.

### Section 7

#### Out of Tolerance

Tolerances should be stated in the work plan, Ref Spec Prov. Section 62

If the hole is discovered to be out of tolerance, Hub will attempt to straighten the hole with a core barrel working on the "high" side of the hole. If the hole is out of tolerance due to an obstruction, the obstruction will be removed or a portion cored through. If we are unable to straighten the hole, the portion of the hole that is obstructed, will be backfilled with lean-mix (or flowable fill) and the hole re-drilled after the mix has setup.

### Section 8

#### Sloping Rock Surfaces

Not applicable to this project.

### Section 9

#### Removal of Obstructions

Hub will have a core barrel and rock auger on site to allow us to drill through boulders or other similar obstructions. Given the likelihood of groundwater or drilling fluid in the excavation it is not anticipated that downhole entry for the removal of obstructions will be utilized. However, should a decision be made to attempt to remove an obstruction by downhole entry, the excavation shall be fully cased to the obstruction level and water intrusion shall be under control before downhole entry procedures will be undertaken.

In the event that an obstruction is encountered requiring excavation below the bottom of the casing, water or polymer slurry will be introduced into the hole, as needed, to maintain hole stability below the bottom of the casing.

We will notify the Engineer when obstructions are encountered and assist in measuring elevations of top and bottom of obstructions to determine pay quantities.

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**Section 10**

Shaft Inspection Procedure

Shaft inspection will be performed by Hub Foundation in conjunction with the Owner's Representative. Shaft approval will be by the Owner's Representative. Hub will notify the Engineer (or his/her designee) at the completion of a shaft or when any unusual or unanticipated geologic conditions are encountered. Hub will assist the Engineer in taking measurements as requested.

Shaft cleanliness will be determined by dropping a weighted tape to the bottom of the hole and sounding the bottom.

A sample drilled shaft log is shown in Appendix D.

**Special Provision Sec. 63(f) requires a MiniSid be provided for inspection. Shaft exc. base cannot have more than 2" of sediment and must have 1" or less over 50% of the base area.**

**Section 11**

Lifting, Placing and Securing C

When will the CSL tubes be filled with water?

Hub will place the cage in the shaft using a service crane provided by the General Contractor. The cage, with CSL tubes attached, will be lifted by the service crane and, if necessary, the drill rig to hold the bottom of the cage during tripping up (upending of the cage for insertion into the casing). The cage will be spliced over the hole using mechanical couplers as indicated by the

**Special Provision Sec. 63(f) requires a MiniSid be provided for inspection. Shaft exc. base cannot have more than 2" of sediment and must have 1" or less over 50% of the base area.**

**Section 12**

Concrete Placement

cage support feet description

**Special Provision Sec. 3(i) requires a 12-inch diameter tremie**

our specification does not allow for an inflatable plug.

It is assumed that the concrete will require placement by the tremie method due to the likely presence of groundwater or drilling fluid in the shaft. Concrete will be placed by the tremie method utilizing either 10" diameter tremie pipe or concrete pump with minimum 4" diameter discharge. A cut sheet of the tremie pipe is included in Appendix A.

The tremie method consists of placing concrete at the bottom of the shaft under water or drilling fluid using either a minimum 4 inch diameter concrete pump discharge or a ~~ten~~ inch diameter tremie pipe, placed in the center of the shaft. As the concrete is placed it displaces the fluid in the shaft which is pumped back to a holding tank. An inflatable "rabbit" will be used between the concrete and the water or drilling fluid to prevent contamination of the concrete. The tremie pipe and hopper will be supported on the top of the casing.

12"

minimum

As the concrete is poured, portions of the tremie pipe will be removed. The tremie pipe will always be embedded a minimum of 10' into the concrete. Concrete will be over-poured about 2 feet to provide good concrete at final grade. The over-pour will be removed using a vac truck immediately following completion of the placement.

**Placement log must incorporate a log of air and concrete temperature, plumbness, and casing data in addition to that shown in Appendix D.**

CSL Tubes will be blown out with a compressor prior to grouting with neat cement grout (approx., 5.0 gal. water to 94 lbs Type I, II, or I/II Portland cement). Neat cement grout will be hand mixed and ~~will be poured through a funnel placed directly into the top of the CSL tube and allowed to free fall. Alternatively, at our option,~~ the grout will be placed using tremie methods.

How are you going to cut and remove the excess casing?

### Section 13

#### Corporate Experience

Spec. Prov. Sec. 63(o)  
requires placement by tremie.  
Sec. 59 (g)  
requires grout meeting AOT  
Spec. 707.03 (shrinkage  
compensating grout)

In 1966 Francis Maxwell founded Hub Foundation Co., Inc. and took over the management of the company in 1981. Jeff and Greg Maxwell joined Hub after graduating from Tufts University in the 1990s. They are presently managing jobs and are poised to take over the company in the future. Hub has completed more than 1100 contracts in the New England and NY area under diverse and difficult conditions.

Hub has capabilities to install drilled shafts ranging in size from 18" inches up to 12 ft. in diameter through soils and into underlying bedrock. Hub also has capabilities to install drilled in soldier piles, drilled mini-piles, secant piles, steel sheet piling, tiebacks, rock anchors, soil nails, and helical piles.

Hub owns 12 hydraulic crawler mounted drill rigs of various sizes to allow us to handle a variety of projects from small to large. Hub also owns a 220-ton capacity Liebherr HS895 lattice boom crane with built in hydraulics, 35 ton single part line pull and full computer monitoring; two Mantis 77 ton capacity hydraulic crawler cranes; an Ape King Kong vibratory hammer capable of vibrating up to 12' diameter casing; a high frequency variable moment vibratory hammer; two ICE vibratory hammers; a Volvo 150 loader; and a Komatsu PW 220 rubber tired backhoe.

Our Soilmec SR-100 is one of the largest hydraulic drill rigs made and is capable of drilling shafts up to 12' in diameter and 230' deep. Our three Soilmec 930's and our SR-90 can drill shafts up to ten feet in diameter and 220' deep. Other equipment is available for various sizes of shafts 18 inches in diameter and larger.

Hub also owns several minipile drill rigs and tieback rigs, including small electric minipile drill rigs capable of work inside existing structures. Hub has the capability to install drilled minipiles, tiebacks, soil nails, rock anchors, and helical piles.

Hub also owns a significant inventory of drilling tools, slurry plant equipment and drilling accessories. We fabricate many of our own drill tools at our shop.

For more information on Hub Foundation Co., Inc. look us up on our website, [www.hubfoundation.com](http://www.hubfoundation.com), or contact our office at 978.456.2387.

#### Some Completed projects

Logan Airport, Boston, MA: Hub has been involved in multiple contracts at Logan Airport over the past few years. Our work has included running the night shift and maintaining pedestrian access to Terminal E at all times while drilling and pouring operations were ongoing. Hub also drilled 8' and 9' diameter shafts up to 220 feet deep for the viaduct shafts. The pours were continual and comprised more than 400 cubic yards of concrete. Contractor: Modern Continental and Flatiron, Flatiron Address: 18 Logan Way, Boston, MA, 02127, Ph: 617.567.4038

Vermont Agency of Transportation

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ON: **January 14, 2016**

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BY: Todd A. Sumner DATE: 01/29/16

Emerson College, Boston, MA: Hub had a 100' x 100' site to drill 17 four foot diameter 90' to 140' deep shafts and nine soldier piles and had to enter through a 12 foot wide alley.  
Contractor: Lee Kennedy Address: 1792 Dorchester Ave, Boston, MA, 02124, Ph: 617.825.6930.

CA/T Utility relocation for the new Central Artery placed in downtown Boston. We have been active on C01A3, C14B1, C14A2, C14C4, C17A2, C19E1, C17A1, C01A7, C19B8, C14C2, C17A6, C19E6, C21C2, and C19BA. We have drilled and placed soldier piles in low headroom situations, under the existing Central Artery, and in high traffic areas such as Kneeland Street. We have also performed night shift work on Causeway Street. Once drilling was completed C19E1, we were required to lift the Soilmec 312, a 40-ton drill rig, with a 200-ton crane. On the C14B1 project we were responsible for rigging and setting four-foot diameter rebar cages 120 feet long, in one piece, between live train tracks and I-93 without disrupting vehicular or train traffic. On C19BA we were contracted to drill 6' and 8' diameter shafts with permanent casing.  
Contractors: The Middlesex Corp., Daniel O'Connell's Sons, The Laxfield Corp., McCourt Construction Co., J. F. White Contract Corp., Modern Continental Construction Co., Modern's  
Address: 600 Memorial Drive, Cambridge, MA, 02139 Ph: 617.864.6300. (2 current projects)

399 Boylston Street: Picking up precast concrete piles 130 feet long in a downtown area on a site 70' by 200', while maintaining pedestrian and vehicular traffic. Contractor: George B. H. Macomber Company, Address: One Design Center Place Boston, MA 02210 Ph: 617.965.7300.

53 State Street, Boston, MA: Installing a soldier beam and lagging system in the midst of old streets and utilities to an excavated depth of 30 feet. After the excavation was complete we turned and drove piles in the hole while a six story façade, left for historical purposes, reminded us that an unplanned move could topple the wall over with disastrous consequences.  
Contractor: Kiewit Eastern and Gilbane Building, Address: 2310 Washington Street, Newton Lower Falls, MA, 02462, Ph: 617.965.7300.

Lechmere Galleria, Cambridge, MA: Installing 3,000 lineal feet of permanent sheeting and jacked raker system, for an excavation up to 40 feet deep. Immediately adjacent to our work was a new building, which had footings 15 feet above the excavation. The site filled in a portion of the Charles River and had to be dewatered. Contractor: Beaver Builders, Address: 1 Wells Ave, Newton Center, MA 02459, Ph: 617.965.9600.

Route 2 Widening, Lincoln, MA: Hub designed and drilled 41 soldier piles to facilitate the widening of Route 2 near an environmentally sensitive area. The beams varied from 23' to 39' in length and were placed through fill up to 25 feet deep. The till consisted of boulders, some of which were larger than the 4'6" diameter casing. A cantilever design allowed traffic to run unimpeded next to a cut as deep as 19 feet. This was done without installing tiebacks, which would have cut into an existing gas main, or bracing, which would have been destructive to the wetlands. Design by James C. Schrock, P.E., Contractor: G. Conway, Inc., Address: 500 Main St., Charlestown, MA, Ph: 617.242.2151.

Groton Submarine Base: The Navy required a new dock in an area where there was little material over rock. In order to secure the dock and fender system we installed 123 18" and 20" piles, which were predrilled with a down hole hammer as much as 25 feet into granite. All of the piles were placed within a 3/4 inch tolerance for a precast deck system to be installed.  
Contractor: The Middlesex Corp., Address: One Spectacle Pond Road, Littleton, MA 01460, Ph: 978.742.4400.

Reconstruction of Rte 146, Millbury and Worcester, MA: We have drilled four-, five-, and six-foot diameter shafts up to 90 feet deep with rock sockets up to eight feet deep into hard schist. The shafts were to support a series of ten bridges over the Blackstone River and the P & W Railroad. Much of the work required fully cased shafts, which was installed using a two-meter casing oscillator to eliminate vibration settlement in loose sands. Contractor: Roads Corp., Address 241 Treble Cove Road, Billerica, MA 01862, Ph: 978.663.9700.

East Milton Square, Milton, MA: Our contract required us to install 42" diameter shafts on 20' centers along the median strip. Phase one holes supported a temporary bridge constructed to carry traffic over the SE Expressway while new bridges were constructed in phase two. This was an extremely tight site requiring planning and coordination between the state, GC and Hub. While on this site there was an Osterberg Load Cell Test to a total capacity of about 6,147 tons. Testing was performed by Loadtest Inc. Contractor: The Middlesex Corp., Address: One Spectacle Pond Road, Littleton, MA, 01460, Ph: 978.742.4400.

Mobil Oil, Boston, MA: An earth retention system was needed to stabilize a granite seawall, which was moving due to a slope failure. The new system had to be installed without any vibration. Hub installed 51" casing in a tangent pile system using a casing oscillator, which was mounted on false work driven under a previous contract. We drilled 50' holes through a dense glacial till containing cobbles and boulders, from a barge in a tidal creek with limited access to an active pier. Hub had to abandon partially completed holes while oil tankers unloaded in an extreme safety environment. The work was performed on a time and material basis because of numerous interruptions. Contractor: Mobil Oil Corp., 1.888.662.4599.

Mohawk Valley Physicians Office Building and Parking Garage, Schenectady, NY: Hub drilled 80 three-, four-, and five-foot diameter shafts, up to 160' deep. Two Osterberg tests showed that the till could support very high loads, saving the owner over \$200,000 by reducing the size and socket depth of the shafts. Contractor: BBL Construction Services, Address: 302 Washington Ave Extension, Albany, NY 12203, Ph: 518.452.5200.

Secant Pile Wall, New Haven, CT: 2003-2004 Hub is drilling a series of over 300 shafts as a secant pile wall for the City of New Haven water department to create a retaining wall for a 5 million gallon rain water runoff overflow reservoir. Hub is using both a Liebherr 225 and a Soilmec 930 to create the secant pile wall. The Liebherr uses a Continuous Flight Auger system, which allows for a 60 foot shaft to be drilled and cased at once. Contractor: Remedial Construction Services ph: 281.664.1114.

Sheridan Hollow Parking Garage, Albany NY: Hub drilled 115 three- to five-foot diameter shafts on a steeply sloping job site. Our 200-ton Liebherr 895 greatly simplified the project with its reach and line pull. Our Soilmec R-930 and R-518 rigs drilled holes up to 100 feet deep through clay and till to support a seven-story parking garage. Turner Construction, 54 State Street, Albany, NY, 518.432.0277.

Blackfan Research Center, Boston, MA: Hub is installing 8' and 10' diameter drilled shafts in a limited space job in a very busy area of Boston. East Coast Slurry, 145 Island Street, Stoughton, MA, 781.344.5700.

500 Atlantic Avenue, Boston, MA: Joint venture with East Coast Slurry to place the foundation for a hotel around the existing Central Artery Tunnel and air filtration stack. Drilling is took place in very tight, downtown conditions through many existing wood piles. Bovis Lend Lease, 99 Chauncy Street, Boston, MA 02111, Ph: 617.598.4300

Memorial Bridge, Portsmouth NH: Installation of 3 ft and 5 ft diameter shafts and 9 5/8" diameter mini-piles in Portsmouth Harbor. Shafts were drilled from trestles through overburden soils into the underlying bedrock. Rock socket depths for the drilled shafts varied between 6'-6 to 8'-6. Minipiles were drilled through the existing main span piers to depths of approximately 100 ft with 25 ft deep rock socket. Archer Western Contractors LLC, 45 Shawmut Road, Canton, MA 02021, Ph 781.793.9988

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BY: Todd A. Sumner DATE: 01/29/16

**Appendix A**

**Drill Rig/Equipment Data**

Vermont Agency of Transportation  
**RECEIVED**  
ON: **January 14, 2016**  
and Checked for  
**CONFORMANCE**  
BY: Todd A. Sumner DATE: 01/29/16

# R-930

Rotary idraulica  
Hydraulic rotary rig



**SOILMEC** 

# R-930

PALI GRANDE DIAMETRO  
LARGE DIAMETER PILES

Le attrezzature di perforazione serie R-930 su carro base SOILMEC sono progettate per eseguire i seguenti lavori:

- ▶ pali trivellati a secco o con fluidi di perforazione;
- ▶ pali trivellati con l'infissione ed estrazione di tubi di rivestimento con o senza morsa;
- ▶ pali ad elica continua;
- ▶ pali a circolazione inversa;
- ▶ pali secanti con doppia testa.

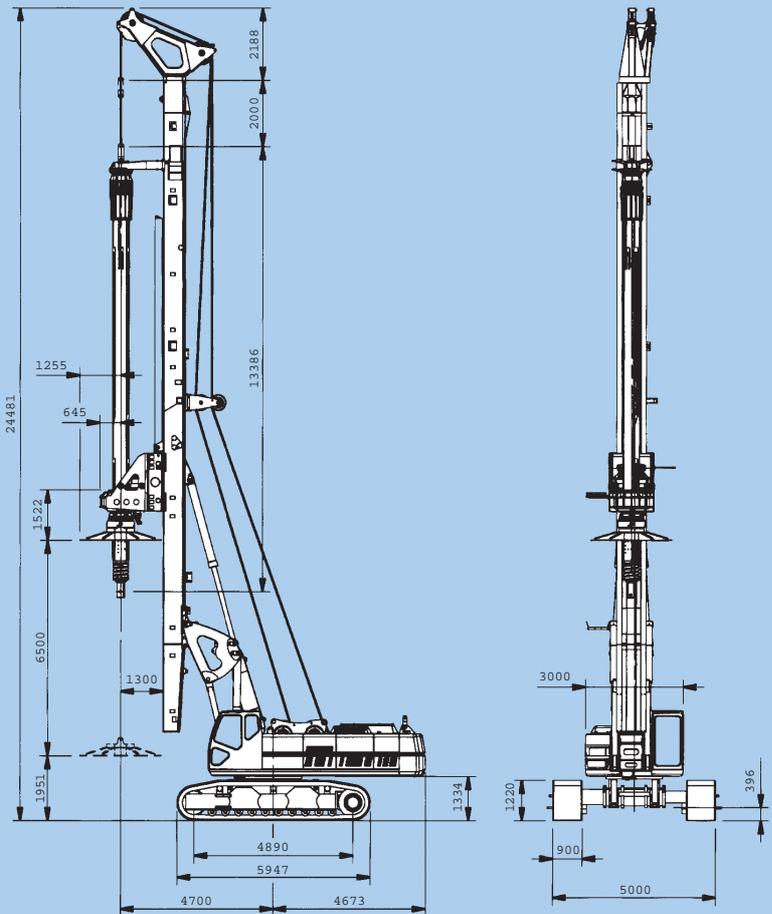
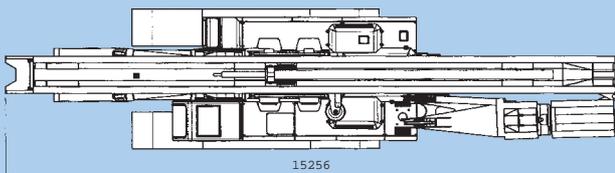
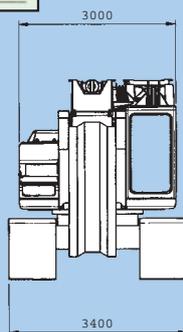
Le caratteristiche qualificanti della R-930 sono:

- ▶ classe macchina 100 t;
- ▶ completamente automontante;
- ▶ possibilità di intubaggio con testa di rotazione;
- ▶ moderna strumentazione;
- ▶ affidabilità e sicurezza.



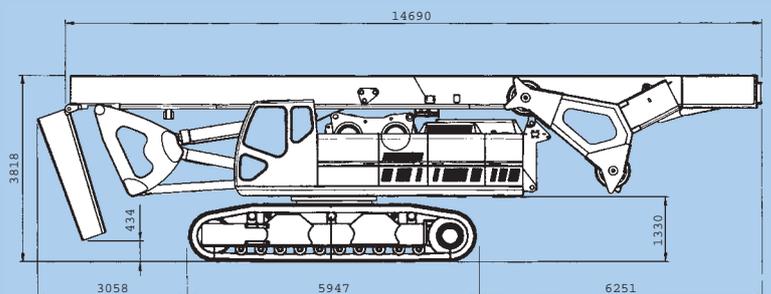
Sistema di Qualità Certificato  
Certified Quality System

Dal 1990 la Soilmec si è uniformata alle normative previste dal sistema di Qualità ISO 9001/UNI 29001.  
In 1990 Soilmec was awarded the certification of its own Quality System to ISO 9001/UNI 29001 series standards



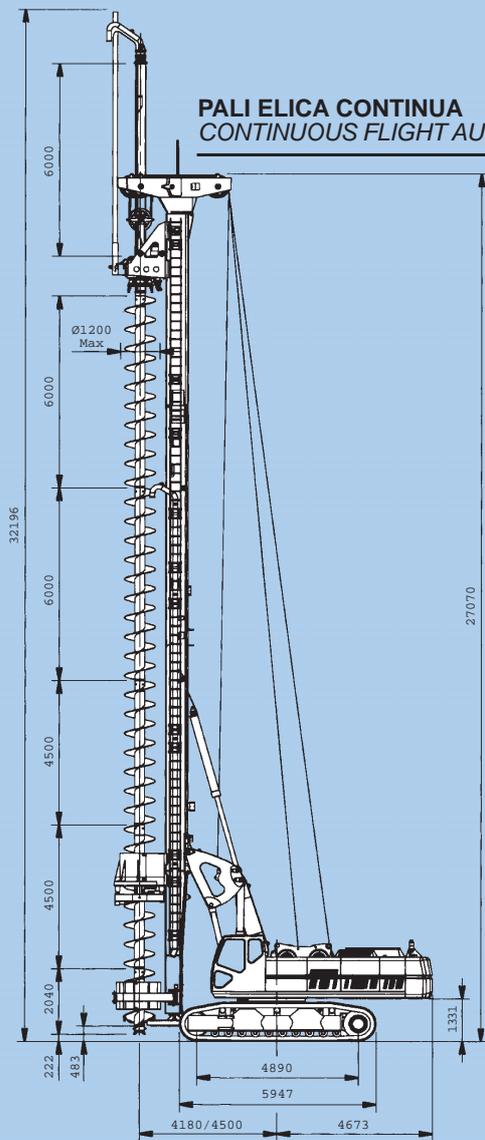
## KELLY BAR / KELLY BAR

<b>Diametro max palo</b> Max pile diameter	mm	<b>2500 / 3000</b> <sup>(1)</sup>
<b>Max Profondità palo</b> Max pile depth	m	<b>76,5</b>

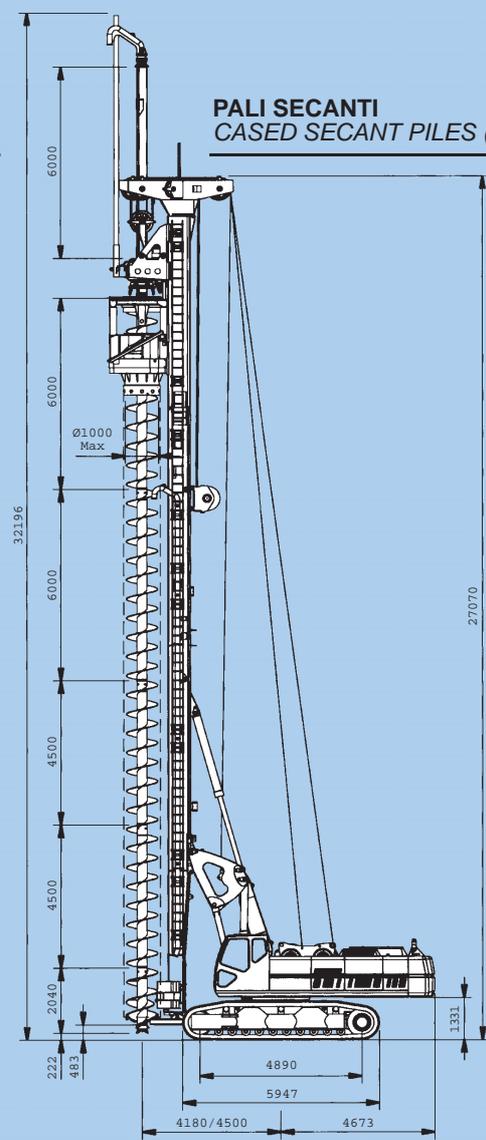


## PESI e DIMENSIONI / WEIGHTS and DIMENSIONS

<b>Larghezza in trasporto</b> Transport width	mm	<b>3400 / 3000</b> <sup>(2)</sup>
<b>Altezza in trasporto</b> Transport height	mm	<b>3560 / 3200</b> <sup>(2)</sup>
<b>Peso in ordine di lavoro</b> Operating weight	ton	<b>100 - 105</b>
<b>Peso in trasporto, min.</b> Minimum transport weight	ton	<b>45</b> <sup>(3)</sup>



**PALI ELICA CONTINUA**  
CONTINUOUS FLIGHT AUGER (CFA)

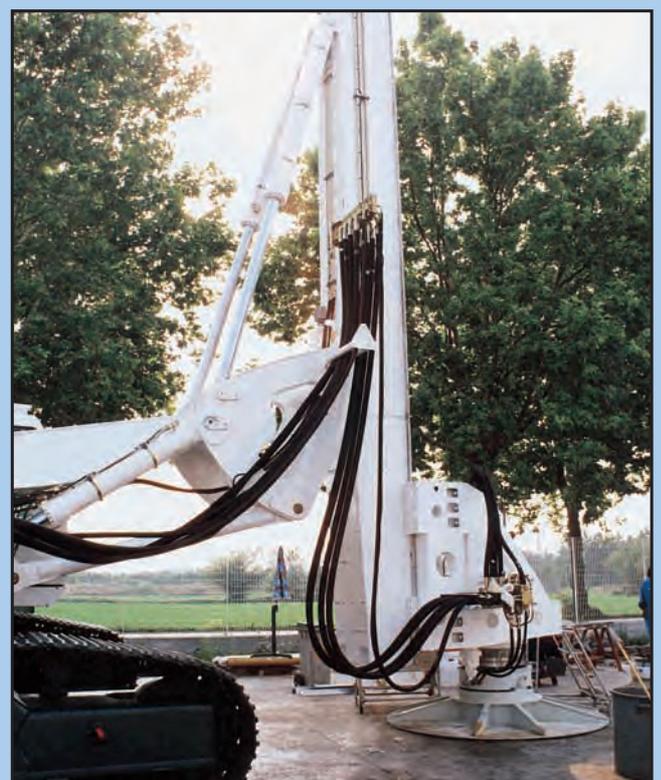


**PALI SECANTI**  
CASED SECANT PILES (CSP)

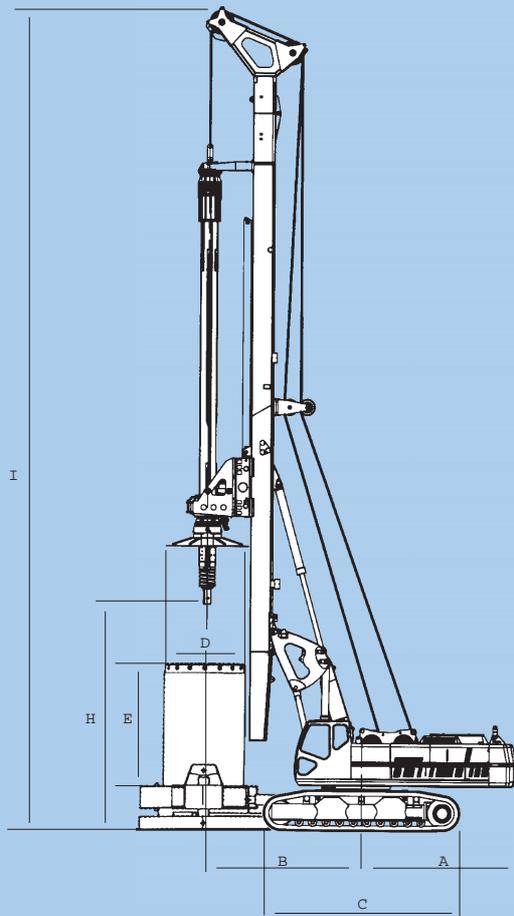
ELICA CONTINUA / CONTINUOUS FLIGHT AUGER		
<b>Diametro max palo</b> Max. pile diameter	mm	<b>1200</b>
<b>Max profondità palo</b> Max. pile depth	m	<b>28.6</b>
<b>Max profondità con pulitore</b> Max. pile depth w. auger cleaner	m	<b>27</b>
<b>Forza di estrazione</b> Extraction force	kN	<b>1160</b>

PALI SECANTI / CASED SECANT PILES		
<b>Diametro max palo</b> Max. pile diameter	mm	<b>1000</b>
<b>Max profondità palo</b> Max. pile depth	m	<b>25</b>
<b>Max profondità intubato</b> Max. cased depth	m	<b>18.5</b>
<b>Tiro/spinta di estrazione</b> Casing pull-up down	kN	<b>320</b>
<b>Coppia 2ª rotary</b> 2 <sup>nd</sup> rotary torque (32 MPa)	kNm	<b>305 @ 4.8 rpm</b>
<b>Velocità max intubaggio</b> Max casing speed	rpm	<b>9.7</b>

- (1) Con / Senza piede antenna. With / Without bottom mast section.
- (2) Con / Senza cingolato. With / Without tracks.
- (3) Senza cingoli, zavorra, rotary, kelly, testata con carrucolo, prolunga antenna.  
Tracks, counterweight, rotary, bottom & top mast section, sheave head removed.

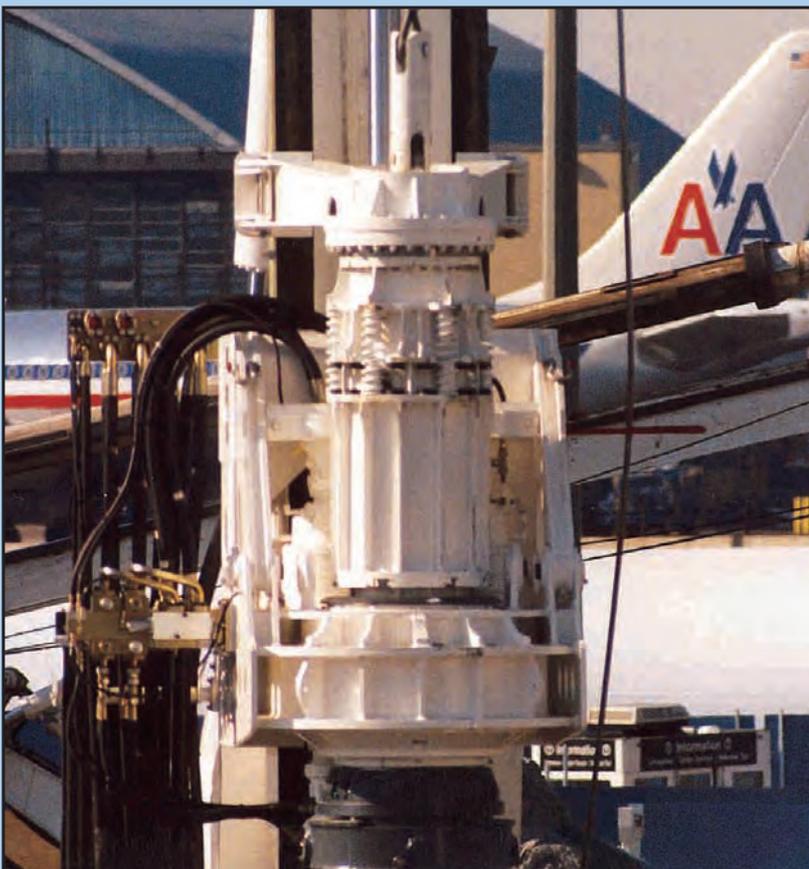


## Rotary idrauliche Hydraulic rotary rigs



A	<b>Raggio di rotazione torretta</b> <i>Tail/swing radius</i>	mm	<b>4670</b>
B	<b>Asse di rotazione - asse di scavo</b> <i>Radius of front end</i>	mm	<b>4700</b>
C	<b>Lunghezza totale cingolo</b> <i>Track total length</i>	mm	<b>5950</b>
D	<b>Diameatro max con morsa</b> <i>Max diameter with casing oscillator</i>	mm	<b>2500</b>
D	<b>Diametro max.*</b> <i>Max diameter *</i>	mm	<b>3000</b>
E	<b>Altezza max tubo colonna</b> <i>Max length of casing element</i>	mm	<b>6000</b>
H	<b>Altezza attacco utensile da terra</b> <i>Tool connection height from ground level</i>		vedi tabella aste <i>see kelly table</i>
I	<b>Altezza totale macchina</b> <i>Machine total height</i>	mm	<b>24500</b>

\* si può ottenere smontando la parte inferiore del mast  
may be obtained by removing the lower mast element



### ASTE A FRIZIONE Ø 483 KELLY FRICTION Ø 483

n° elementi n° elements	lungh. length	profondità depth	peso weight	H
4x	10,5 m	37,0 m	7000 kg	9900 mm
4x	11,5 m	41,0 m	7500 kg	8800 mm
4x	13,5 m	49,5 m	8500 kg	6760 mm
4x	15,5 m	57,5 m	9500 kg	4770 mm
4x	16,5 m	61,0 m	10000 kg	3860 mm
5x	10,5 m	46,0 m	7600 kg	9900 mm
5x	11,5 m	51,5 m	8300 kg	8800 mm
5x	13,5 m	62,0 m	9600 kg	6760 mm
5x	15,5 m	72,0 m	10900 kg	4770 mm
5x	16,5 m	76,5 m	11500 kg	3860 mm

### ASTE A BLOCCAGGIO MECCANICO Ø 483 KELLY MECHANICAL LOCKING Ø 483

n° elementi n° elements	lungh. length	profondità depth	peso weight	H
4x	10,5 m	37,0 m	7000 kg	9900 mm
4x	11,5 m	41,0 m	7500 kg	8800 mm
4x	13,5 m	49,0 m	8500 kg	6760 mm
4x	15,5 m	57,0 m	9500 kg	4770 mm
4x	16,5 m	61,0 m	10000 kg	3860 mm

La misura standard per il quadro attacco utensili è 200 x 200  
Standard dimension of tool connection is 200 x 200 mm



exit

print

zoom



SOTTOCARRO CINGOLATO / UNDERCARRIAGE		
<b>Lunghezza totale</b> <i>Overall length</i>	mm	<b>5950</b>
<b>Larghezza pattini</b> <i>Track shoe width</i>	mm	<b>900</b>
<b>Larghezza totale, aperto</b> <i>Overall width (retracted side frames)</i>	mm	<b>5000</b>
<b>Larghezza totale, chiuso</b> <i>Overall width (extended side frames)</i>	mm	<b>3400</b>
<b>Pressione al suolo</b> <i>Ground pressure</i>	MPa	<b>0,01</b>
MOTORE DIESEL / DIESEL ENGINE *		
<b>Marca / Modello</b> <i>Make and model</i>	<b>Deutz BF8M1015C</b>	
<b>Potenza massima</b> <i>Power rating</i>	kW (HP)	<b>364 (488) @ 2200 rpm</b>
POMPE IDRAULICHE / HYDRAULIC PUMPS		
<b>Portata pompe principali</b> <i>Main pumps</i>	lt/min	<b>2 x 380</b>
<b>Taratura idraulica</b> <i>Hydr. power setting</i>	kW (HP)	<b>247 (331)</b>
<b>Pressione massima di utilizzo</b> <i>Max working pressure</i>	MPa	<b>35</b>
ARGANO PRINCIPALE / MAIN WINCH <b>Controlled Descent</b>		
<b>Tiro nominale in 1° strato</b> <i>1st layer nominal line pull</i>	kN	<b>290</b>
<b>Velocità massima in 1° strato</b> <i>1st layer nominal rope speed</i>	m/min	<b>82</b>
<b>Diametro fune</b> <i>Rope diameter</i>	mm	<b>30</b>
ARGANO SECONDARIO / SERVICE WINCH <b>Controlled Descent (SW-140) Free Fall (SF-140)</b>		
<b>Tiro nominale in 1° strato</b> <i>1st layer nominal line pull</i>	kN	<b>140</b>
<b>Velocità massima in 1° strato</b> <i>1st layer nominal rope speed</i>	m/min	<b>87</b>
<b>Diametro fune</b> <i>Rope diameter</i>	mm	<b>26</b>
TAVOLA ROTARY / ROTARY TABLE		
<b>Coppia massima (35 MPa)</b> <i>Maximum torque (35 MPa)</i>	kNm	<b>305</b>
<b>Velocità di scarico</b> <i>Spin off speed</i>	rpm	<b>117</b>
<b>Velocità max. perforazione</b> <i>Maximum drilling speed</i>	rpm	<b>27.1</b>
<b>Forza max. spinta / estrazione</b> <i>Max pull / push force</i>	kN	<b>318 / 322</b> sul casing / on casing
<b>Forza max. in spinta sul kelly</b> <i>Max force pull on kelly</i>	kN	<b>153</b>
<b>Corsa cilindro di pull-down</b> <i>Pull down cylinder stroke</i>	mm	<b>6500</b>

The R-930 drilling rig mounted on SOILMEC base carrier has been specially designed to perform the following applications:

- ▶ bored piles with or without drilling fluid;
- ▶ casing with rotary head or by the use of an oscillator;
- ▶ continuous flight auger piles (C.F.A.);
- ▶ bored piles by reverse circulation;
- ▶ secant piles with double head (C.S.P.).

The main features of R-930 are the followings:

- ▶ a 100 ton class machine;
- ▶ completely self-erecting;
- ▶ casing can be installed by means of a rotary head;
- ▶ sophisticated instrumentation;
- ▶ reliability and safety.



\* Conforme alle norme sulle emissioni dei diesel industriali / Nonroad diesel exhaust regulations compliance (EU - 97/68/CE, U.S.A. - EPA; California - CARB.)

Tutti i dati tecnici sono da considerare indicativi.  
La SOILMEC si riserva la facoltà di modificarli opportunamente.

All technical data are purely indicative and subject to change without notice.



**SOILMEC** 

Drilling and Foundation Equipment

5819, via Dismano - 47028 Cesena (FC) - Italy

Tel. +39-0547-319111 - Fax +39-0547-318548

<http://www.soilmec.it>

e-mail: [soilmec@soilmec.it](mailto:soilmec@soilmec.it)

SOILMEC



# APE Model Vibratory Driver Extractor

## The Worlds Largest Provider of Foundation Construction Equipment



SPECIFICATIONS	DATA
Eccentric Moment	4,500 in-lbs (51.85 kgm)
Drive Force	225 tons (2,002 kN)
Frequency Maximum (VPM)	0 - 2,300 vpm
Max Line Pull	99 tons (881 kN)
Max Bare Hammer Weight	15,400 lbs (6,985 kg)
Throat Width	14.00 in (36 cm)
Length	69.00 in (175 cm)
Height w/o Clamp	102.00 in (259 cm)

### APE Model 700 Power Unit

SPECIFICATIONS	DATA
Engine Type	Caterpillar C18 Tier III
Horse Power	700 HP (515 kW)
Drive Pressure	0 - 4,800 psi (331 bar)
Drive Flow	220 gpm (833 lpm)
Clamp Pressure	4,800 psi (69,618 bar)
Clamp Flow	10 gpm (3 lpm)
Engine Speed	2,100 rpm
Weight	19,000 lbs (8,618 kg)
Length	152 in (385 cm)
Width	82 in (208 cm)
Height	94 in (239 cm)
Hydraulic Reservoir	<u>Consult Factory</u>
Fuel Capacity	<u>Consult Factory</u>



[WWW.APEVIBRO.COM](http://WWW.APEVIBRO.COM)

(800) 248-8498

webmaster@apevibro.com



**Specification Data**

**Sec. 45**

**PAGE 1460**  
**Apr. 20, 1992**

ACE

# Self Priming Centrifugal Pump

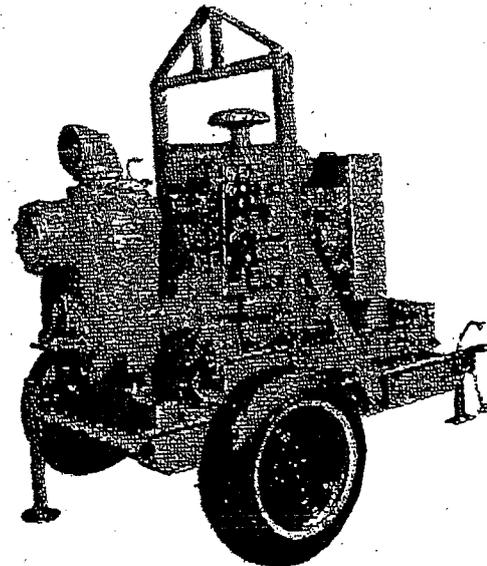
Diesel Engine Driven

Model 16C2-4039D and 16C20-4039D

Size 6" x 6"



Total Head		CAPACITY OF PUMP IN U.S. GALLONS PER MINUTE AT CONTINUOUS PERFORMANCE				
P.S.I.	Feet					
64	147	420	420	420	420	420
54	125	615	875	930	939	930
43.5	100	660	945	1170	1340	1350
33	75	685	960	1195	1425	1515
22	50	695	960	1205	1455	1565
Suction lift		25'	20'	15'	10'	5'



**PUMP SPECIFICATIONS**

Size: 6" [152,4 mm] x 6" [152,4 mm] N.P.T.-Female  
 Casing: Gray Iron No. 30  
 (Maximum Operating Pressure 130 psi. [898 kPa])  
 Impeller: Open Type, Two Vanes, Ductile Iron No. 60-40-18  
 (Handles 3" [76,2 mm] Dia. Spherical Solids)  
 Impeller Shaft: Alloy Steel No. 4140  
 Wear Plate, Replaceable: Steel No. 1018  
 Cover Plate, Removable: Gray Iron No. 30 (47 lbs. [21,3 kg.])  
 Intermediate Bracket: Gray Iron No. 30  
 Seal Plate: Gray Iron No. 30  
 Seal: (Model 16C2-4039D Only)  
 Double Grease-Lubricated with Spring Loaded Grease Cup.  
 Sintered Bronze Stationary Seal Seats. Rotating Faces Are Steel.  
 Maximum Temperature of Liquid Pumped, 110°F [43°C]  
 Maximum Suction Pressure 10 Pounds Per Square Inch [69 kPa].  
 Seal: (Model 16C20-4039D Only)  
 Mechanical Oil-Lubricated Double Floating Self-Aligning.  
 Rotating and Stationary Faces are Tungsten Titanium Carbide.  
 Stationary Seat is Stainless Steel No. 316. Elastomers are Viton.  
 Cage and Spring are Stainless Steel No. 18-8. Maximum  
 Temperature of Liquid Pumped is 160°F [71°C]\*  
 \* Consult factory for applications with liquids in excess of  
 temperature indicated.  
 Seal Liner: Bronze No. C83800 (Model 16C2-4039D Only)  
 Shaft Sleeve: Alloy Steel No. 4130 (Model 16C20-4039D Only)  
 Flap Valve: Neoprene with Steel Reinforcing  
 Radial Bearing: Open Ball  
 Thrust Bearing: Open Double Ball  
 Bearing Lubrication: Oil  
 Flanges: Gray Iron No. 30  
 Gaskets: Resistant Synthetic Rubber & Cork; Vegetable Fiber;  
 Compressed Synthetic Fibers; Teflon  
 Hardware: Standard Plated Steel  
**Standard Equipment:**  
 Hoisting Bail  
 Skid Base  
 90° Discharge Elbow  
 Strainer  
 Oil Level Sight Gauge  
**Optional Equipment:**  
 2 Wheel Truck Assy with Pneumatic Tires, P235/75R15  
 Battery  
 Over the Road Trailer (Meets D.O.T. Requirements)

**ENGINE SPECIFICATIONS**

Model: John Deere 4039D  
 Type: Four Cylinder, Four Cycle,  
 Liquid Cooled Diesel Engine  
 Displacement: 239 Cu. In. [3.9 L]  
 Governor: Mechanical  
 Lubrication: Forced Circulation  
 Air Cleaner: Dry Type  
 Oil Reservoir: 9 U.S. Quarts [8.5 L]  
 Fuel Tank: 38.9 U.S. Gallons [147.2 L]  
 Operating Time; Full Load: 12.5 Hours  
 Starter: 12 Volt Electric

**Standard Features:**

Safety Shut Down Switches for Low Oil Pressure  
 and High Coolant Temperature,  
 Instrument Panel with Temp. Gauge, Oil pressure  
 Gauge, Ammeter, Hourmeter & Tachometer.  
 Muffler with Guard and Weather Cap.

**JOHN DEERE PUBLISHED PERFORMANCE:**

Max. Cont. B.H.P. 71 @ 2200 RPM  
 Max. Dyn. B.H.P. 80 @ 2500 RPM

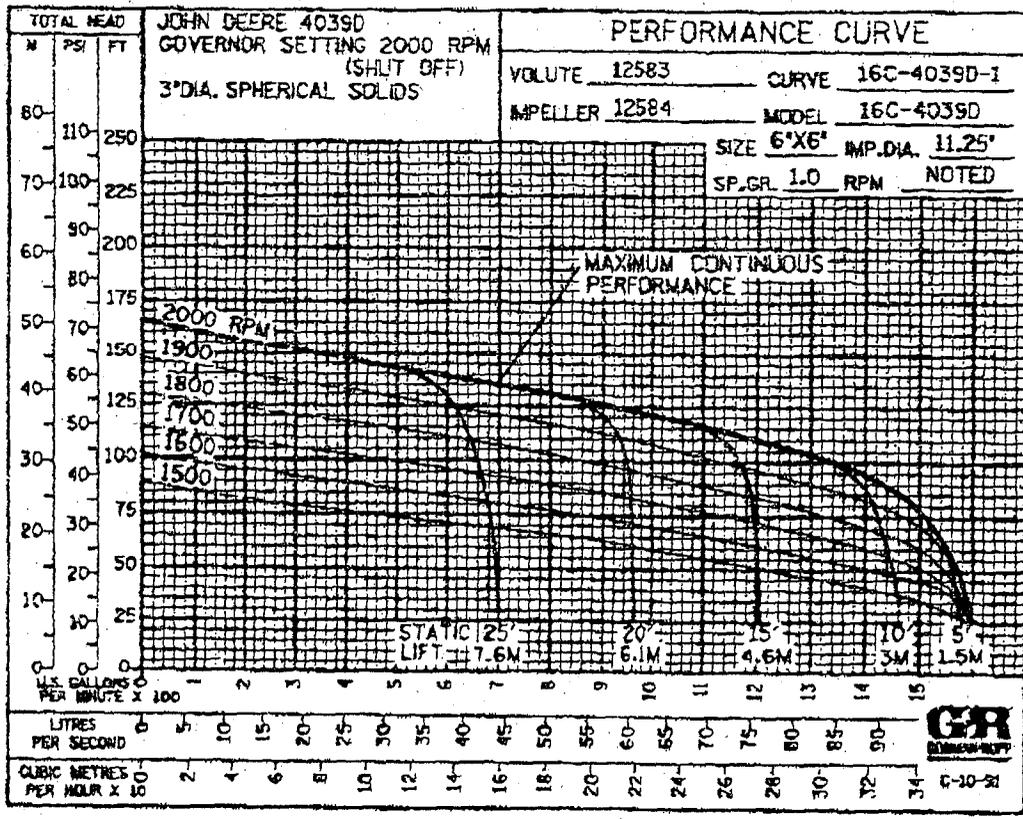
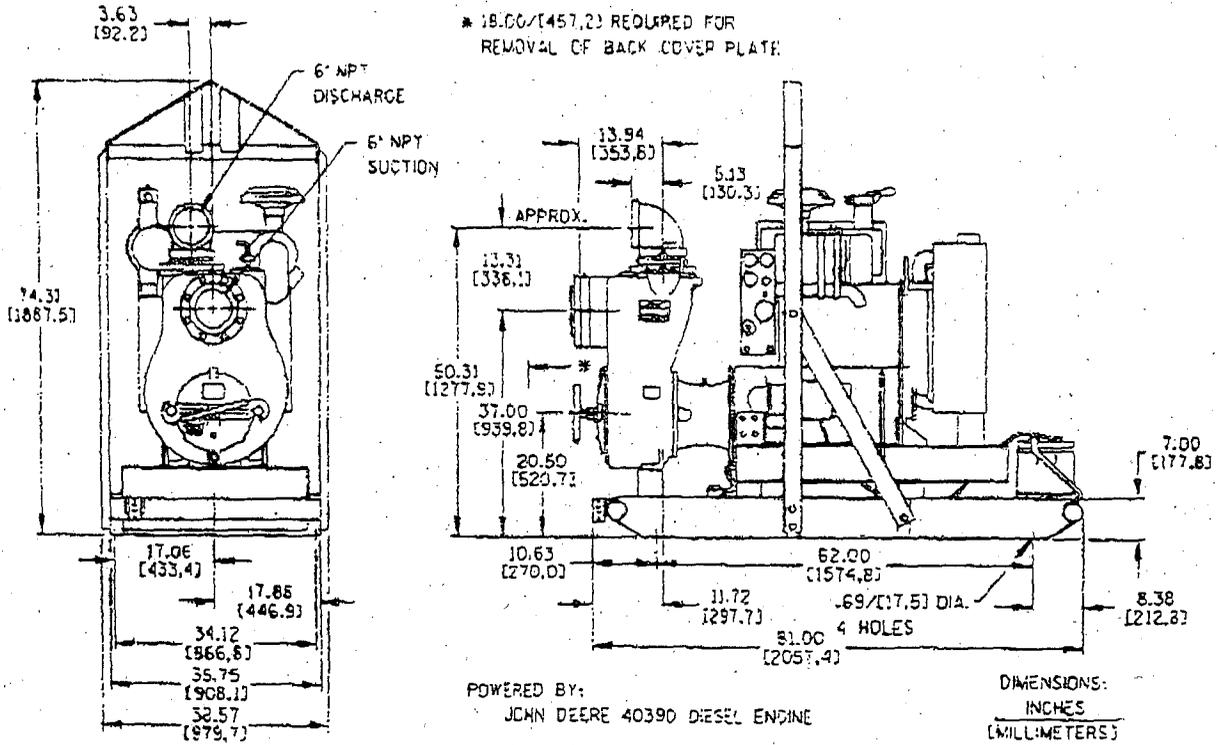


THE GORMAN-RUPP COMPANY • MANSFIELD, OHIO

GORMAN-RUPP OF CANADA LIMITED • ST. THOMAS, ONTARIO, CANADA

Printed in U.S.A.

<b>Specification Data</b>	<b>OVERALL DIMENSIONS and WEIGHTS APPROXIMATE</b>	<b>SKID BASE</b>	<b>2-WHEEL</b>
		<b>NET WEIGHT:</b> 2482 LBS. [1126 KG.]	2756 LBS. [1250 KG.]
<b>SECTION 45, PAGE 1460</b>		<b>SHIPPING WEIGHT:</b> 2582 LBS. [1171 KG.]	2756 LBS. [1250 KG.]
		<b>EXPORT CRATE:</b> 158 CU. FT. [4.4 CU. M.]	174 CU. FT. [4.9 CU. M.]

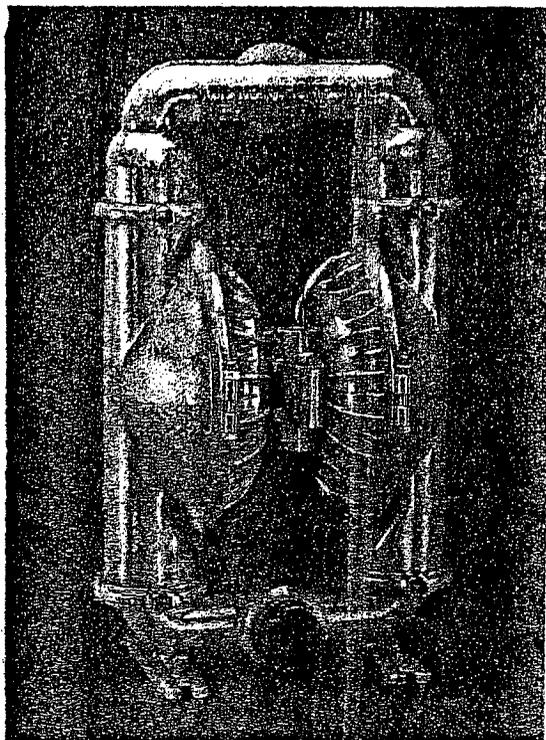


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Printed in U.S.A.

# M15 METAL PUMP



## SPECIFICATIONS

### Materials of Construction, Wetted Housings

(Water Chambers, Inlet/Discharge Manifolds)

MATERIAL	SHP. WT.	MATERIAL	SHP. WT.
Aluminum	110 lbs.	316 Stainless Steel	165 lbs.
Hastelloy C	218 lbs.	Cast Iron	181 lbs.

### Materials of Construction, Non-Wetted Housings

DESCRIPTION	MATERIAL
Center Block	Aluminum or Aluminum, Nickel-Plated or Stainless Steel or Polypropylene
Air Chambers	Aluminum or Aluminum, Nickel-Plated or Stainless Steel or Cast Iron
Air Valve	Brass or Brass, Nickel-Plated or Stainless Steel

### Suction Lift Capability

DRY LIFT	PRIMED LIFT
17' (5.18m)	25' (7.62m)

The above figures represent rubber-fitted pump capabilities. Consult your distributor for TPE and/or Teflon®-fitted pump data.

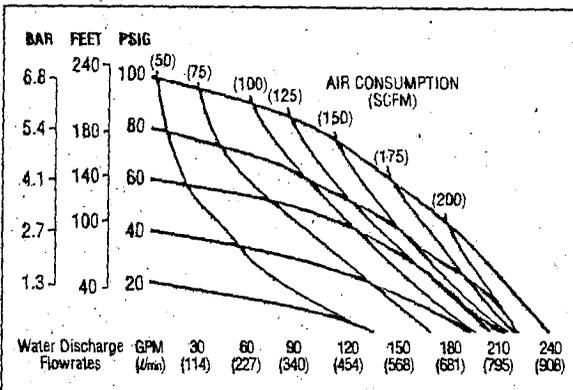
### Maximum Diameter Solids

¾" (9.52mm) Diameter

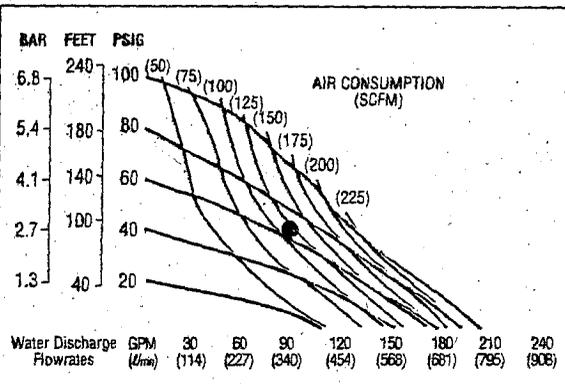
### Elastomer Options

MATERIAL	TEMPERATURE LIMITS
Polyurethane	+10 (-12.2) to +150 (65.6) F° (C°)
Neoprene	0 (-17.8) to +200 (93.3) F° (C°)
Buna-N	+10 (-12.2) to +180 (82.2) F° (C°)
Nordel	-60 (-51.1) to +280 (137.8) F° (C°)
Viton	-40 (-40.0) to +350 (176.7) F° (C°)
Saniflex™	-20 (-28.9) to +220 (104.4) F° (C°)
Teflon®	+40 (4.4) to +220 (104.4) F° (C°)
Wil-Flex™	-40 (-40.0) to +225 (107.2) F° (C°)

## RUBBER/TPE-FITTED M15 PUMP



## TEFLON-FITTED M15 PUMP



## M15 Metal Pump Flows up to 240 G.P.M.

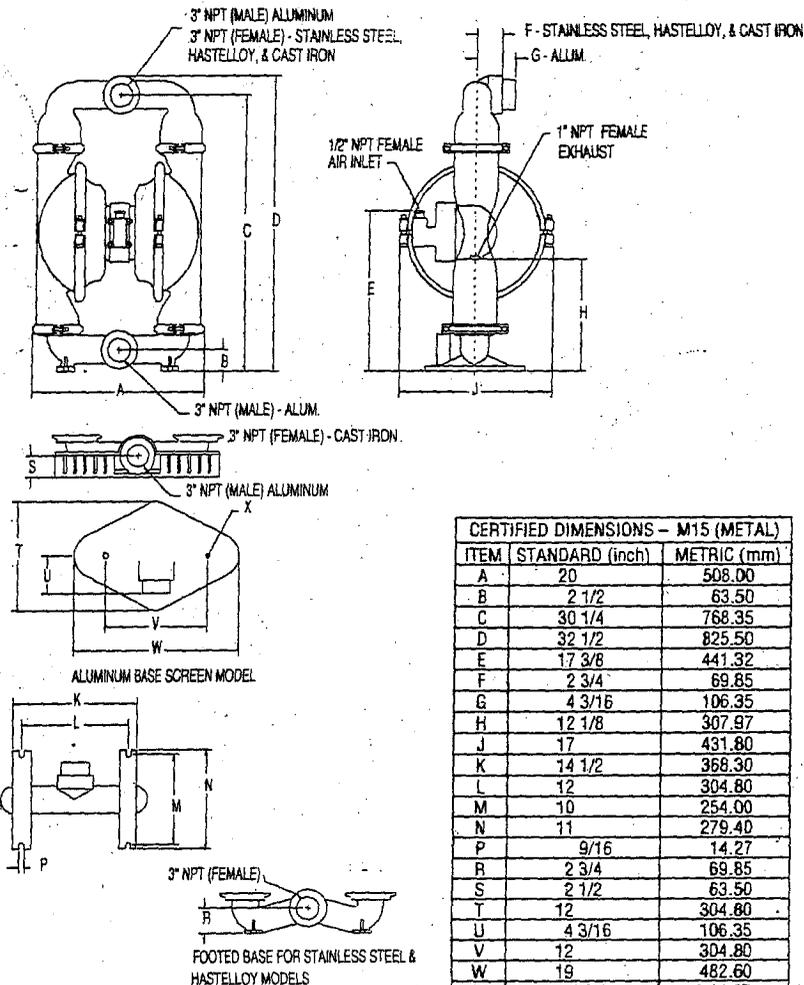
Maximum pump operating pressures should not exceed 125 psig (8.62 Bar).

Volumes indicated on charts were determined by actually pumping water into calibrated tanks.

### Example:

To pump 90 gpm against a discharge head of 40 psig requires 65 psig and 125 scfm air consumption. (See dot on Teflon-fitted chart.)

## DIMENSIONAL DRAWING



CERTIFIED DIMENSIONS - M15 (METAL)		
ITEM	STANDARD (inch)	METRIC (mm)
A	20	508.00
B	2 1/2	63.50
C	30 1/4	768.35
D	32 1/2	825.50
E	17 3/8	441.32
F	2 3/4	69.85
G	4 3/16	106.35
H	12 1/8	307.97
J	17	431.80
K	14 1/2	368.30
L	12	304.80
M	10	254.00
N	11	279.40
P	9/16	14.27
R	2 3/4	69.85
S	2 1/2	63.50
T	12	304.80
U	4 3/16	106.35
V	12	304.80
W	19	482.60
X	Ø9/16	Ø14.27

BSP threads available.

# PUMP DYNAMICS

The Wilden diaphragm pump is an air-operated, positive displacement, self-priming pump. These drawings show the flow pattern through the pump upon its initial stroke. It is assumed the pump has not been primed prior to its initial stroke.

**FIGURE 1** The air valve directs pressurized air to the back side of diaphragm A. The compressed air is applied directly to the liquid column separated by elastomeric diaphragms. The diaphragm acts as a separation membrane between the compressed air and the liquid. Driving the diaphragm with air instead of the shaft balances the load and removes mechanical stress from the diaphragm, dramatically extending diaphragm life. The compressed air moves the diaphragm away from the center block of the pump. The opposite diaphragm is pulled in by the shaft connected to the pressurized diaphragm. Diaphragm B is now on its air exhaust stroke; air behind the diaphragm has been forced out to atmosphere through the exhaust port of the pump. The movement of diaphragm B toward the center block of the pump creates a vacuum within chamber B. Atmospheric pressure forces fluid into the inlet manifold forcing the inlet valve ball off its seat. Liquid is free to move past the inlet valve ball and fill the liquid chamber.

**FIGURE 2** When the pressurized diaphragm, diaphragm A, reaches the limit of its discharge stroke, the air valve redirects pressurized air to the back side of diaphragm B. The pressurized air forces diaphragm B away from the center block while pulling diaphragm A to the center block. Diaphragm B is now on its liquid discharge stroke. Diaphragm B forces the inlet valve ball onto its seat due to the hydraulic forces developed. These same hydraulic forces lift the discharge valve ball off its seat, while the opposite discharge valve ball is forced onto its seat, forcing fluid to flow through the pump discharge. The movement of diaphragm A to the center block of the pump creates a vacuum within liquid chamber A. Atmospheric pressure forces fluid into the inlet manifold of the pump. The inlet valve ball is forced off its seat allowing the fluid being transferred to fill the liquid chamber.

**FIGURE 3** Upon completion of the stroke, the air valve again redirects air to the back side of diaphragm A, and starts diaphragm B on its air exhaust stroke. As the pump reaches its original starting point, each diaphragm has gone through one air exhaust or one fluid discharge stroke. This constitutes one complete pumping cycle. The pump may take several cycles to become completely primed depending on the conditions of the application.

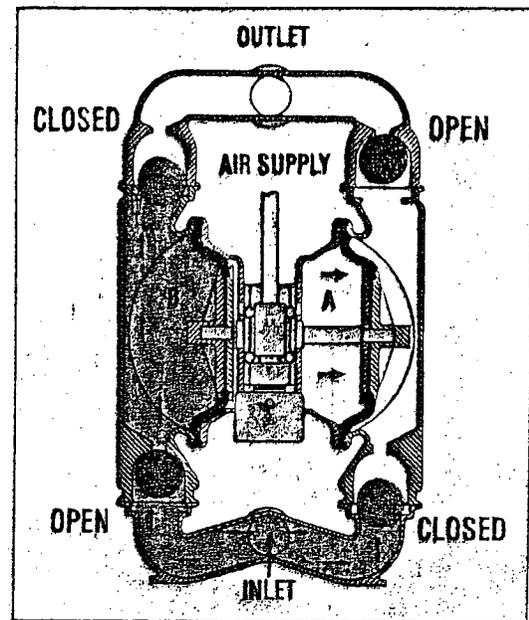


FIGURE 1

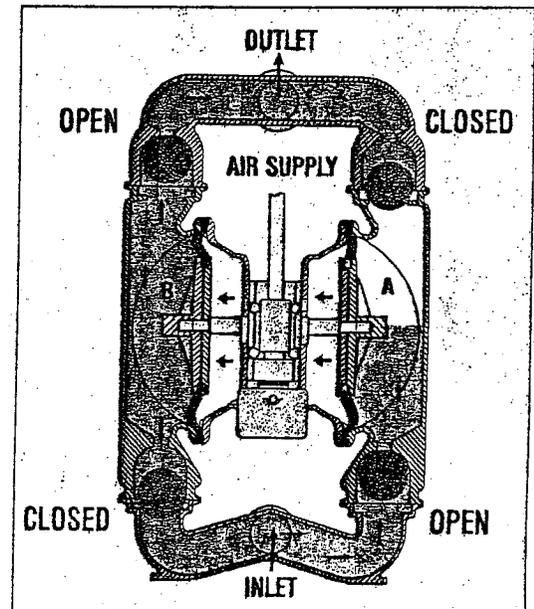


FIGURE 2

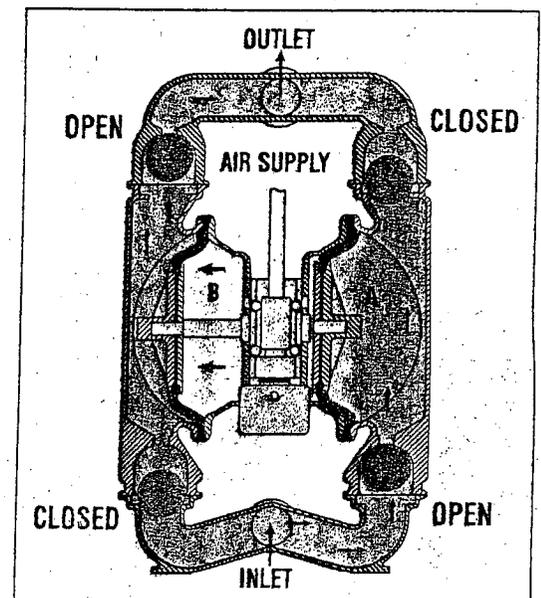
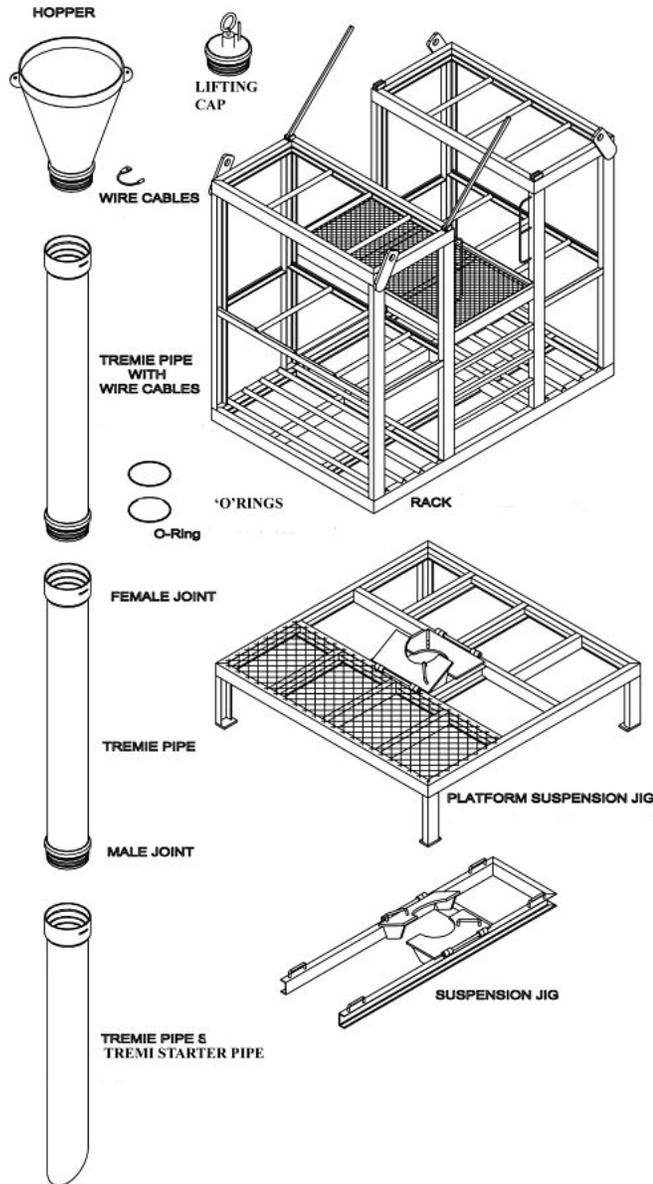


FIGURE 3



## Tremie Pipes

In the Tremie Concrete pouring method, Concrete is placed below water / ground level through a pipe, the lower end of which is kept immersed in fresh concrete so that the rising concrete from the bottom displaces the water / Bentonite without washing out the cement content. Tremie can also be used as a noun to refer to the hopper and drop pipe used to place the concrete underwater / below ground level.



### Concrete Placement

Three issues are critical to the placement of concrete under water or slurry:

- A delivery method must be used that keeps the concrete separated from the water or slurry and prevents intermixing.
- The concrete must maintain a high slump to completely fill the shaft and flow easily around the reinforcing steel.
- The top of the shaft must be thoroughly flushed at completion of the pour.

## TECHNICAL DATA

# SAMPLE BAILER

## DOUBLE BALL DISCRETE DEPTH COLLECTION

### DESCRIPTION

SAMPLE BAILER has a second ball check located at the top that permits the bailer to secure a sample from a specific depth without influence from the slurry above. Meets contract specifications for collecting slurry samples for testing physical drilling slurry properties.

### RECOMMENDED USE

Tie the suspension cord to the bailer hook. Lower the bailer slowly down the borehole to the desired depth. Yank up on the SAMPLE BAILER allowing the SAMPLE BAILER to collect a sample, and then raise the bailer gently to the surface to maintain sample integrity. Empty the SAMPLE BAILER contents into a sample bottle.

### ADVANTAGES

- ▶ Collects slurry samples accurately
- ▶ Meets specification to collect slurry samples from different depths
- ▶ Large enough to collect slurry for all the required tests
- ▶ Used to collect samples for specified physical properties of drilling slurry density, sand content, pH, and viscosity

### CHARACTERISTICS

The white PVC re-usable sample bailers are designed to retrieve a sample from specific depths. The threaded all PVC construction and the removable top and bottom valves make cleaning quick and easy.

### PACKAGING

3" white PVC threaded SAMPLE BAILER 3.500 O.D. x 24" long.



**Appendix B**  
**Drilling Tools**

Vermont Agency of Transportation

**RECEIVED**

ON: **January 14, 2016**

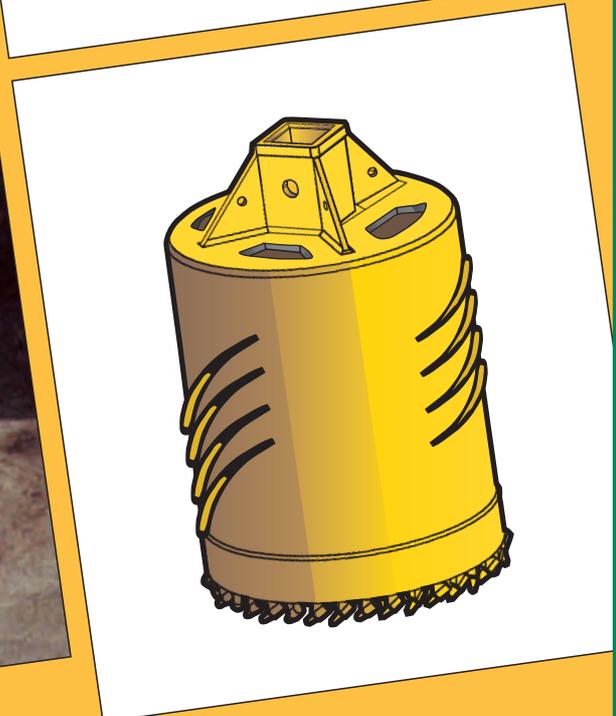
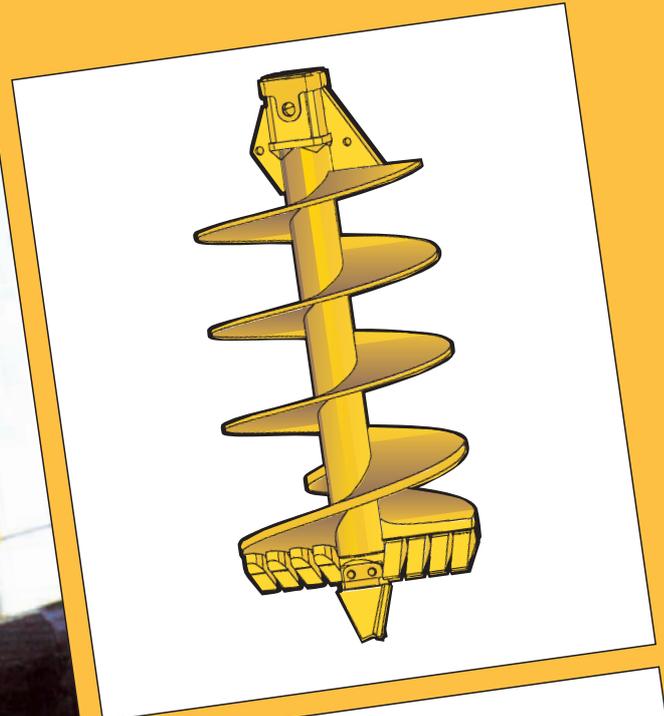
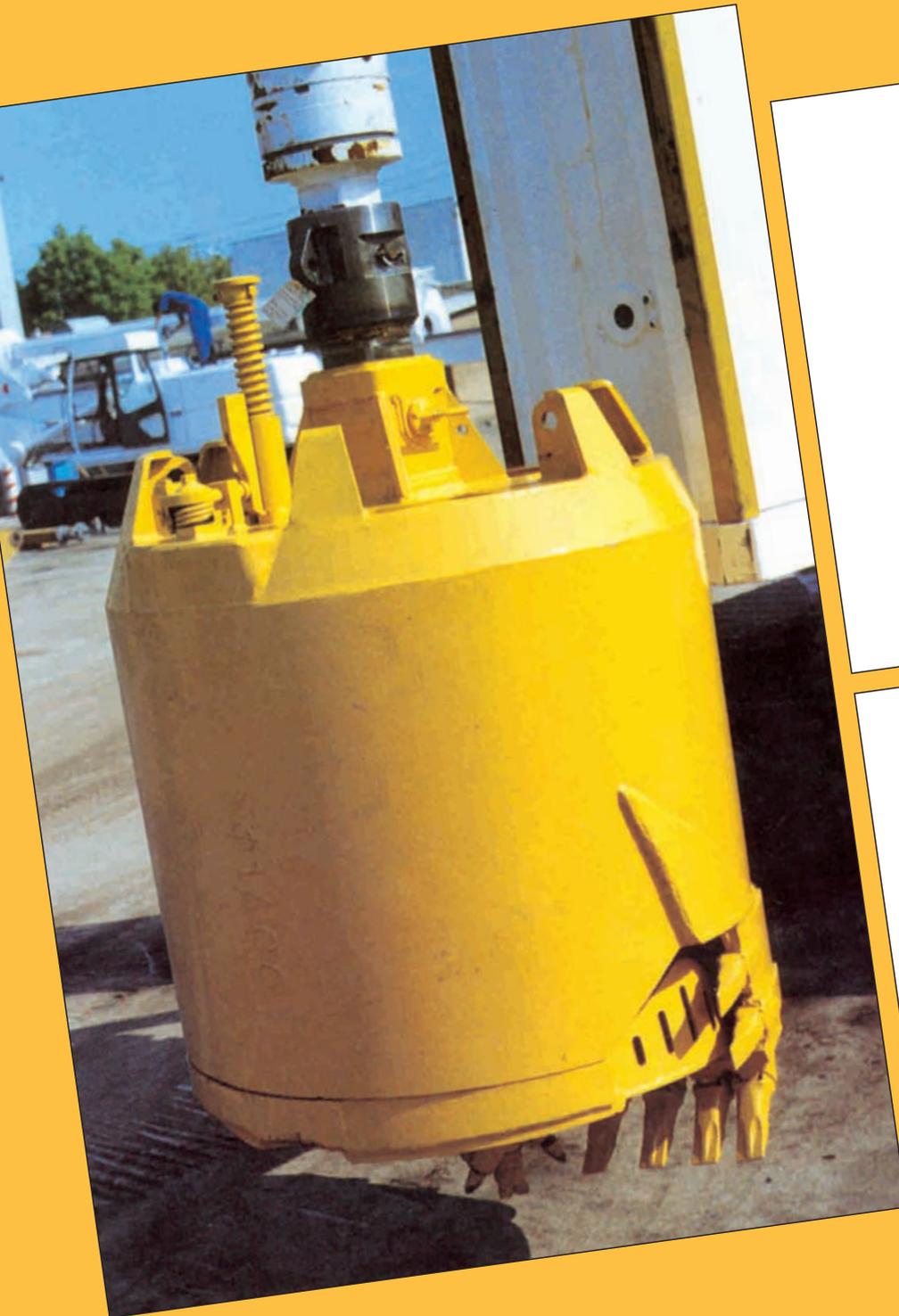
and Checked for

**CONFORMANCE**

BY: **Todd A. Sumner** DATE: **01/29/16**

Rotary Drilling Rig

# Utensili Drilling Tools



**SOILMEC** 

<<

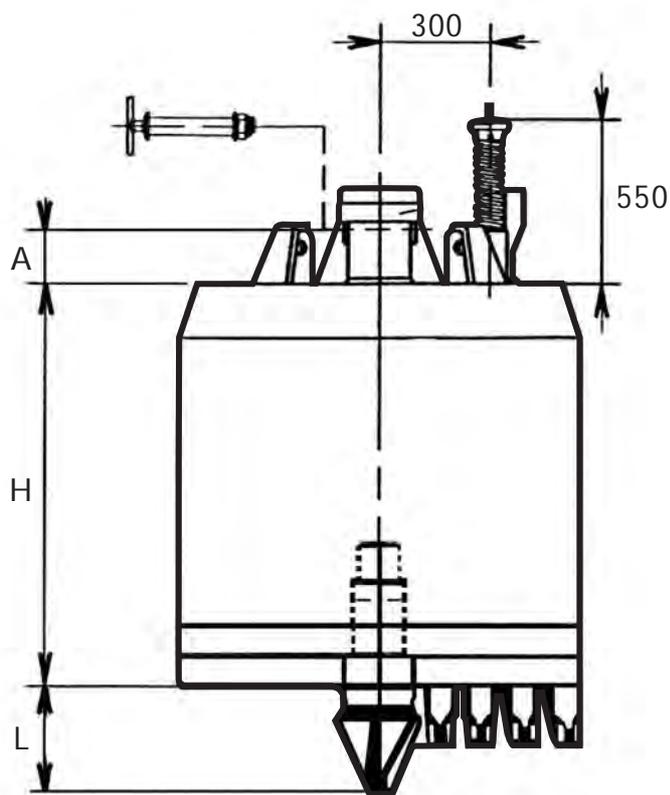
exit

print

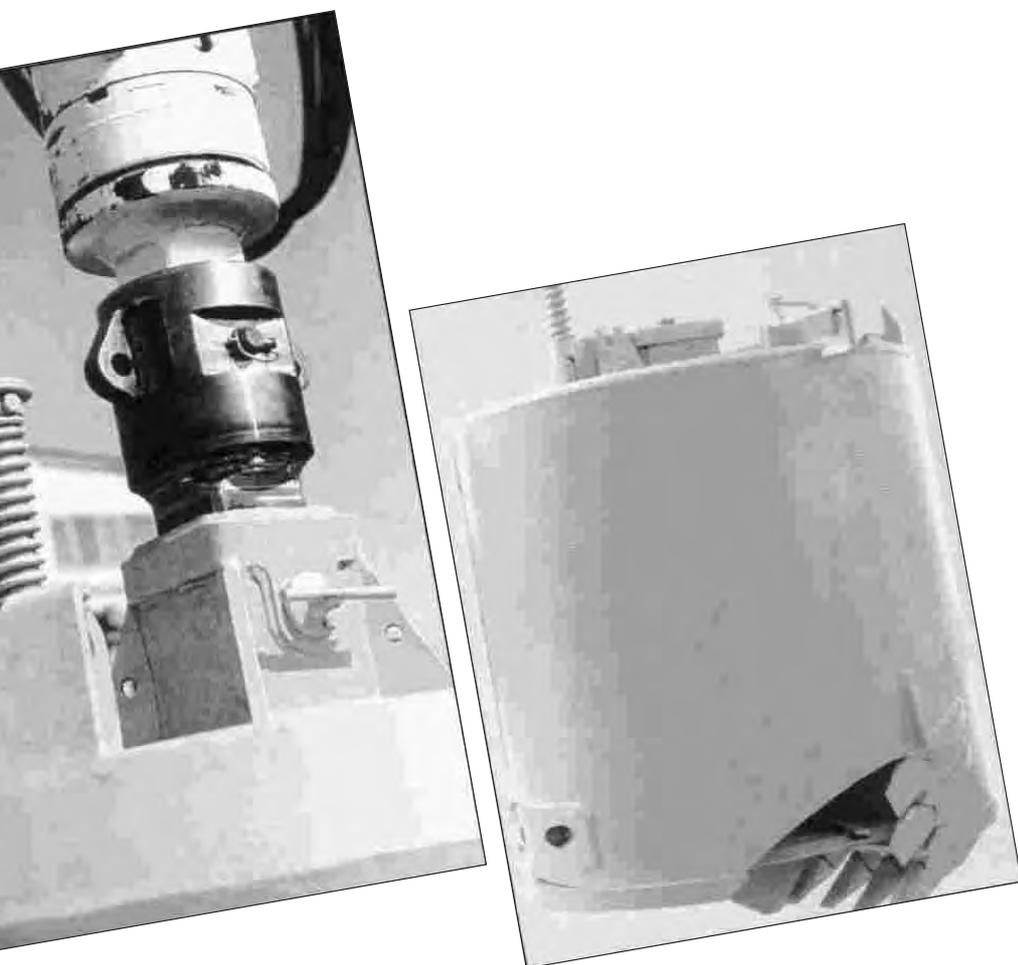
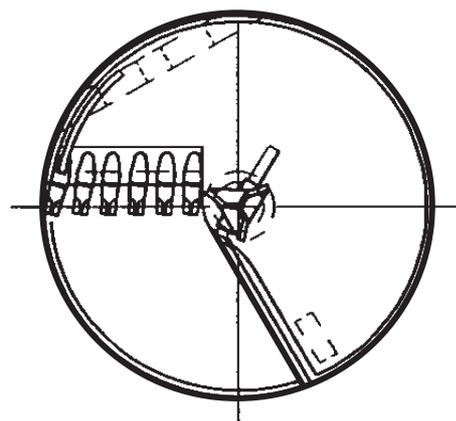
zoom

>>

# Bucket / Buckets



a fondo rotante  
with guillotine type closing bottom



HD/R serie  
series

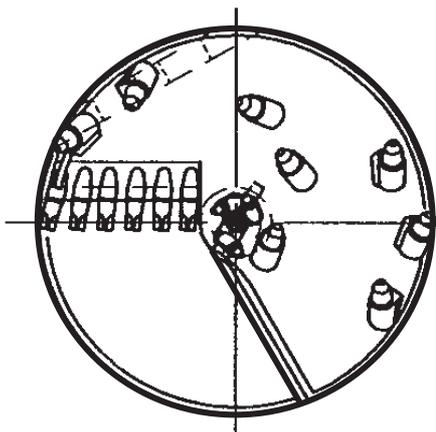
①

Ø scavo excavation	Peso indicativo approx. weight	Lungh. (H) length
mm	kg	mm
800	1020	1250
900	1150	1250
1000	1300	1250
1100	1420	1250
1200	1580	1250
1300	1700	1250
1400	1810	1250
1500	1900	1350
1600	2000	1350
1700	2180	1350
1800	2480	1350
1900	2600	1350
2000	2720	1350
2100	-	1350
2200	-	1350

N.B. Altri diametri a richiesta  
Other dimensions upon request

a fondo rotante per roccia,  
variante a denti misti

*with guillotine type closing bottom for  
rock, mixed teeth type*



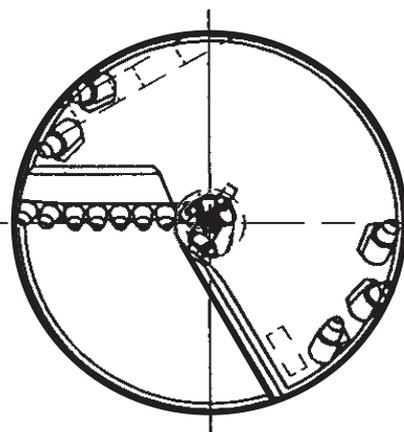
**HK/R** serie series ②

Ø scavo excavation	Peso indicativo approx. weight	Lungh. (H) length
mm	kg	mm
800	1000	1200
900	1030	1200
1000	1280	1200
1100	1390	1200
1200	1550	1200
1300	1670	1200
1400	1780	1200
1500	1860	1300
1600	1960	1300
1700	2140	1300
1800	2430	1300
1900	2550	1300
2000	2670	1300
2100	-	1300
2200	-	1300

N.B. Altri diametri a richiesta  
Other dimensions upon request

a fondo rotante per roccia,  
variante a picchi

*with guillotine type closing bottom  
for rock, bit type*



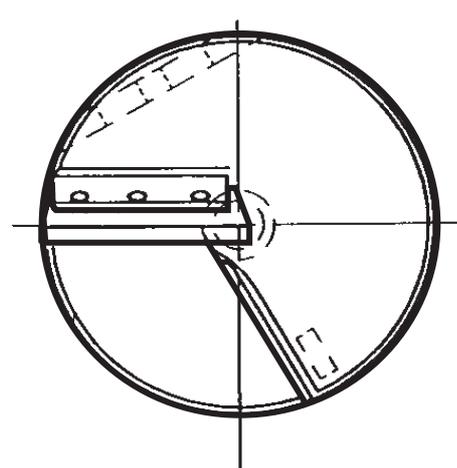
**RK/R** serie series ③

Ø scavo excavation	Peso indicativo approx. weight	Lungh. (H) length
mm	kg	mm
800	960	1250
900	990	1250
1000	1260	1250
1100	1370	1250
1200	1520	1250
1300	1630	1250
1400	1750	1250
1500	1850	1350
1600	1950	1350
1700	2130	1350
1800	2400	1350
1900	2500	1350
2000	2640	1350
2100	-	1350
2200	-	1350

N.B. Altri diametri a richiesta  
Other dimensions upon request

a fondo rotante,  
pulitore di fondo

*with guillotine type closing bottom  
and bottom cleaner*



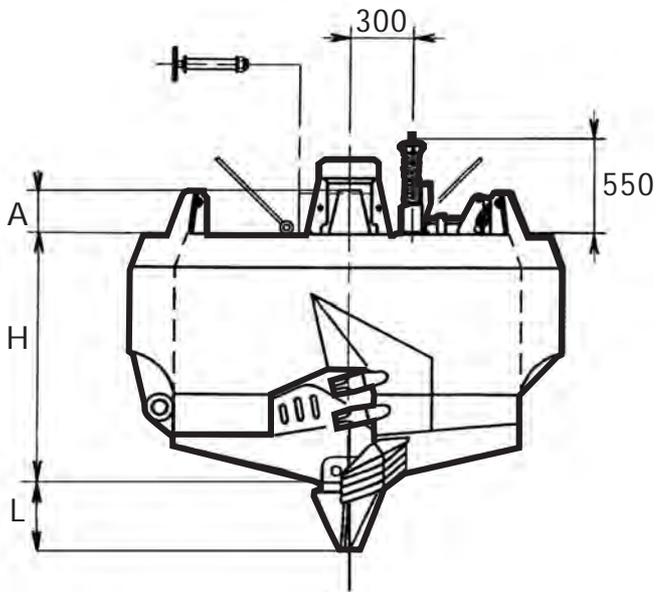
**CL/R** serie series ④

Ø scavo excavation	Peso indicativo approx. weight	Lungh. (H) length
mm	kg	mm
800	950	1250
900	980	1250
1000	1250	1250
1100	1350	1250
1200	1500	1250
1300	1610	1250
1400	1720	1250
1500	1800	1350
1600	1900	1350
1700	2080	1350
1800	2360	1350
1900	2460	1350
2000	2580	1350
2100	-	1350
2200	-	1350

N.B. Altri diametri a richiesta  
Other dimensions upon request

# Bucket / Buckets

alta capacità di carico,  
terreni compatti  
*high load capacity, hard soil*

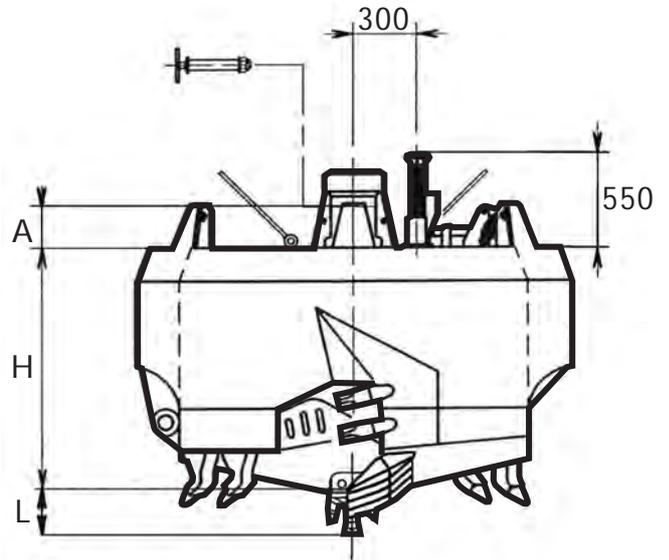


## HD serie series

Ø scavo excavation	Peso indicativo approx. weight	Lungh. (H) length
mm	kg	mm
800	870	1400
900	960	1400
1000	1100	1400
1100	1200	1400
1200	1340	1400
1300	1440	1400
1400	1540	1400
1500	1610	1500
1600	1700	1500
1700	1850	1500
1800	2100	1500
1900	2200	1500
2000	2300	1500
2100	-	1500
2200	-	1500

N.B. Altri diametri a richiesta  
Other dimensions upon request

alta capacità di carico, da roccia,  
singolo principio  
*high load capacity, for rock, single start*



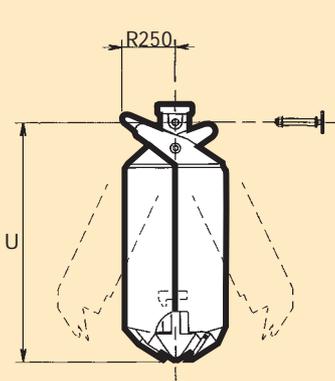
## RK serie series

Ø scavo excavation	Peso indicativo approx. weight	Lungh. (H) length
mm	kg	mm
800	900	1400
900	1000	1400
1000	1150	1400
1100	1250	1400
1200	1400	1400
1300	1500	1400
1400	1600	1400
1500	1700	1500
1600	1800	1500
1700	1950	1500
1800	2200	1500
1900	2350	1500
2000	2450	1500
2100	-	1500
2200	-	1500

N.B. Altri diametri a richiesta  
Other dimensions upon request

# Bucket speciali / Special Buckets

# Carotieri / Core barrels

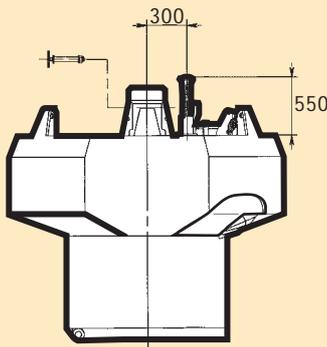


a corpo apribile,  
per piccoli diametri  
**butterfly bucket for small diameter**

**SB** serie series (7/8)

Ø scavo excavation	Peso indicativo approx. weight	Lungh. (U) length
mm	kg	mm
500	315	1450
600	365	1450
700	450	1450

N.B. Altri diametri a richiesta  
Other dimensions upon request

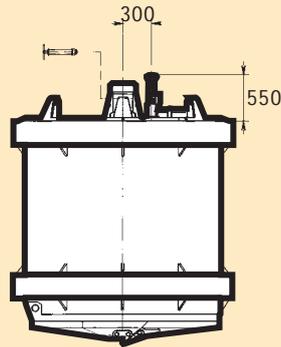


allargatori  
a due diametri  
**two dimension reamers**

**DD** serie series (9)

Ø scavo preforo pre-hole excavation	Ø scavo excavation
mm	mm
1200	1500
1200	1600
1200	1700
1200	1800
1200	1900
1200	2000
1200	2100
1200	2200
1800	2300
1800	2400
1800	2500
1800	2600
1800	2700
1800	2800
1800	2900
1800	3000

N.B. Altri diametri a richiesta  
Other dimensions upon request

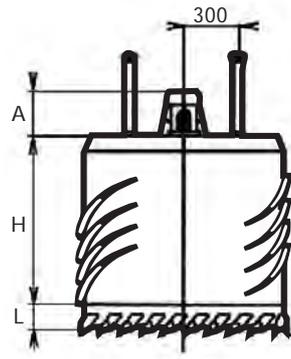


a fondo rotante, fasce di  
centraggio per diam. medio grandi  
**with guillotine type closing bottom,  
centering device for medium large diameters**

**OF** serie series (10)

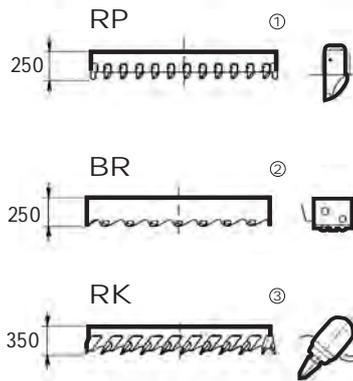
Tipo Bucket Bucket Type	Ø scavo excavation
	mm
1500	1500
1600	1600
1700	1700
1800	1800
1900	1900
2000	2000
2100	2100
2200	2200
2300	2300
2400	2400
2500	2500

N.B. Altri diametri a richiesta  
Other dimensions upon request



con denti tipo RIPPER  
with teeth ripper type  
**RP a corona  
RP cutting ring type**

Ø scavo excavation	Peso indicativo approx. weight	Lungh. (H) length
mm	kg	mm
800	490	1150
900	570	1150
1000	660	1150
1100	760	1150
1200	900	1150
1300	950	1150
1400	1050	1200
1500	1260	1200
1600	1500	1200
1700	1730	1200
1800	1950	1200



con denti a placchette abrasive  
with teeth with abrasive plates

**BR a corona  
BR cutting ring type**

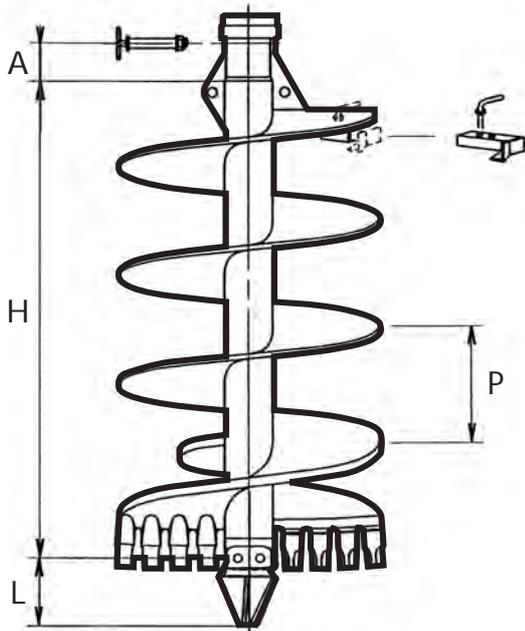
Ø scavo excavation	Peso indicativo approx. weight	Lungh. (H) length
mm	kg	mm
600	350	1150
700	430	1150
800	480	1150
900	560	1150
1000	650	1150
1100	750	1150
1200	890	1150
1300	940	1150
1400	1050	1200
1500	1250	1200
1600	1490	1200
1700	1730	1200
1800	1850	1200
1900	-	1200
2000	-	1200

con picchi  
with bits

**RK a corona  
BR cutting ring type**

Ø scavo excavation	Peso indicativo approx. weight	Lungh. (H) length
mm	kg	mm
600	380	1150
700	460	1150
800	520	1150
900	600	1150
1000	700	1150
1100	810	1150
1200	950	1150
1300	1000	1150
1400	1100	1200
1500	1320	1200
1600	1560	1200
1700	1800	1200
1800	2050	1200
1900	-	1200
2000	-	1200

# Trivelle / Augers



alta capacità di carico per terreni compatti

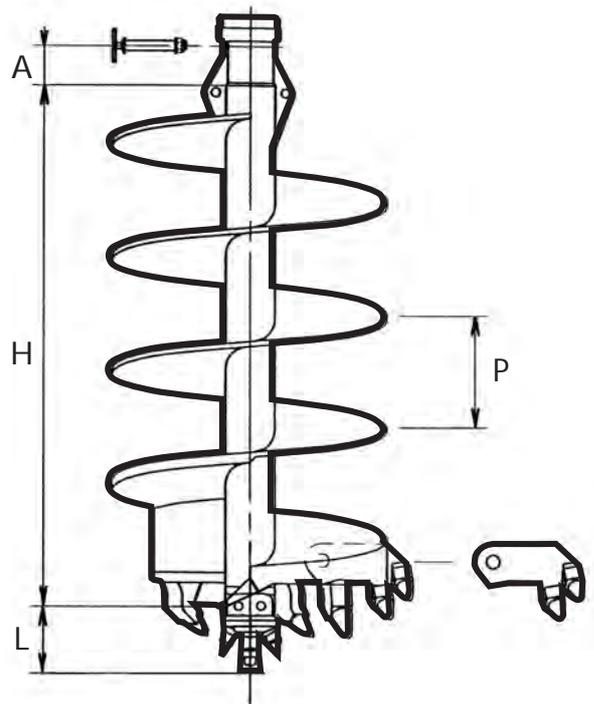
high load capacity for hard soil

**HD/H** serie <sup>①</sup>

Ø scavo excavation	Passo Elica (P) Pitch	Peso indicativo approx. weight	Lungh. (H) length
mm (*)	mm	kg	mm
400 (600)	300	200	1800
500 (700)	300	290	1800
600 (800)	350	350	1700
700 (900)	350	500	1700
800 (1000)	400	600	1900
900 (1100)	400	700	1900
1000 (1200)	400	740	1900
1100 (1300)	450	800	2100
1200 (1400)	450	930	2100
1300 (1500)	500	1100	1900
1400 (1600)	500	1250	1900
1500 (1700)	500	-	1900
1600 (1800)	550	-	2000
1700 (1900)	550	-	2000
1800 (2000)	550	-	2000

(\*)con allargatore superiore  
with upper reamer

N.B. Altri diametri a richiesta  
Other dimensions upon request



alta capacità di carico da roccia, singolo principio

high load capacity for rock, single start

**HK/H** serie <sup>②</sup>

Ø scavo excavation	Passo Elica (P) Pitch	Peso indicativo approx. weight	Lungh. (H) length
mm (*)	mm	kg	mm
400	300	230	1800
500	300	320	1800
600 (700)	350	520	1700
700 (800)	350	650	1700
800 (900)	400	750	1900
900 (1000)	400	850	1900
1000 (1100)	400	980	1900
1100 (1200)	450	1130	2100
1200 (1300)	450	1130	2100
1300 (1400)	500	1510	2050
1400 (1500)	500	1740	1850
1500 (1600)	500	2000	1850
1600 (1700)	550	-	2000
1700 (1800)	550	-	2000

(\*)con allargatore inferiore  
with lower reamer

N.B. Altri diametri a richiesta  
Other dimensions upon request

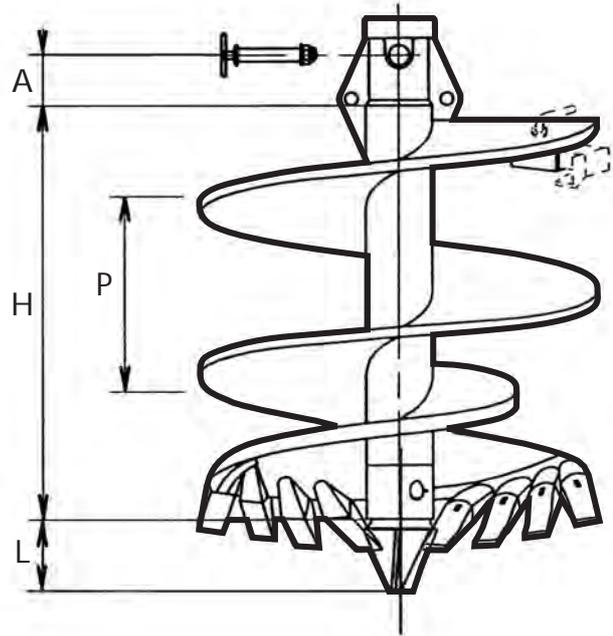
tradizionale per terreni compatti  
*traditional type for hard soils*

**HD** serie  
*series*

Ø scavo excavation	Passo Elica (P) Pitch	Peso indicativo approx. weight	Lungh. (H) length
mm (*)	mm	kg	mm
800 (1000)	400	450	1050
900 (1100)	400	480	1050
1000 (1200)	400	520	1050
1100 (1300)	500	610	1050
1200 (1400)	500	750	1050
1300 (1500)	500	840	1050
1400 (1600)	500	880	1050
1500 (1700)	500	940	1050
1600 (1800)	600	1050	1200
1700 (1900)	600	1100	1200
1800 (2000)	600	1230	1200

(\*)con allargatore superiore  
*with upper reamer*

N.B. Altri diametri a richiesta  
*Other dimensions upon request*

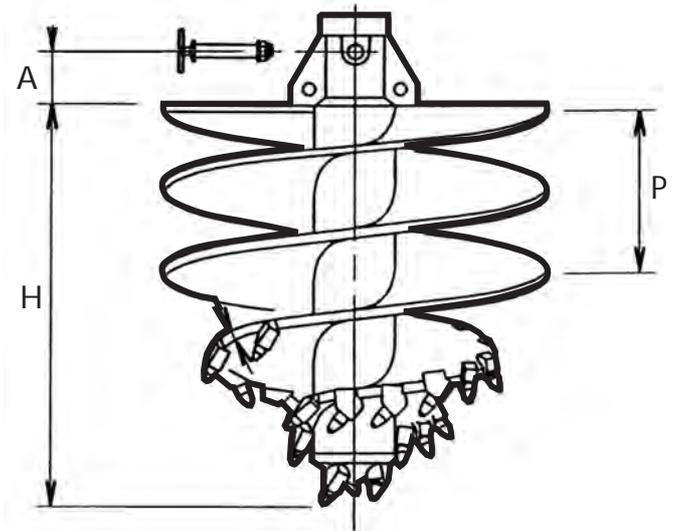


tradizionale da roccia  
*traditional type for rock*

**RK** serie  
*series*

Ø scavo excavation	Passo Elica (P) Pitch	Peso indicativo approx. weight	Lungh. (H) length
mm	mm	kg	mm
<b>400</b>	300	225	850
<b>500</b>	300	240	850
<b>600</b>	400	250	1050
<b>700</b>	400	300	1050
<b>800</b>	400	360	1050
<b>900</b>	400	450	1050
<b>1000</b>	500	560	1250
<b>1100</b>	550	640	1250
<b>1200</b>	550	750	1250
<b>1300</b>	500	860	1250
<b>1400</b>	500	970	1250
<b>1500</b>	500	1090	1250
<b>1600</b>	500	1240	1250
<b>1700</b>	500	1400	1250
<b>1800</b>	500	1580	1250

N.B. Altri diametri a richiesta  
*Other dimensions upon request*

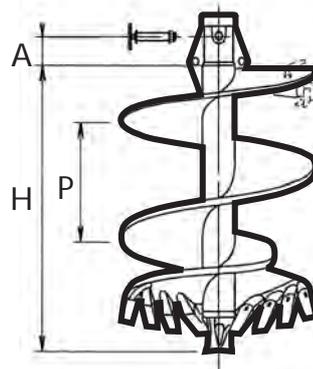


tradizionale economica  
 per terreni facili, piccoli diametri  
*cheap traditional type for loose soils, small diameters*

**LD** serie  
*series*

Ø scavo excavation	Passo Elica (P) Pitch	Peso indicativo approx. weight	Lungh. (H) length
mm (*)	mm	kg	mm
400 (600)	300	200	1250
500 (700)	300	280	1350
600 (800)	300	305	1350
700 (900)	400	360	1450

(\*)con allargatore superiore  
*with upper reamer*

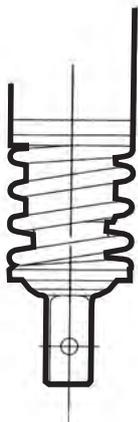


# Adattatori Asta-Utensili / Adaptors

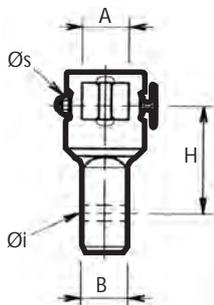
Tipo AXB AXB Type	H (mm)	Øs (mm)	Øi (mm)	Peso/Weight (kg)
175 x 130	335	54	41	150
175 x 150	365	54	52	165
175 x 200	400	54	62	175
150 x 130	320	52	41	125
150 x 175	231	52	54	140
150 x 200	250	52	62	155
130 x 150	350	41	52	110
130 x 175	400	41	54	145
130 x 200	435	41	62	125
200 x 150	400	70	52	220
200 x 175	-	-	-	-
200 x 130	-	-	-	-

## Aste telescopiche Telescopic Kelly

Ø 406  
Ø 355  
Ø 324  
Ø 298

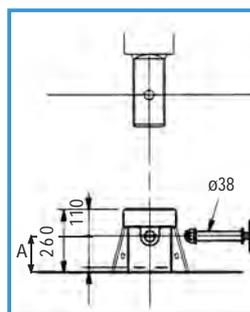
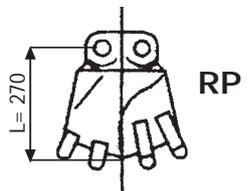
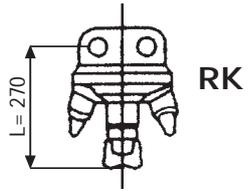
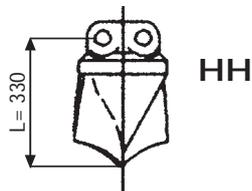
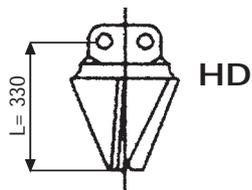
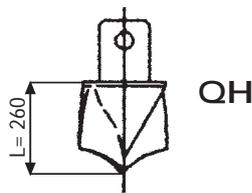
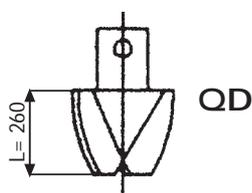


## ADATTATORE Adaptor



Attacco asta su utensile  
Kelly box on tool

## Punte pilota Leading elements



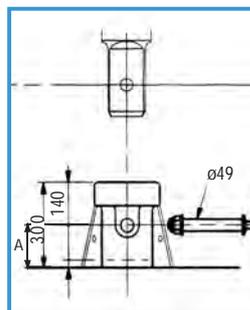
Attacco asta tipo  
Kelly box type W (130x130)

Coppia  
Torque 150 kNm

Peso Totale  
Total weight 40 kg

A = 150 mm

Ø Scavo Max  
Max excavation diam. 1800 mm

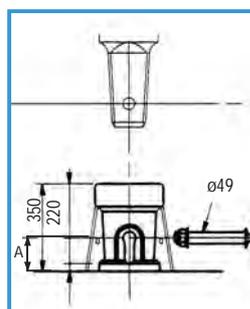


Attacco asta tipo  
Kelly box type X (150x150)

Coppia  
Torque 220 kNm

Peso Totale  
Total weight 65 kg

A = 160 mm

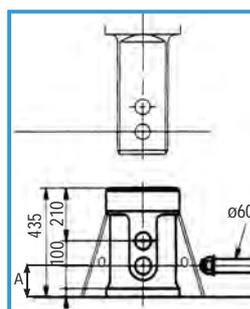


Attacco asta tipo  
Kelly box type K (175x175)

Coppia  
Torque 360 kNm

Peso Totale  
Total weight 90 kg

A = 130 mm



Attacco asta tipo  
Kelly box type Z (200x200)

Coppia  
Torque 540 kNm

Peso Totale  
Total weight 140 kg

A = 125 mm

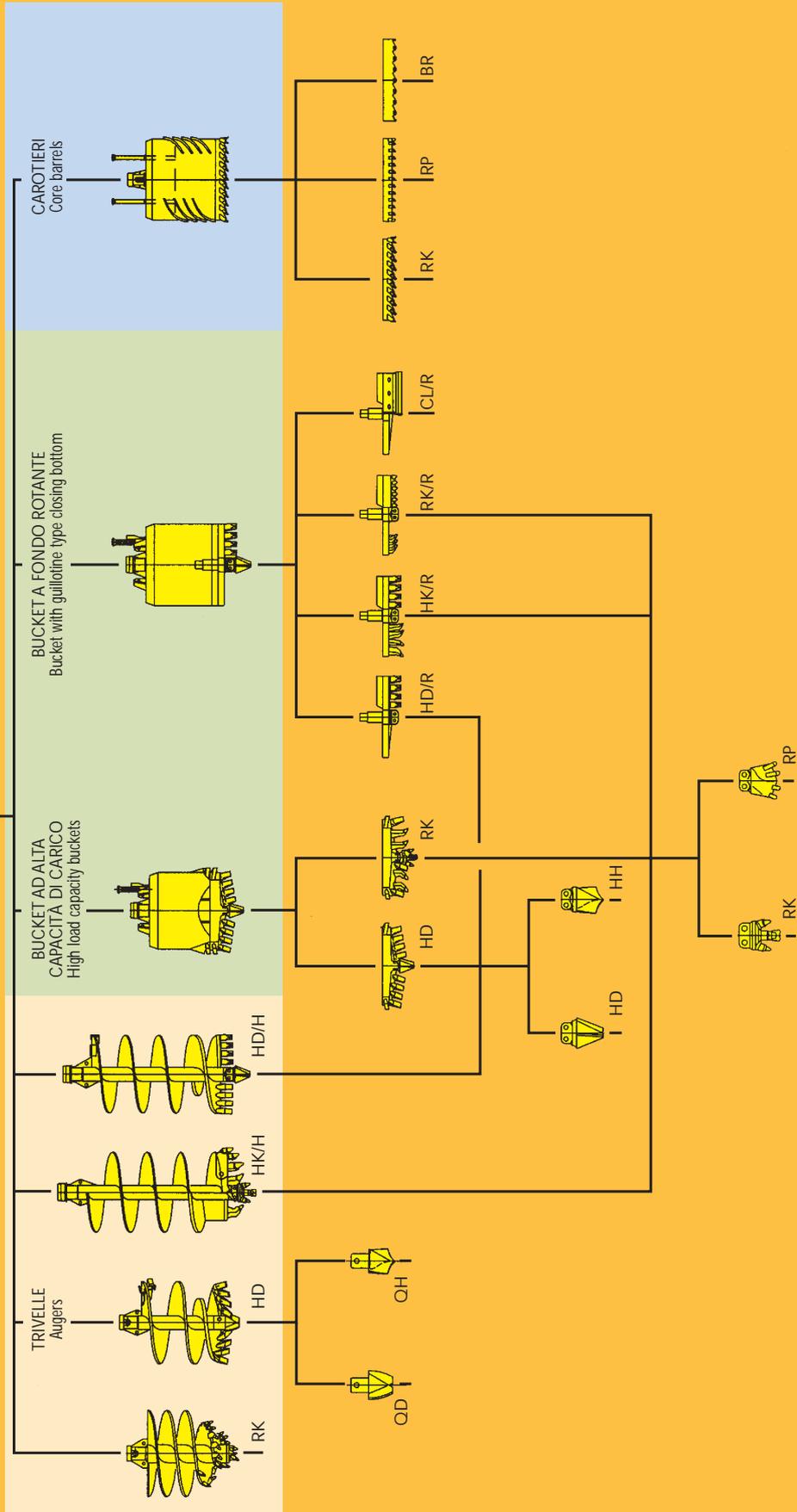
Ø Scavo Min  
Min excavation diam. 800 mm



# ATTACCO ASTA SU UTENSILE Kelly box on tool



## UTENSILI / Drilling tools



Drilling and Foundation Equipment

5819, via Dismano - 47023 CESENA - ITALY  
 tel. 0547-319111 - telefax 0547-318548  
 E-mail: soilmec@soilmec.it

**Appendix C**  
**Polymer Slurry**

Vermont Agency of Transportation

**RECEIVED**

ON: **January 14, 2016**

and Checked for

**CONFORMANCE**

BY: Todd A. Sumner DATE: 01/29/16



# SlurryPro® CDP™

## Physical Data:

Appearance: Opaque to White free flowing granular solid  
 Odor: Odorless.  
 pH: NA  
 Freeze Point: NA  
 Specific Gravity: 1.00-1.01 (Water = 1.0)

## Description & Function:

The SlurryPro® CDP™ system is designed for preparation of viscous earth-stabilizing fluids or slurries to stabilize even the most challenging soil environments in a variety of excavation techniques including drilling, trenching, tunneling and diaphragm wall applications in the geoconstruction industry.

## General Application Instructions:

KB recommends CDP initially be mixed at a around a rate of 0.75 to 1.25 kg/m<sup>3</sup> of fresh water or water pretreated with ProTek™ 100. For larger projects this should be done in a properly designed mixing tank, please see KB's "Mix Tank Diagram" for specifics. Many contractors find they can start with lower dosages and adjust as required for stability. On smaller projects or highly mobile projects, such as power lines, CDP may be applied at the point of excavation. Typical product consumption rates are suggested to be as follows, again many contractors find less is acceptable:

Formation Type	Suggested SlurryPro CDP Initial Dosage			Typical Marsh Funnel Visc.
	lbs/yd <sup>3</sup>	lbs/1000 gals	kg/m <sup>3</sup>	
Clay & Shale	1.687-2.109	8.345-10.432	1.0-1.25+	60-75±
Silt & Fine to Medium Sand	1.687-2.531	8.345-12.518	1.0-1.5+	65-100±
Coarse Sand to Pea Gravel	2.025-3.037	10.014-15.022	1.2-1.8+	75-100±
Gravel to Cobbles	2.109-3.375	10.432-16.691	1.25-2.0+	85-100+

Formation Type	Suggested SlurryPro CDP Refreshment Dosage			Typical Marsh Funnel Visc.
	lbs/yd <sup>3</sup>	lbs/1000 gals	kg/m <sup>3</sup>	
Clay & Shale	1.012-1.519	5.007-7.511	0.6-0.9+	60-75±
Silt & Fine to Medium Sand	1.181-1.687	5.842-8.345	0.7-1.0+	65-100±
Coarse Sand to Pea Gravel	1.266-2.025	6.259-10.014	0.75-1.2+	75-100±
Gravel to Cobbles	1.266-2.109	6.259-10.432	0.75-1.25+	85-100+

Additional CDP may also be introduced at the point of excavation through a KB Eductor or into the mix tank or agitated slurry storage tanks. The addition of small quantities of CDP at the hole provides the following benefits: rapid increase in viscosity to stabilize highly permeable soils and immediate intervention in case of emergencies or other atypical situations. When adding SlurryPro CDP at the point of excavation, please pour CDP slowly into a KB Eductor feeding into an adequately flowing stream of slurry emptying into the excavation. SlurryPro CDP may also be added directly to the stream of fluid flowing into a pile while the excavation tool is one meter (3 feet) below the surface of the slurry and rotating to form a vortex within the slurry column. Avoid clumping the dry CDP into "white gel balls" in the slurry by slowly sifting product into the fluid stream. Feeding CDP too quickly with lack of proper agitation causes balling of the polymer particles into "fish eyes" and larger polymer masses wasting CDP. After adding CDP to the any excavation, raise and lower the excavation tool from the top of the hole to the bottom to assist in proper distribution of the product throughout the slurry column. The slurry viscosity within the excavation should never be allowed to drop below 55 seconds per quart regardless of what type of soil is being excavated.

be done in the mixing tank and not at the point of slurry entrance into the next excavation. At least one sedimentation tank is always recommended for recaptured slurry to pass through prior to the mix tank and the re-addition of CDP. The dosage rate of the SlurryPro CDP synthetic polymer in the initial make-up water should err on the side of caution and use the higher levels recommended in the dosage chart. Only after the slurry has been established and a secure dosage and viscosity obtained should the dosage be reduced.

When excavating in more challenging formations, appropriate slurry Additives are recommended in combination with a SlurryPro system to increase slurry stabilization performance. The more challenging the formation type the more benefit will be realized from various SlurryPro Specialty Additives. Unusual site conditions may arise during actual excavation, in which case the recommendations from KB technical personnel must always be followed.

## Special Operational Precautions and Instructions:

It is suggested from experience, the specific gravity of a SlurryPro CDP fluid should not exceed 1.04 under normal operating conditions. If low hydrostatic conditions are encountered where the water table is less than 3 meters or 10 feet beneath the slurry level, the specific gravity of the slurry should be increased as required using WeightIt to raise the slurry S.G. accordingly.

Due to the unique characteristics of a KB Earth Stabilization System as compared to bentonite, several key operational procedures are recommended to be modified from bentonite systems. These modifications will have a major impact on the overall effectiveness and successful use of KB International's Earth Stabilization Systems. For smaller projects, please consult KB International's "General Operating, Product Addition, and Testing Procedures." For larger or more complicated projects, please contact KB International for specific project planning.

## Packaging:

10 kilo / 22 lb. resealable plastic pails & 25 kilo / 55 lb. poly bags

## Availability:

SlurryPro CDP is available out of KB International's Charleston, SC warehouse and various other regional warehouses. Please check for availability in your area.



## Technology to Build On!

**KB International LLC • 735 Broad Street, Suite 209 • Chattanooga, TN 37402**  
**Phone: 1 (423) 266-6964 • Fax: 1 (832) 201-9196 • email: info@kbtech.com • www.kbtech.com**

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# SHORE PAC®

## VISCOUS SOIL STABILIZING POLYMER

### DESCRIPTION

SHORE PAC is an easy mixing, water soluble, polymer supplied as a granular powder. SHORE PAC is designed for preparation of viscous earth-reinforcing fluids or slurries for a variety of drilling, trenching, and walling applications in the geo-construction industry.

### RECOMMENDED USE

SHORE PAC is ideal for slurry trenching, diaphragm walls, drilled shafts/bored piles, and tunneling.

### CHARACTERISTICS

- Can be mixed directly in the borehole or excavation
- Stabilizes borehole while excavating; improves skin friction
- Non-gelling, even at high viscosities, facilitating settlement of fines, and maintenance of a clean fluid
- High cohesiveness to bind excavated soil and gravel
- Improves loading and removal of spoils
- Works well in both fresh and saltwater

### MIXING AND APPLICATIONS

SHORE PAC should be mixed by sifting carefully into a stream of water directed into the excavation or an agitator mix tank. Fanning the water stream over a sloping pan or across the blade of an auger facilitates lump-free mixing. If mixed directly in excavation, the tool should be reciprocated gently after product is added to distribute and homogenize the polymer. Make-up water should have a pH of 8-10; add 6 lbs SODA ASH per 1,000 gallons water.

### PACKAGING

36 lb pail, 36 per pallet, 6-7.5 lb jugs - 45 lb case, 36 per pallet, or 55 lb bags, 36 per pallet.



FORMATION	SHORE PAC DOSAGE RATE*		MARSH FUNNEL VISCOSITY
	Lbs/1,000 gal	Kg/m <sup>3</sup>	
Clay & Shale	3.4 - 4.0	0.4 - 0.5	35 - 50
Silt & Fine to Medium Sand	4.0 - 5.0	0.5 - 0.6	45 - 55
Coarse Sand to Pea Gravel	6.0 - 8.0	0.7 - 0.9	60 - 70
Gravel to Cobbles	9.0 - 12.0	1.0 - 1.3	80-125

\* In application where brackish, salt, or seawater contaminates slurry or is used as make-up water, SHORE PAC dosage should be increased

North America: 847.851.1800 | 800.527.9948 | [www.CETCO.com](http://www.CETCO.com)

UPDATED: JULY 2015

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FORM: TDS\_SHORE\_PAC\_AM\_EN\_201507



**CETCO®**



The BIG-FOOT<sup>®</sup> polymer slurry system is formulated to make a viscous slurry fluid to fortify the most challenging soil conditions. BIG-FOOT soil stabilizing polymer is an easy mixing, 100% active polymer packaged as a granular powder.

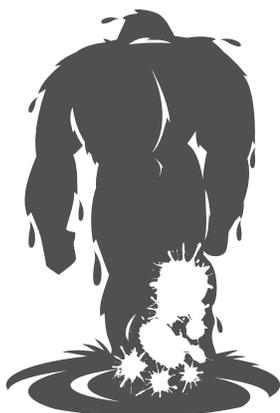
Due to its concentrated formula, small amounts of BIG-FOOT earth-reinforcing polymer mixed with fresh water builds high viscosity. BIG-FOOT is ideal for drilled shafts, mini-piles, slurry trenching, diaphragm walls, HDD, reverse circulation (RC) rotary drilling and tunneling.

## Benefits of BIG-FOOT

- Stabilizes reactive clay and shale formations
- Mixes smoothly into flowing water with minor sheer
- Self-cleaning no solids equipment required
- Improves skin friction & end bearing capacity
- Non-gelling, even at high viscosities, facilitating settlement of fines and maintenance of a clean fluid
- Binds excavated sand & gravel soil for fast drilling and removal of spoils

TYPICAL PROPERTIES	
Appearance	White granular solid
pH (0.25% Solution)	8.5 to 9.0
Specific Gravity	1.00-1.01 (water= 1.0)
Bulk Density lb/ft <sup>2</sup>	52
Odor	Odorless

**MIXING DOSAGE:** BIG-FOOT should be mixed at a minimum rate of 8 to 9 lb/1,000 gal of fresh water pretreated with M-BOOSTER<sup>®</sup>. For larger projects this should be done in a properly designed mixing tank.



SOIL FORMATION	BIG-FOOT <sup>®</sup> POLYMER MIX DOSAGE*			MARSH FUNNEL VISCOSITY
	lb/yd <sup>3</sup>	lb/1,000 gal	kg/m <sup>3</sup>	sec/qtr
Clay & Shale	0.8-1.0	4.0-5.0	0.5-0.6	40-45
Silt & Fine-Medium Sand	1.2-1.25	6.0-6.5	0.7-0.75	50-55
Coarse Sand-Pea Gravel	1.4-1.6	7.0-8.0	0.8-0.9	60-70
Gravel-Cobble	1.7-2.0	9.0-10.0	1.1-1.2	75-95

\* In application where brackish, salt or seawater contaminates slurry or is used as make-up water, BIG-FOOT dosage should be increased.

orders@matrixcp.com 877.591.3137 P 630.791.0893 C 630.730.7428 F 630.791.3459 matrixcp.com

### MIXING FORMULA (IN ORDER OF ADDING):

- 1 Prepare the make-up water** by adding M-BOOSTER at a concentration of 6 to 7 lbs/1,000 gal (0.7 to 0.8 kg/m<sup>3</sup>) for a target pH of 9.0 to 10.0.
- 2 Add BIG-FOOT polymer** through the same mixer at a dosage of 8.0 to 9.0 lb/1,000 gal (1.0 to 1.1 kg/m<sup>3</sup>) of mix water depending on desired viscosity.
- 3 Check slurry properties** as listed below and record time taken. Check slurry properties when each hole is completed and make required adjustments to bring slurry back into desirable property range.
- 4 Once desired slurry properties are reached, the slurry is ready for use.**
- 5 The slurry level should always be higher than the water table** or river level in the open-hole section to maintain a constant hydrostatic loading on excavation.
- 6 Measure Marsh funnel viscosity.** Target viscosity should be in the range of 70 to 80 sec/qt.
- 7 If Geology consists of gravels and sand with little or no fines add FORTIFY<sup>®</sup>** at a concentration of 5 to 6 lb/1,000 gal (0.6 to 0.7 kg/m<sup>3</sup>) via MATRIX high shear mixer to promote enhanced rate of hydration and reduce the amount of un-yielded material ("fish eyes").

On smaller projects or mobile projects, such as Transmission Line and Cell Towers, BIG-FOOT may be added at the excavation by sprinkling carefully into a stream of water directed into the excavation or an agitator mix tank.

Fanning the water stream over a sloping pan or across the blade of an auger facilitates lump-free mixing. If mixed directly in excavation, the tool should be reciprocated gently after product is added to distribute and homogenize the polymer. After completing the addition of BIG-FOOT into the excavation raise and lower the drilling tool from the top of the excavation to the bottom to assist in the proper distribution of the product.

### For best results add 6-7-lb M-BOOSTER/1,000 gal of mix water for a pH of 9-10.

- Total chloride (salt) should be less than <1500 ppm (mg/L).
- Total hardness (calcium) less than <100 ppm.
- Total chlorine less than <50 ppm.

**BREAK-DOWN:** BIG-FOOT slurry can be chemically broken down using NEUTRALIZER<sup>®</sup>. This dry breaker when added into a slurry mixed with BIG-FOOT polymer at a dosage of 15 lb/3,500 gal will reduce the viscosity of the slurry preparing for disposal.

**PACKAGING:** BIG-FOOT dry polymer is packaged in 55 lb (25 kg) poly bags, 30 per pallet, and 35 lb (15.88 kg) plastic pails, 36 per pallet.

**AVAILABILITY:** BIG-FOOT dry polymer can be purchased through any MATRIX Construction Products Distributor. To place an order contact MATRIX Construction Products.

orders@matrixcp.com 877.591.3137 P 630.791.0893 C 630.730.7428 F 630.791.3459 [matrixcp.com](http://matrixcp.com)

**Appendix D**

**Sample Drilled Shaft Installation Logs**

Vermont Agency of Transportation  
**RECEIVED**  
ON: **January 14, 2016**  
and Checked for  
**CONFORMANCE**  
BY: **Todd A. Sumner** DATE: **01/29/16**

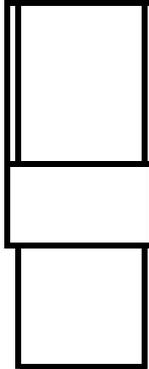
HUB Foundation Co., Inc.  
 139 Billerica Road  
 Chelmsford, MA 01824

**Drilled Shaft  
 Installation Report**

Superintendent: \_\_\_\_\_  
 Date: \_\_\_\_\_  
 Job: \_\_\_\_\_  
 Shaft No: \_\_\_\_\_

Pour #: \_\_\_\_\_ GC: \_\_\_\_\_

Shaft Geometry	Design	As Built
Shaft Diameter		in
Rock Socket Diameter		in
Casing Diameter		in
Length of Rock Socket		ft
Shaft Depth		ft



	Elev.	Depth
Top of Casing		N/A
Top of Ground		
Top of Beam		
Top of Concrete		
Bot. of Casing		
Top of Till		
Top of Rock		
Tip:		

Installation	Date	Time
Excavation Started		
Excavation Completed		
Rock Socket Started		
Rock Socket Completed		
Obstruction Started		
Obstruction Completed		
Bottom Cleaning Completed		
Final Check of Bottom		
Beam Placed		
Concreting Started		
Concreting Completed		
Temporary Casing Removed		

*Drilling Fluid Observations*

**Type of Drilling Fluid Used:**

Slurry Testing				
Time	pH	Viscosity	Sand %	Density

Beams and Concrete Placement Inspected By: \_\_\_\_\_

**Additional Remarks:**

Additional Remarks:	Pay Quantities		Tremie Start Length: _____
	Soil Excavation		Hole Start Depth: _____
	Rock		Theoretical Rises / 10 CY Truck
	Obstruction		Rise in Socket: _____ ft
	Concrete		Rise @ Shaft Diameter: _____ ft
Flow Fill		Rise in Casing: _____ ft	
		Casing Wall Thickness: _____ in	

Set #	Truck No.	Batch Time	Truck Vol (CY)	Volume (CY)	Start Time	Finish Time	Depth to Conc.*	Tremie Length	Tremie Removed*	Tremie in Conc.*	Rise
1											
2											
3											
4											
5											
6											
7											
8											
9											

\*Datum per column are recorded after the truck is poured.